2020 YMEP Final Technical Report for California Creek 19-036

Placer Claims: Fox 1-13

Location of Property: 64˚4’28”N, 140˚22’00”W

NTS Mapsheet: 116C/01

Mining District: Dawson

Report For: Metallic Minerals Corp.

Chris Arsenault and Nicolai Goeppel

ON BEHALF OF HIGHER GROUND EXPLORATION LTD.

Debbie James ON BEHALF OF TRUEPOINT EXPLORATION

Table of Contents

List of Figures 2
List of Tables 2
Introduction 3
Location and Access 4
Placer Tenure 6
Permitting and Land Claims 6
History of Exploration and Mining – California Creek 7
2015 Placer Exploration 8
Geology 11
Regional Bedrock Geology *11*
Local Bedrock Geology and Mineral Occurrences *11*
Quaternary History *13*
Surficial Geology *13*
Placer Geology *14*
2019 Exploration Work 15
2019 Ground Magnetometer Survey California Creek *16*
Test Shafting *19*
UAV-MAG Survey *20*
Work Schedule & Expenditures 2019-2020 ..... *24*
Conclusion and Recommendations 24
Statement of Qualifications 27
References 29
Digital Appendices 32
Appendix A - Ground Geophysics Data *32*
Appendix B - UAV-Mag Geophysics Field Report and Data *32*

List of Figures

Figure 1 - General Location of California Creek Project, Yukon.....5
Figure 2 – Location of California Creek Placer Project and Dawson region placer tenures.....7
Figure 3 - Terrane map of Yukon, showing location of the California Creek placer property. After Yukon Geological Survey (2018).....10
Figure 4 - Bedrock Geology of California Creek area, after Yukon Geological Survey (2018).....12
Figure 5 - Surficial Geology, California Creek, with potential paleochannels after Yukon Geological Survey (2018) and Duk-Rodkin (1996).....15
Figure 6 – Geophysical Survey Area.....18
Figure 7 – California Creek Magnetometer Survey Area A.....18
Figure 8 – California Creek Magnetometer Survey Area B.....19
Figure 9 - UAV-MAG Survey layout. Takeoff and landing zones are marked by yellow pins.....20
Figure 10 – Comparison of geophysical maps from airborne survey 21
Figure 11 – Interpretation of magnetic features from Analytical Signal geophysics maps..23

List of Tables

Table 1 – Placer Claim Status, California Creek Property.....6
Table 2 - 2015 GPR survey coordinates and lengths.....9
Table 3 - Coordinates of the 2015 test pits, California Creek.....9

Introduction

The following is a final technical report summary of work completed under the 2019 YMEP grant funding for the California Creek placer property, which consists of placer claims Fox 1-13 and formally prospecting leases ID01732 (3 miles) and ID01733 (3 miles). The property is held by Bill Harris and Metallic Minerals Corp. YESAB (Project number 2018-0158) and Class 4 water license applications have been filed for the property and are expected to be in place for 2020.

California Creek is a left limit tributary of the Sixtymile River, located in central Yukon approximately 45 km due west of Dawson City, Yukon. The California Creek Placer Property is located in the main valley and right limit bench of California Creek, approximately 4.5 km upstream of its confluence with the Sixtymile River.

The YMEP funding was used to complete a drone magnetometer survey (UAV-MAG) as well as two shafts which were dug to investigate the depth to bedrock and understand the sedimentary layers of the area. Further exploration will be focused on determining highly prospective zones for mining and determining the feasibility of the project.

California Creek has been subjected to intermittent exploration since the time of the Klondike Gold Rush, with the earliest documented hand exploration taking place at the mouth in 1918. Various operators explored in the 1970s and 1980s, but subsequent activity was sparse until 2008, when a consortium of prospectors explored by hand trenching and sampling on the right fork. Placer gold values of up to 1 gram per tonne were recovered in hand-dug samples. Several kilometres upstream of the project area, on the left fork of California Creek, a mining operation has been active (Clayton Contracting and Yukon Exploration Green Gold Inc.) since 2016.

In 2015, four geophysical (ground-penetrating radar) surveys and 3 test pits were conducted on the Fox claims by previous owner Boris Logutov. The stratigraphy interpreted from the GPR surveys included overburden (muck) from 1.0 to 1.8 metres, alluvium from 1.5 to 7.0

metres, and weathered bedrock from 0.5 to 1.1 metres. Bedrock depths were interpreted as up to 8 metres below surface. The stratigraphy of the pits was described as muck from 1.0 to 1.4 m, overlying alluvium from 1.5-1.8 m, over a bedrock of quartz-sandstone. Hand-washed samples showed grades of 0.5 to 1.2 grams of gold per cubic metre.

California Creek has not been subjected to the same level of historic placer exploration as other drainages in the Sixtymile River drainage, and there has been only minimal exploration using modern methodologies such as geophysics. However, with historic placer mining operations downstream, and an active mining operation upstream, the California Creek property is bracketed by gold-bearing gravels on both sides. Additionally, limited sampling of the gravels on the property have indicated potentially economic quantities of placer gold, and initial geophysical surveys appear to indicate that bedrock is at mineable depths.

Location and Access

California Creek is a left limit tributary of the Sixtymile River, located in central Yukon approximately 45 km by air due west of Dawson City, Yukon (Figure 1). The California Creek Placer Property is located in the main valley and right limit bench of California Creek, approximately 4.5 km upstream of its confluence with the Sixtymile River.

The centre of the property is 64°04'28"N and 140°22'00"W, on NTS map sheet 116C/01, in the Dawson Mining District (Figure 2).

Access to the property can be gained by summer road from Dawson City. The route runs from Dawson City west along the Top of the World Highway, then at the 87 km point there is a left (south) turnoff. A 4WD road at this point runs east-southeast a distance of 13 km to the top of the claim group on California Creek. The total distance from Dawson City is approximately 100 kilometers.

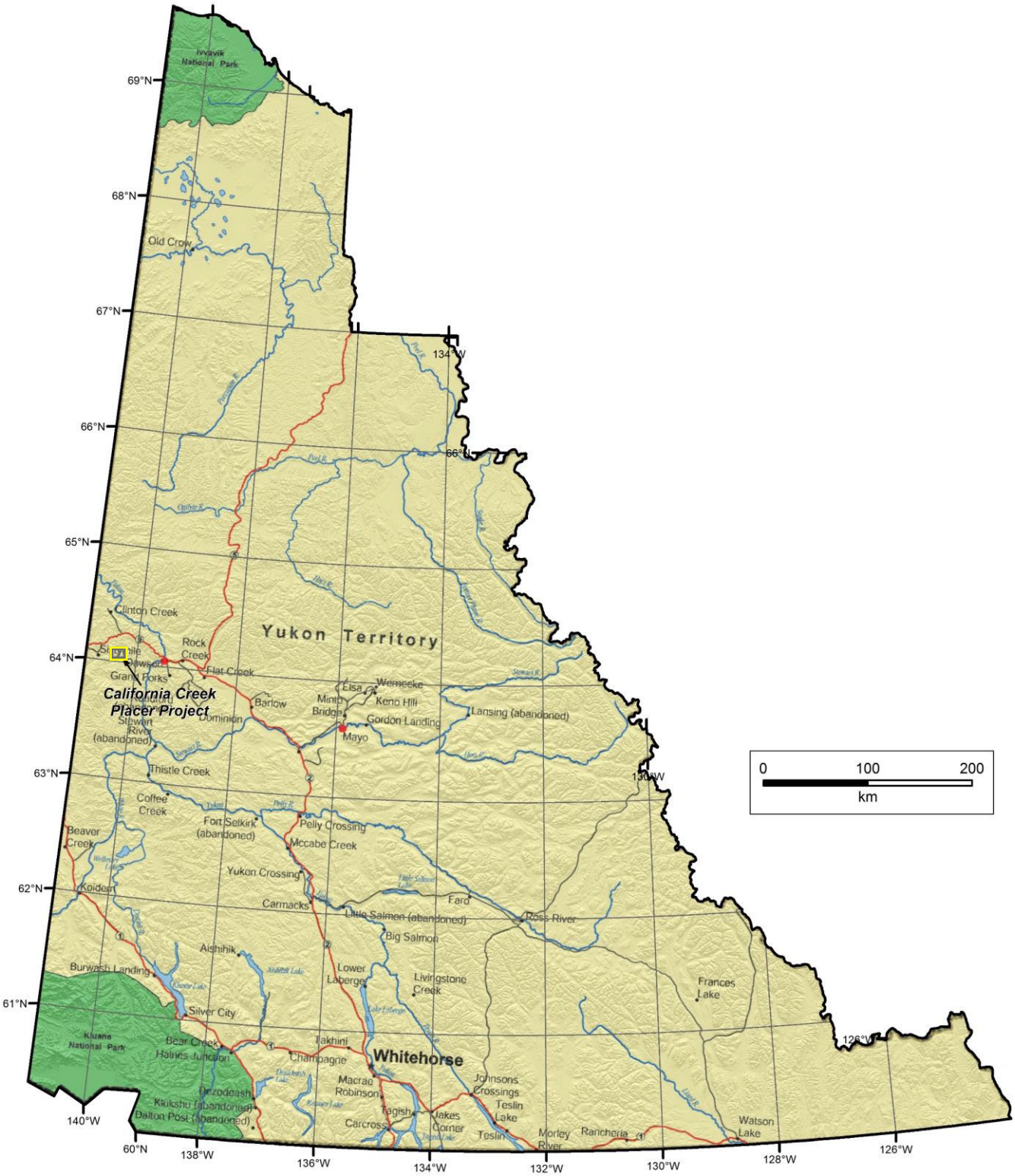


Figure 1: *General Location of California Creek Project, Yukon.*

Placer Tenure

Table 1 shows the current placer claim and prospecting lease status for the California Creek property.

*Disclaimer** The two 3-mile leases along the right-limit of California creek that the 2019 shafting program were carried out on, had a discrepancy with neighboring First Nation category B lands and the Dawson mining recorder made an administrative decision to drop the leases. The issue was due to the location of the placer posts and the existing California creek baseline conflicted with settlement lands. The leases will be staked in a different configuration by establishing a new bench base line to ensure there are no issues in future staking once crews are able to conduct exploration pending the COVID-19 pandemic.

***Table 1**: Placer Claim Status, California Creek Property*

GRANT NUMBER	STATUS	CLAIM NAME	OWNER NAME	STAKING DATE	RECORDED DATE	EXPIRY DATE
P 516225	Active	Fox 1	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516226	Active	Fox 2	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516227	Active	Fox 3	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516228	Active	Fox 4	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516229	Active	Fox 5	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516230	Active	Fox 6	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516231	Active	Fox 7	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516232	Active	Fox 8	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516233	Active	Fox 9	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516234	Active	Fox 10	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516235	Active	Fox 11	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516236	Active	Fox 12	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020
P 516237	Active	Fox 13	Bill G. Harris - 100%	7/23/2014	7/24/2014	10/24/2020

Permitting and Land Claims

YESAB (Project number 2018-0158) and Class 4 water license applications have been filed for the property and are expected to be in place for the 2019 season. Tr'ondek Hwech'in

Settlement Land TH S- 14B1 lies adjacent to the north boundary of the Fox 1 claim and along the eastern boundary of the recently expired prospecting lease ID01732.

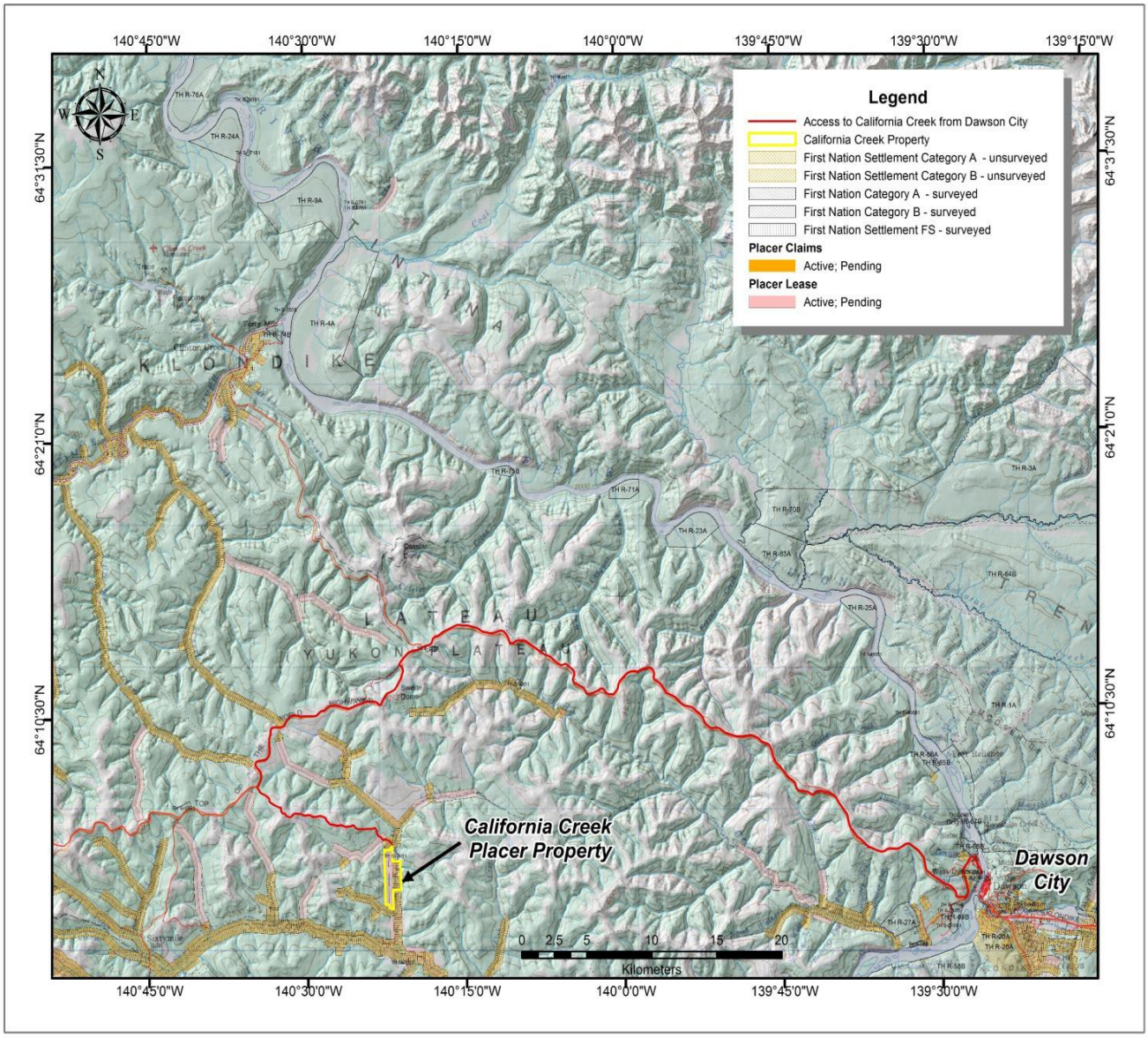


Figure 2: Location of California Creek Placer Project and Dawson region placer tenures. The property lies 100 km by road from Dawson City.

History of Exploration and Mining – California Creek

California Creek has been subjected to intermittent exploration since the time of the Klondike Gold Rush, with the earliest documented hand exploration taking place at the

mouth in 1918 (LeBarge, 2007). Various operators explored in the 1970s and 1980s. This included Cogasa Mining Corp. Ltd., who held a 5 mile placer prospecting lease at the bottom of California Creek in 1977.

Panterra Resources mined near the mouth in 1981 and 1982, however little was documented about their activity (LeBarge, 2007). In 1985, George Karens and partners reported values of 0.02 to 0.12 ounces per cubic yard in trench testing in the vicinity of the current Fox 1 and Fox 2 claims (LeBarge and Morison, 1990; LeBarge, 2007).

Also, in 1985, a 61-hole, 1215 ft. (370 m) rotary drill program was undertaken by Wilshire Mortgage north of the present day Fox claims on the right fork of California Creek. The highest values in the drill holes (according to LeBarge and Morison, 1990) were 0.0229 ounces per ton, which is approximately 0.7851 grams per tonne or 1.6 grams per cubic metre. Nuggets up to 2 mesh in size were also recovered in six of the drill holes.

Activity on the creek was sparse until 2008, when a consortium of prospectors explored by hand trenching and sampling on the right fork (Reshetov, 2008). Values of up to 1 gram per tonne were recovered in hand-dug samples.

Several kilometres upstream of the project area, on the left fork of California Creek, a mining operation has been active (Clayton Contracting and Yukon Exploration Green Gold Inc.) since 2016.

In 2015, geophysical (ground-penetrating radar) surveys and test pits were conducted on the Fox claims by then-owner Boris Logutov. This work is described later in this report.

2015 Placer Exploration

Logutov (2015) conducted four lines of ground penetrating radar geophysical surveys on the Fox claims (1297m total) in 2015. The stratigraphy interpreted from the GPR surveys

included overburden (muck) from 1.0 to 1.8 metres, which was overlying alluvium from 1.5 to 7.0 metres thick, and weathered bedrock from 0.5 to 1.1 metres thick. Bedrock depths were interpreted as up to 8 metres below surface.

In addition, three test pits were hand-dug along three of the geophysical lines. Stratigraphy of the pits was described as muck from 1.0 to 1.4 m, overlying alluvium from 1.5-1.8 m, over a bedrock of quartz-sandstone. Hand-washed samples showed grades of 0.5 to 1.2 grams of gold per cubic metre.

The coordinates of the endpoints of the ground-penetrating radar surveys are given in Table 2. Note, GPR Line 2015-01 appears to have the start and endpoints transposed in the Logutov report. A correction is proposed here, so that all the lines started in the west and ended in the east. This would therefore match the figures and the positions of the test pits as given in the Logutov report. Table 3 shows the approximate coordinates of the 2015 test pits. The 2015 GPR survey lines and test pits are plotted on the map in Figure 6.

Table 2 - 2015 GPR survey coordinates and lengths.

Survey Name	Start Point		End Point		Length (m)
	Latitude	**Longitude**	**Latitude**	**Longitude**	
GPR 2015-01	64.081978	-140.36202	64.081842	-140.355239	331.2
GPR 2015-02	64.080264	-140.362689	64.080298	-140.35575	338.6
GPR 2015-03	64.0764	-140.362809	64.076542	-140.35614	319.8
GPR 2015-04	64.072086	-140.363436	64.072123	-140.35736	307.6

Table 3 - Coordinates of the 2015 test pits, California Creek.

Name	GPR Line	Latitude	Longitude	Depth (m)
Pit 1	GPR 2015-01	64.081876	-140.356925	2.5
Pit 2	GPR 2015-02	64.080287	-140.357932	3.5
Pit 3	GPR 2015-03	64.076467	-140.35968	5.0

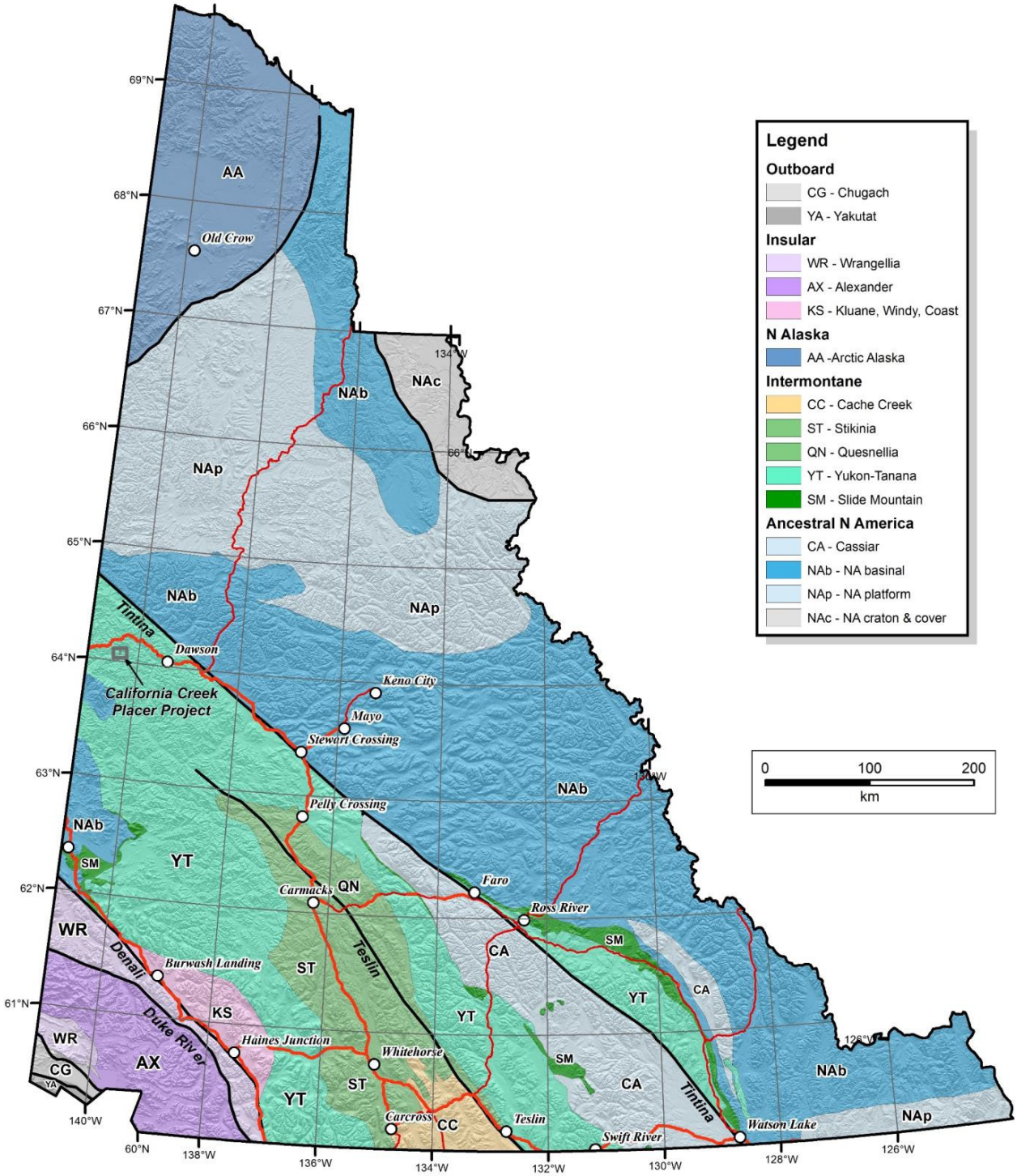


Figure 3 - Terrane map of Yukon, showing location of the California Creek placer property. After Yukon Geological Survey (2018).

Geology

Regional Bedrock Geology

The project area is situated within the Yukon-Tanana terrane (Figure 3), an accreted pericratonic sequence that covers a large part of the northern Cordillera from northern British Columbia to east-central Alaska (Gordey and Ryan, 2005; Colpron and Nelson, 2006). The Yukon Tanana Terrane consists of Paleozoic schist and gneiss that were deformed and metamorphosed in the late Paleozoic, and intruded by several suites of Mesozoic intrusions that range in age from Jurassic to Eocene (Colpron and Nelson, 2006). The Paleozoic rocks are pervasively foliated with at least two overprinting fabrics (MacKenzie and Craw, 2010; MacKenzie et al, 2008). During Late Permian to Early Jurassic time these rocks were tectonically-stacked along thrust faults which were parallel to regional foliation. Later tensional- extensional tectonics during the mid-Cretaceous resulted in brittle fracture of the Paleozoic rocks, which is likely responsible for structurally-controlled gold mineralization in the south Klondike area including the White Gold exploration camp (MacKenzie et al, 2008; MacKenzie and Craw, 2010; MacKenzie and Craw, 2012).

Significant lode gold has been found throughout the central Yukon and Klondike regions, where it is spatially associated with world-class placer gold deposits (Chapman et. al., 2011 and others). The precise genetic relationship between lode gold sources and local placer gold deposits is enigmatic and has been the subject of many scientific studies.

Local Bedrock Geology and Mineral Occurrences

Figure 4 shows the bedrock underlying the California Creek property as Devonian-Mississippian carbonaceous metasedimentary rocks of the Finlayson group (map unit DMF1), which is intruded along its southern extent by Mississippian Simpson Range Suite metagranodiorite, metadiorite and metatonalite (map unit MgSR). The Simpson Range Suite is the most extensive within the property boundaries.

There is one known nearby mineral occurrence, Minfile #116C 017 (ANACORTES). It is mapped as occurring within the Mississippian Simpson Range Suite (MgSR), but described in the Yukon Minfile as a vein gold occurrence hosted in Nasina Series quartzite and schist (YGS, 2018). Diamond drilling was conducted in 1983, consisting of 29 holes totaling 70.7 metres, but the results are not available.

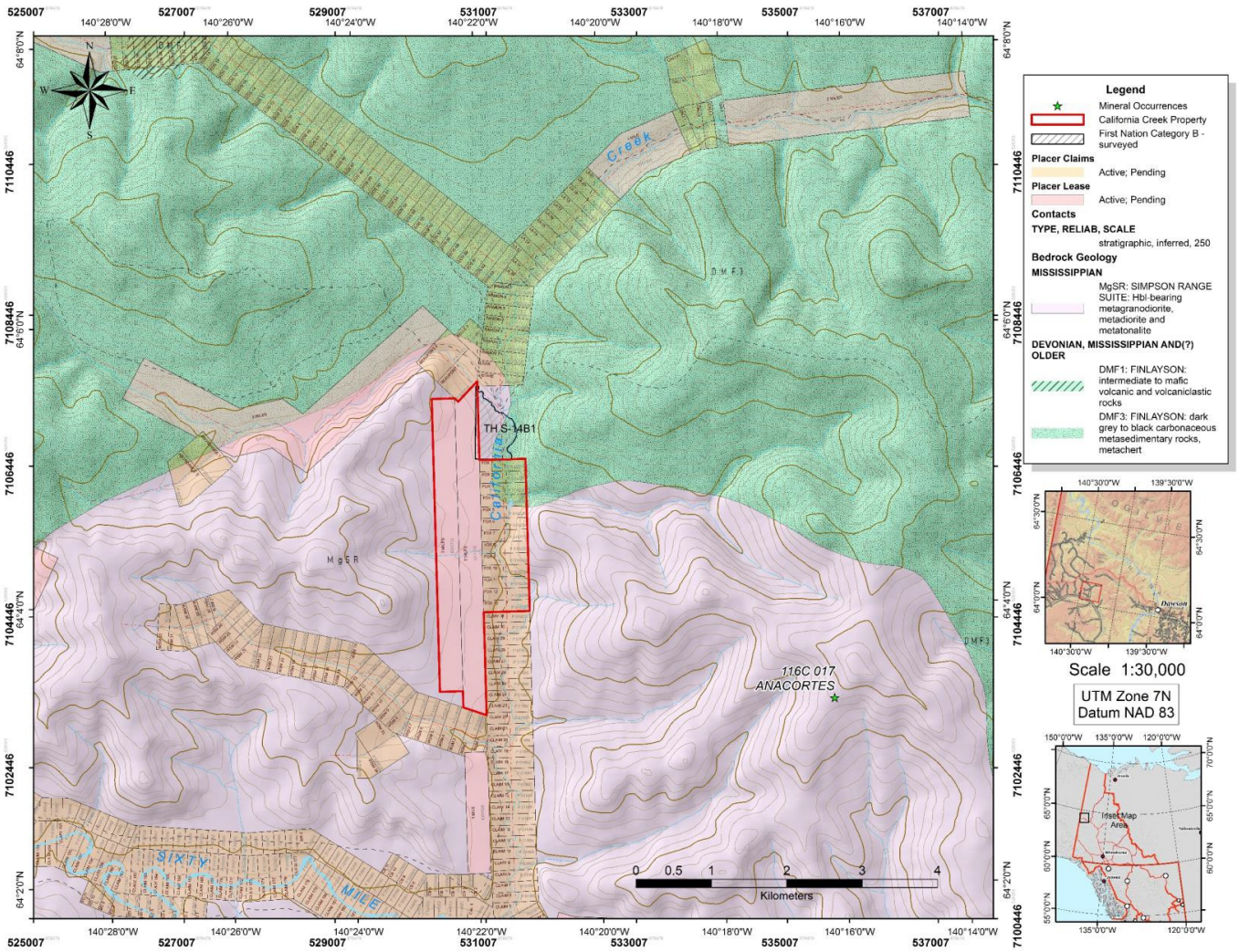


Figure 4 - Bedrock Geology of California Creek area, after Yukon Geological Survey (2018).

Quaternary History

Most of the Klondike region has not been glaciated (Duk-Rodkin, 1999; Jackson et al., 2001). However, a terminal moraine was interpreted and mapped approximately 5 km west of the confluence of California Creek and Sixtymile River (Duk-Rodkin, 1996). This feature (moraine) may be a remnant of a pre-Reid glaciation, which also deposited glaciofluvial gravel on low to mid-level terraces along the Sixtymile River (Duk-Rodkin, 1996). Despite this interpretation, there remains some contention as to the Quaternary history of the Sixtymile drainage. For example, Lowey (2004) shows the Sixtymile river drainage to be unglaciated, while Jackson (2005) mapped several glaciofluvial terraces along the Sixtymile river valley, upstream of Bedrock Creek, and on the left limit of Mosquito Creek.

It is likely however, that the California Creek drainage escaped glaciation, although several right limit tributaries of the Sixtymile River were subjected to alpine ice advances during the pre-Reid glaciation (Lowey, 2004). Additionally, climatic influences and associated base level changes brought on by local and regional glaciations would have had significant effects on the weathering and erosion of local bedrock, as well as the deposition of the alluvial and colluvial materials into the valleys. It was during these periods that the broad alluvial terraces along California Creek were formed.

Surficial Geology

The surficial geology of the California Creek and Sixtymile River area was mapped at 1:250 000 scale by Duk-Rodkin (1996). Figure 5 shows that the entire California Creek valley is mapped as an alluvial complex (map unit Ax), with an extensive terrace (bench) dominating the right limit of the drainage along the main stem and right fork. The slopes above the creek are mapped as a colluvial veneer (map unit Cv). At the confluence of California Creek and the Sixtymile River, several pre-Reid age glaciofluvial terraces (map unit GPRtv) are mapped above the modern river valley.

Placer Geology

The placer geology of the Sixtymile River drainage was first described in detail by Hughes (1986); but more recently described by LeBarge (2006), who subdivided the local alluvial deposits on the basis of age and physiographic setting. Four types of alluvium were proposed: modern (Holocene); interglacial (prior to the McConnell glacial episode); pre-Reid and older; and technogenic (man-made) deposits. The extensive right-limit terrace on California Creek is mapped by Duk-Rodkin (1996) as an alluvial complex, and is likely comprised of a combination of both pre-McConnell-age interglacial (and possibly periglacial) gravels and older, pre-Reid age periglacial alluvial deposits such as those described by LeBarge (2006). These types of deposits are placer gold bearing in other nearby Sixtymile River drainages.

The stratigraphy of a deposit mined by Englefield Resources Ltd. in 1987 at the mouth of California Creek is described by LeBarge (2007) as a one metre of moderately sorted, imbricate sandy boulder-cobble gravel which fines upward into one metre of a rusty weathering gravel. The underlying bedrock is described as quartzite.

On the left fork of California Creek, a mining operation has been active (Clayton Contracting and Yukon Exploration Green Gold Inc.) since 2016. Bond and van Loon (2018) describe the stratigraphy there as including marble and shale bedrock where the marble has formed resistant "reefs" of high bedrock with a rough surface and accumulations of large marble boulders. Silt-rich, poorly-sorted, 0-0.6 m (0-2 ft.) thick pay gravel is packed into depressions, fractures and void space between the bedrock blocks. Overlying the silty pay gravel is a moderately sorted gravel 0.6 to 2 m (2-6.6 ft) thick which represents the modern creek gravel. The two gravel units are overlain by 0.3 to 2.4 m (1-8 ft) of frozen muck and weathered bedrock colluvium. The placer gold includes small nuggets with iron and manganese-staining.

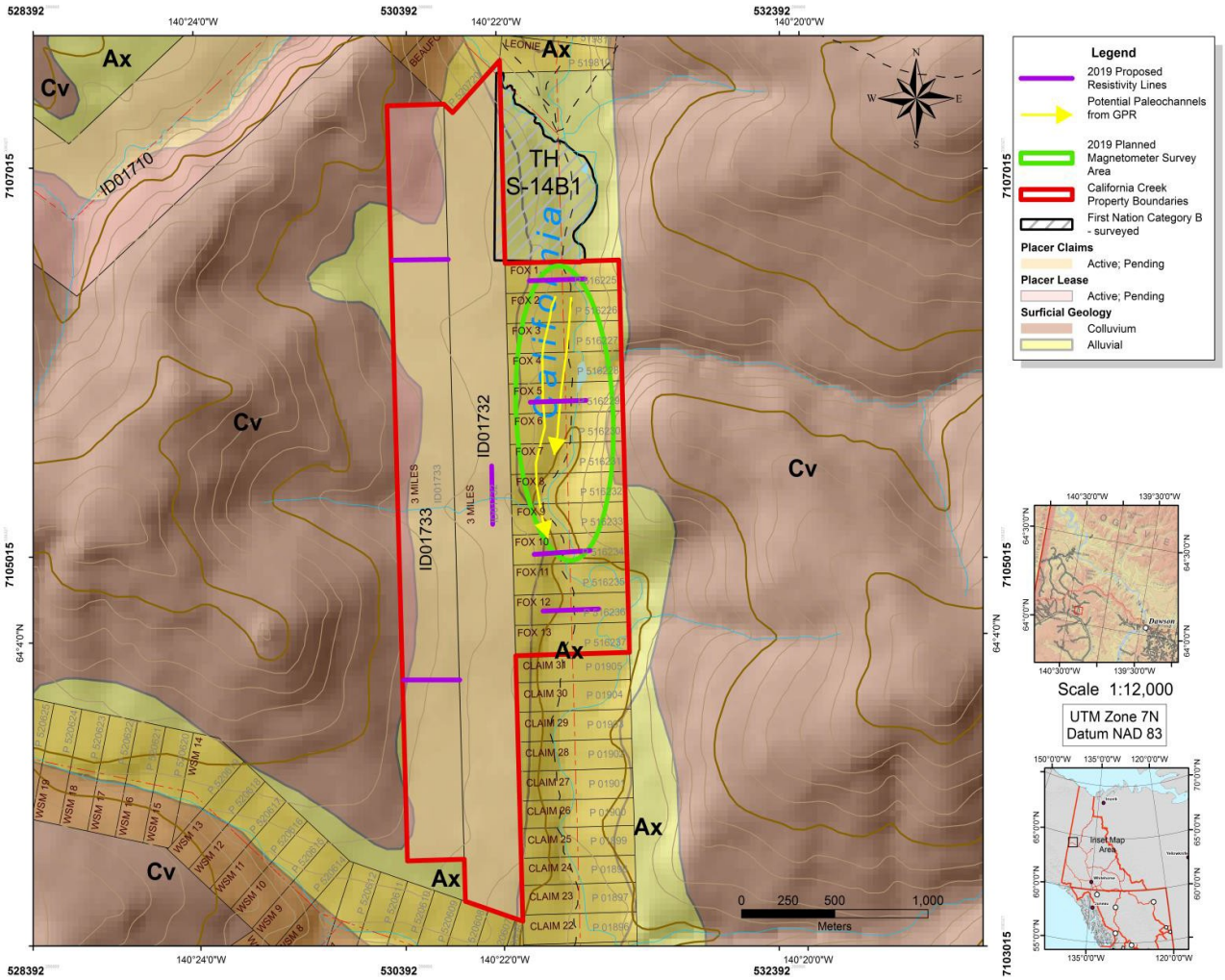


Figure 5 - California Creek placer property showing surficial geology & interpreted paleochannels

2019 Exploration Work

YMEP funding for the 2019 field season was used to identify the most prospective areas of California Creek by conducting a UAV-MAG survey and ground magnetics survey over the area to target high magnetic responses which could indicate placer gravels rich in magnetite associated with gold. Results from the UAV-MAG drone survey are pending and expect to receive results within early April 2020.

Additionally, two shafts were dug to identify the depth to bedrock and to gain an understanding of the sedimentary geology of the area and to test the sediments for the gold grade.

2019 Ground Magnetometer Survey California Creek

On October 15th and 16th, 2019 a ground magnetometer survey was carried out on California creek at the upstream or north end of the California creek claims (Figure 6). The area was accessed by a long ranger helicopter from Fireweed helicopters base in Dawson city. Due to icing conditions during the survey the second day was reduced and more helicopter time was required to safely access and leave the property. In addition, the shafting crew, camp and equipment had to be evacuated from the site as winter conditions made the road access impassible.

The magnetometer unit is a GEM systems GSM-19 (serial number 7022236) proton precession magnetometer. The unit interface is harnessed to the operator's chest attached with cables to a 2m staff has the attached sensor and GPS. The magnetometer survey measures magnetic susceptibility of the subsurface, the greater the accumulation of magnetic minerals the greater the magnetic response. In this case, higher magnetic susceptibility represents potential pay streaks as higher velocity fluvial flows would have concentrated gold and other heavy minerals by washing away lighter minerals (heavy minerals e.g. magnetite, ilmenite, platinum, other PGEs, cobalt, Ni-alloy, scheelite, etc.). It should be noted that the computer generation of the geophysical maps uses an interpolation between points; therefore, data is extrapolated between readings and has less confidence as distance between reading increases. The smaller the distance between readings the greater the resolution in the projection and the higher the accuracy of the data. To reduce these effects separate maps have been generated for the different areas surveyed.

A total of 1.57 line-kilometers was surveyed on the California Creek property; consisting of two grids Survey A on the upstream end that was 1.54 line-kilometer and Survey B that was 0.414 line-kilometers. Magnetometer survey lines were oriented perpendicular to the drainage and spaced 25m apart with readings taken every 10m. Survey areas primarily focused on the creek bottom with only a few readings taken on the edge and on top of benches. Bedrock was observed in the Survey B area along the western edge of the drainage bottom.

Survey A consisted of 105 readings ranging from 56683.27 – 56990.99 nano tesla (nT). Survey A results indicate higher magnetic response at the edge of the bench and in an immediately east of the creek where a north – south trending high corresponds with recent fluvial incision that is observable in high resolution satellite imagery. Figures 7 & 8 outlines the magnetometer results.

Survey B was conducted downstream to the south 500m from Survey A. A total of 38 readings were taken and ranged from 53855.47 – 56836.02 nT. The survey appears to have detected more of bedrock response but pinpoints the location of a thrust fault juxtaposing quartzite / quartz-muscovite-chlorite schist to the north and orthogneiss to the south, which is also mapped in the regional bedrock maps for the area. This is illustrated in the broad magnetic high in the southern part of the area and the broad low to the north. This contact would serve a potential ledge or 'gold trap' for any fluvial activity. Bedrock was observed along the western side of the survey area, suggesting shallow bedrock in the area which would account for the survey response. The low magnetic response from the schist unit which occupies Survey A area would suggest that magnetic anomalies from Survey A are likely more a result of fluvial activity and concentrating of heavy minerals. Figures 7 & 8 outlines the magnetometer results.

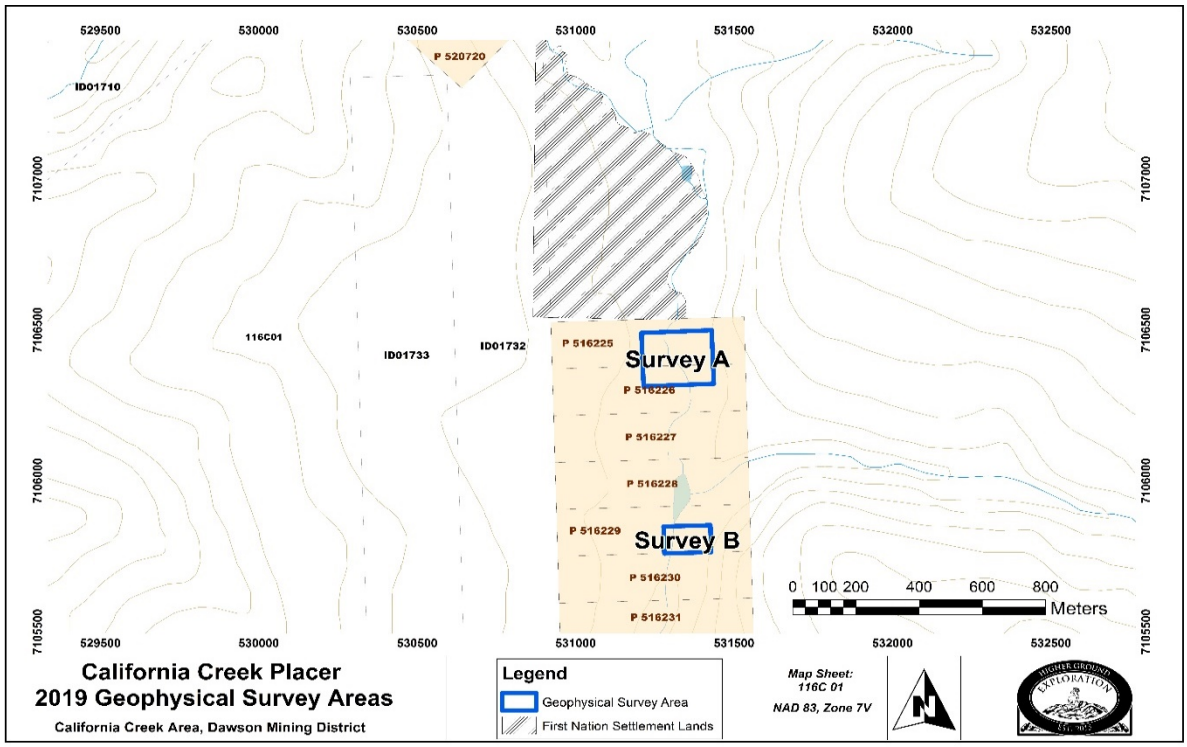


***Figure 6**: Geophysical survey area*

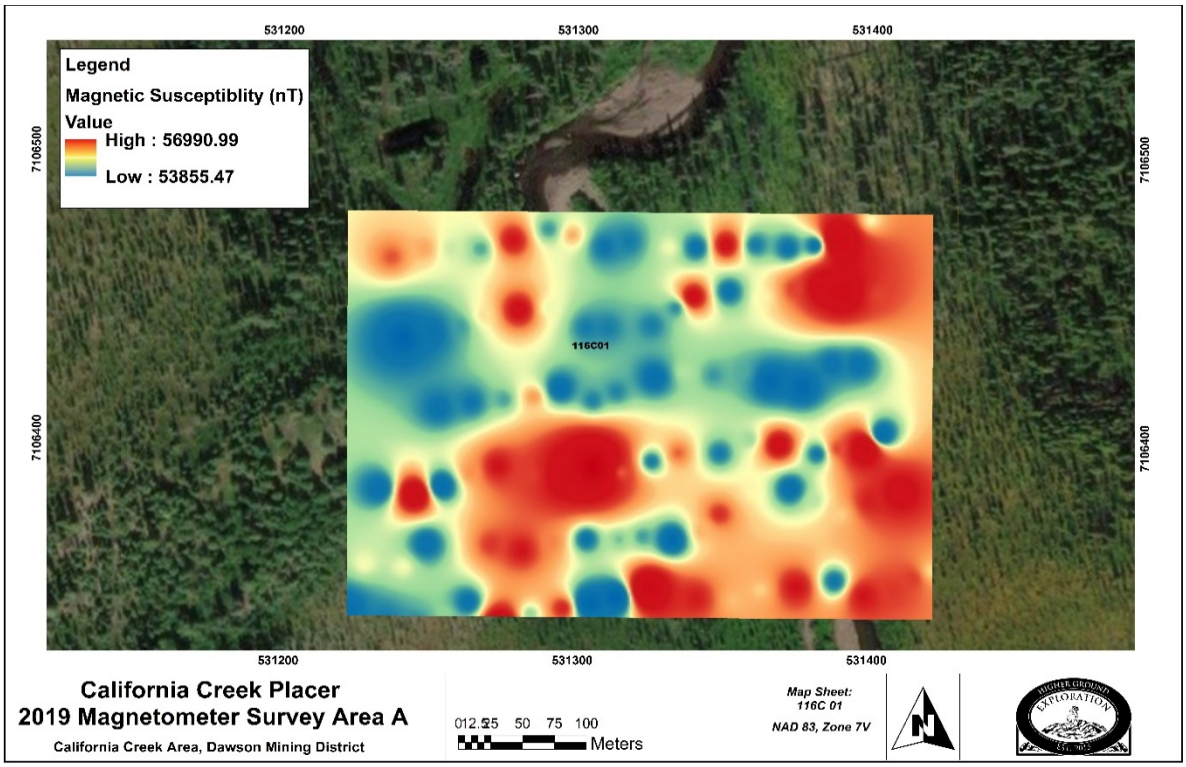


***Figure 7**: California Creek magnetometer survey Area A*

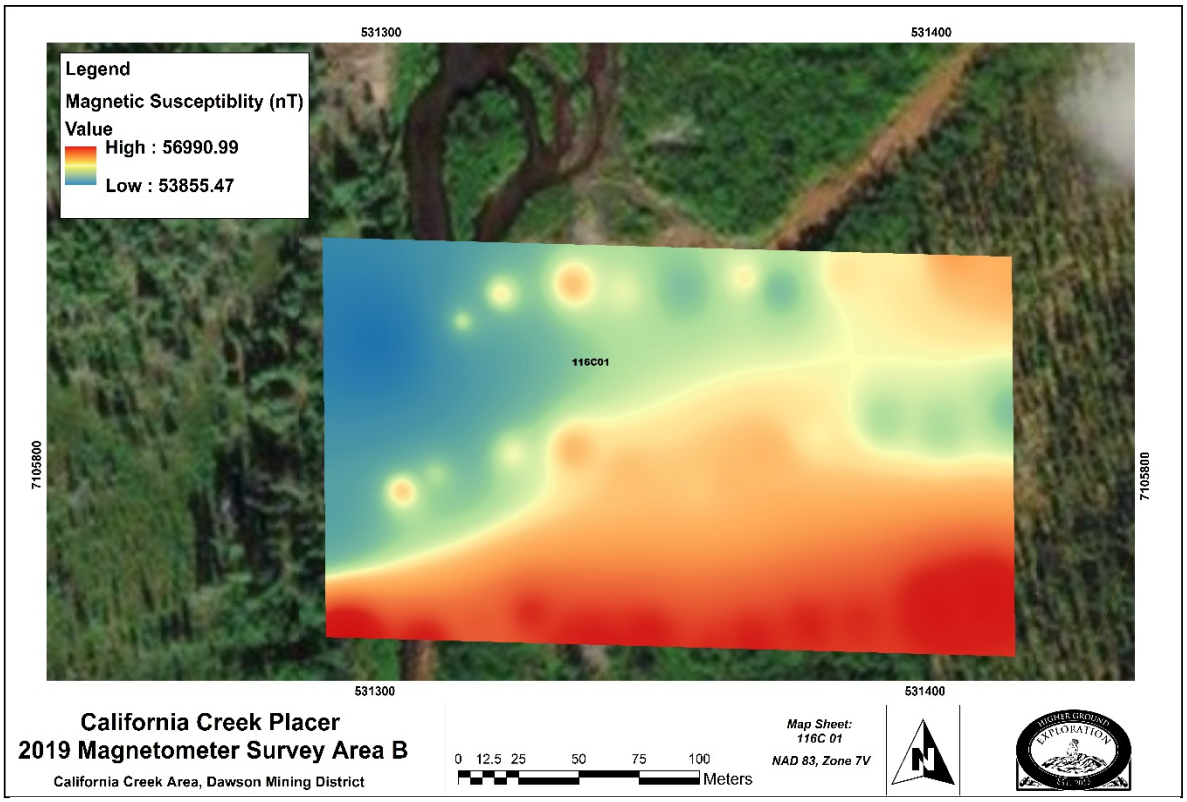


***Figure 8**: California Creek magnetometer survey Area B*

Test Shafting

Shafting was completed on California Creek in the winter of 2019. 2 shafts were dug using a crew of 2-3 labourers while using fire and pickaxe as methods to thaw the ground and advance to bedrock. Due to the poor weather at the time and the amount of snow present, a generator was not able to be used to thaw the ground, and so fire was used instead.

The first tier shaft advanced to a total of 7 feet with gravel being reached at 6 feet. The second tier shaft was dug to a depth of 8 feet, with all material being fine silt.

The locations of the two shafts dug on the project were:

Shaft 1 tier 1 - 07W 530848 7106502 UTM

Shaft 2 tier 2 - 07W 530589 7106235 UTM

Labour for the shafting work was contracted out to Kane Morgan and 2 other Dawson residents.

*Disclaimer** The two 3-mile leases along the right-limit of California creek that the 2019 shafting program were carried out on, had a discrepancy with neighboring First Nation category B lands and the Dawson mining recorder made an administrative decision to drop the leases. The issue was due to the location of the placer posts and existing California creek baseline conflicted with settlement lands. Leases must be staked in a different manner establishing a new bench base line to ensure there are no issues in future staking. An attempt was made to restake the leases during the UAV-Mag survey, but powers of attorney could not be obtained for the stakers due to COVID-19 pandemic restrictions on access to notary publics in BC. The leases will be staked in a different configuration by establishing a new bench base line to ensure there are no issues in future staking once crews are able to conduct exploration pending the COVID-19 pandemic.

UAV-MAG Survey

The airborne magnetic survey (UAV-MAG™) was carried out by Pioneer Aerial Surveys of Regina, Saskatchewan using an Unmanned Aerial Vehicle (UAV). 85.69 line-kilometers were flown over California Creek at 50m line spacing at an azimuth of 090 °. Flying height was 35m above ground level based on elevation data from the Airbus 12m

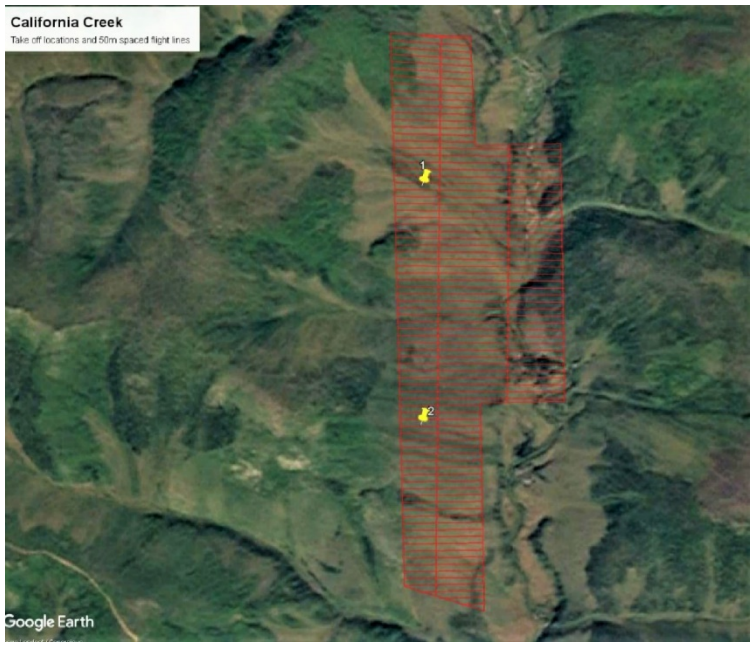
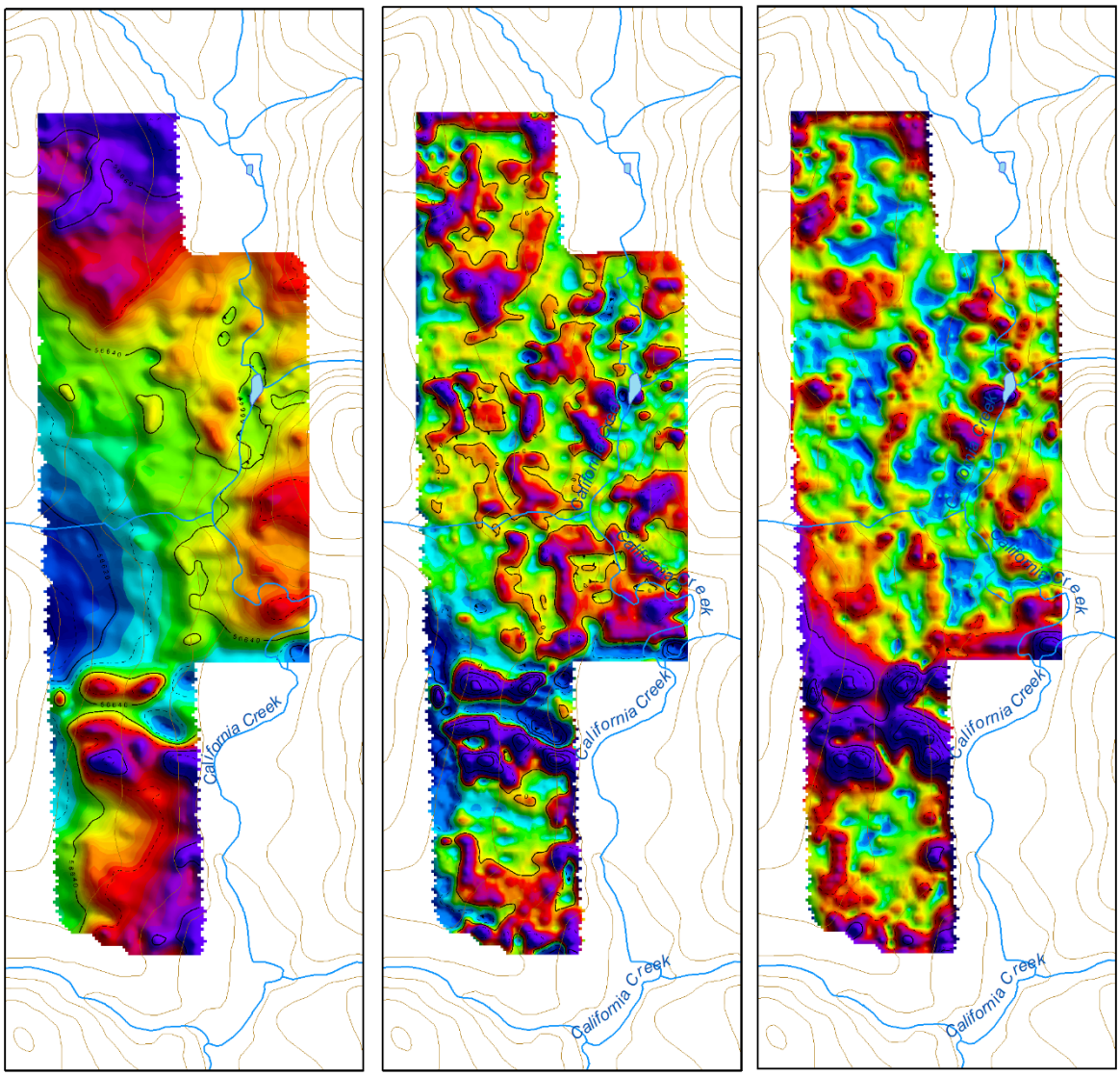


Figure 9: *UAV-MAG Survey layout. Takeoff and Landing Zones are marked by yellow pins.*



Total Magnetic Intensity **First Vertical Derivative** **Analytical Signal**

METALLIC MINERALS
California Creek
Results
Airborne Magnetic Survey
1:30,000 Date: 2020-04-04

Figure 10: Comparison of geophysical maps from airborne survey.

WorldDEM™ dataset (included in deliverables). The UAV survey was conducted on March 18th, 2020 with a two-man crew which was based out of Dawson. Fireweed Helicopters was contracted to transport the field crew to California Creek. The logistics report, maps and deliverables are included in a digital appendix. Magnetic map products created from the

survey include total magnetic intensity (TMI), first vertical derivative (FVD) of the magnetic intensity and analytical signal (AS). See figure 10 and the geophysics report.

The results of the survey will be used to delineate magnetically susceptible gravels that could be related to placer gold deposits. An initial interpretation of the survey (figure 11) has been done and further interpretation is ongoing.

The most prospective areas are numbers 2-5 as shown on figure 10. Area 2 is a north-south trending anomaly that runs through the right-limit bench at a favourable elevation. Areas 3-5 outline a potential paystreak that corresponds with shallow bedrock overlain by gravels observed during the ground magnetic survey. It lies approximately 3-5m above the creek level and is marked by a change in vegetation (caribou lichen verse sphagnum moss, mature well grown trees verse stunted conifers) suggesting well drained soils or soils forming over gravels. At the southeastern extent the potential paystreak corresponds with 4 large point bars along the creek (5). The 3-5 anomalies have been dissected by recent fluvial action, but together form a similar feature to the intact linear feature 2. The results are shown over Analytical Signal as this data presentation highlights edges and sharp magnetic features. The first vertical derivative is similar to the analytic signal but not as clearly and the total magnetic intensity best displays changes in bedrock.

On the west side of California Creek and in the southern part of survey, the TMI displays more of a bedrock response with a broad low to the west and a higher magnetic response to the south, suggesting a change in underlying rock type.

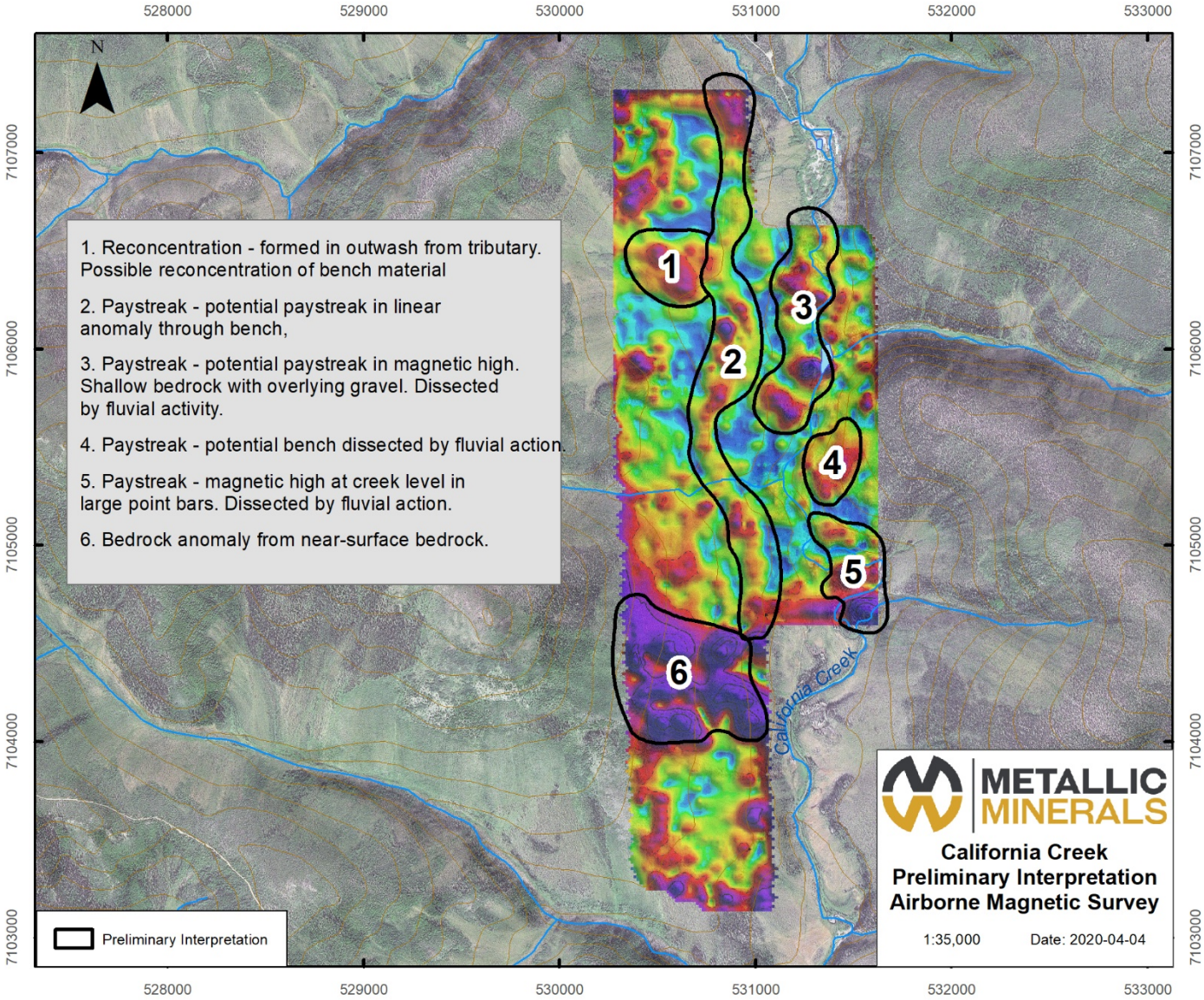


Figure 11: Interpretation of magnetic features from Analytical Signal geophysics map.

Work Schedule & Expenditures 2019-2020

Dates	Activity	Field days (incl mobe)	Cost (incl GST)	personnel	mandays	Field expenses	Invoices
May 23-25, 2019	Site visit	3	$1260	Nicolai Goeppel,	3	300	HGE 1952
Oct 10 - 17	Ground mag survey	4	2913.75 + 9806.37	Nicolai Goeppel	5	500	HE 1952 Fireweed 5390
Oct 10-17	shafting	8	7000	Kane Morgan, 2 helpers	24	2400	2252262,
Oct 14-17	Site work	4	3386.25	Bill Harris	4	400	MMS 20-02 rev
Mar 17-19, 2020	UAV-mag	3	4544.51+ 11539.19		6	Incl in invoice	Fireweed 5420 Pioneer
Mar 29-Apr 4	report	0	2000				
Totals			**$42450.07**		**42**	**$3600.00**	**$46,050.07**

Conclusion and Recommendations

The 2019-2020 placer exploration program was successful in discovering shallow gravels at 6 ft on the right limit bench of California creek through shafting, delineating potential pay streaks and favourable sites for alluvial gold accumulations through a ground magnetometer survey and completed a drone magnetometer survey across the entire property. Based on 2019-2020 results and the results of previous placer exploration further work is warranted. A future program consisting of prospecting, shafting, mechanical test pitting, drilling and bulk sampling is recommended. The California creek property offers numerous bedrock exposures that offer excellent sites for prospecting and hand dug test pitting. Mechanical test pitting or during the winter months shafting would be effective to test magnetic anomalies observed in Survey A of the ground magnetometer survey, around the potential ledge in Survey B and in areas of known shallow bedrock. Such sites if indicating favourable grades would be positive sites for larger volume tests. Drilling would only be warranted if areas prove to be deeper than what can be achieved through

mechanical test pitting. Based on partially thawed conditions and the expected class 4 mining license which would allow for a larger excavator to do the testing providing greater reach; mechanical test pitting would be more cost effective and useful if bulk sampling is warranted. If they can be found, the 1985 drilling locations offer an excellent site for immediate bulk sampling.

As described by LeBarge (2006), considerable placer potential remains in the Sixtymile River drainage and its tributaries, including California Creek. This includes alluvial settings such as 1) pre-Reid and older buried abandoned channels; 2) interglacial buried and/or abandoned alluvial terraces; 3) modern (Holocene) alluvial channels and gulches; and 4) technogenic deposits.

California Creek has not been subjected to the same level of historic placer exploration as other drainages in the Sixtymile River drainage, and there has been only minimal exploration using modern methodologies such as geophysics. However, with historic placer mining operations downstream, and an active mining operation upstream, the California Creek property is bracketed by gold-bearing gravels on both sides. Additionally, limited sampling of the gravels on the property have indicated potentially economic quantities of placer gold, and initial geophysical surveys appear to indicate that bedrock is at mineable depths.

It is therefore recommended that further exploration be conducted on the Fox 1-13 claims and on the right limit bench of former prospecting leases ID01732 and ID01733 (now expired). This should include geophysical (electrical resistivity) surveys, both to confirm the earlier ground-penetrating radar survey results and to explore new areas which have little or no data.

Drilling and excavator test-pitting should be conducted on targets identified by the previous GPR surveys and new targets identified by the proposed resistivity surveys.

Shafting to bedrock should also take place on targets which are not evaluated by test-pitting and auger drilling. This should be followed by increasingly larger bulk sampling and full-scale mining, should results of progressive testing prove favorable.

Statement of Qualifications

I, Chris Arsenault do hereby certify that:

1. I graduated with a B.Sc. in Geology from Acadia University in 2014 and a technical diploma in Earth Resources Technology from Sir Sanford Fleming College in 2011.
2. I have worked as an independent consultant Geologist since 2015 in the Yukon Territory, Ontario, Nova Scotia, and British Colombia. I have been involved in the mineral exploration industry of the Yukon since 2007 and have a thorough understanding of grass roots project generation of the territory. I have prior experience conducting ground based geophysical surveys targeting base metals in Arizona and Minnesota, USA over known economical deposits.
3. I have prepared this report which relies upon existing data relating to the project area, including field work conducted by geologists from multiple mineral exploration companies, government institutions, and academic literature which describes the geological settings of the project area and surrounding areas.
4. I have ensured that adequate quality control and assurance measures were taken in handling of all drilled core and subsequent samples submitted for assays.

I Nicolai Goeppel, of the city of Whitehorse, Yukon, certify that:

1. I worked and carried out work on the California Creek Property in 2019
2. I have completed an Earth Sciences B.Sc. at Memorial University of St. John's, Newfoundland in 2014
3. I have worked in the mineral exploration industry in the Yukon, Newfoundland, and British Columbia since 2009
4. I have been involved in the placer industry my entire life and engaged in placer gold exploration in the Yukon and BC since 2009
5. Owner and founder of Higher Ground Exploration Services since 2015

Dated this 31st of March, 2020

I, Deborah Ann Rachel James of 11-3194 Gibbins Road, Duncan, British Columbia, do hereby certify the following:

- I am a Professional Geoscientist in good standing with the Association of Professional Engineers and Geoscientists of B.C.

- I graduated from the University of British Columbia with a B.Sc. degree in Geological Sciences in 1988
- I have been employed continuously in the mineral exploration and mining industry since 2006 and have been practising my profession as a geologist continuously since 2006.
- I have worked in the Yukon Territory in 1988-1989 and from 2006-present. During that time I have worked in the field on the Mt. Skukum Au-Ag vein deposit near Carcross, YT, the Nucleus and Revenue Cu-Au Porphyry deposits at the Freegold Mountain Property in the Dawson Range, Ni-Cu-PGE occurrences in the Kluane Ranges in southwest YT, Ag-Pb veins in the Keno Hill District, and the Stu Copper Property.
- I have not visited California Creek and my role for this report was to compile the program expenses and insert the section on the UAV-Mag survey and submit the report.

References

Bond, J.D. and van Loon, S., 2018. Yukon Placer Mining Industry 2015-2017. Yukon Geological Survey

Chapman, R.J., Mortensen, J.K., and LeBarge, W.P. 2011. Styles of lode gold mineralization contributing to the placers of the Indian River and Black Hills Creek, Yukon Territory, Canada as deduced from microchemical characterization of placer gold grains. Miner Deposita., vol. 46, pp. 881–903.

Colpron, M. and Nelson, J.L. (eds.), 2006. Paleozoic evolution and metallogeny of pericratonic terranes at the ancient Pacific margin of North America, Canadian and Alaskan Cordillera. Geological Association of Canada, Special Paper 45, 523 p.

Duk-Rodkin, A., 1996. Surficial Geology, Dawson, Yukon Territory; Geological Survey of Canada, Open File 3288, Scale 1:250,000.

Duk-Rodkin, A., 1999. Glacial Limits Map of Yukon Territory. Geological Survey of Canada, Open File 3694, Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada, Geoscience Map 1999-2, 1:1 000 000 scale.

Gordey, S.P. and Ryan, J.J., 2005. Geology map, Stewart River area (115 N, 115-O and part of 115 J), Yukon Territory. Geological Survey of Canada, Open File 4970, 1:250 000 scale.

Hughes, R.L., 1986. Sedimentology of the Sixtymile River placer gravels, Yukon Territory. Unpublished M.Sc. thesis, Department of Geology, University of Alberta, Edmonton, Alberta, 210 p.

Jackson, L.E., Jr., Shimamura, K., and Huscroft, C.A., 2001. Late Cenozoic geology, Ancient Pacific Margin NATMAP Report 3: A re-evaluation of glacial limits in the Stewart River basin of Stewart River map area, Yukon Territory. Geological Survey of Canada, Current Research, 2001-A3, 8 p.

Jackson, L.E., Jr., 2005. Surficial geology, Ogilvie, Yukon Territory, 115 O/12. Geological Survey of Canada, Open File 4589, 1:50 000 scale.

LeBarge, W., 2006. Placer geology and prospective exploration targets of Sixtymile River area, west- central Yukon. In: Yukon Exploration and Geology 2005, D.S. Emond, G.D. Bradshaw, L.L. Lewis and L.H. Weston (eds.), Yukon Geological Survey, p. 155-174.

LeBarge, W.P., 2007. Yukon Placer Database–Geology and mining activity of placer occurrences, Yukon Geological Survey, 2 CD-ROMs.

LeBarge, W.P., and Morison, S.R., 1990. Yukon Placer Mining and Exploration, 1985-1988; Exploration and Geological Services Division, Indian and Northern Affairs Canada, 151 p.

Logutov, B., 2015. Report of completed geological and geophysical works on the Grouping claims Fox 1- 13 California Cr., Assessment report #120236, Yukon Government, 8 p. Confidential.

Lowey, G.W.., 2004. Placer geology of the Stewart River (115N&O) and part of the Dawson (116B&C) map areas, west-central Yukon, Canada. Yukon Geological Survey, Bulletin 14, 275 p.

MacKenzie, D., Craw, D., and Mortensen, J.K., 2008. Structural controls on orogenic gold mineralisation in the Klondike goldfield, Canada. Mineralium Deposita, vol. 43, p. 435-448.

MacKenzie, D.J. and Craw, D., 2010. Structural controls on hydrothermal gold mineralization in the White River area, Yukon. *In*: Yukon Exploration and Geology 2009, K.E. MacFarlane, L.H. Weston and L.R. Blackburn (eds.), Yukon Geological Survey, p. 253-263.

MacKenzie, D. and Craw, D., 2012. Contrasting structural settings of mafic and ultramafic rocks in the Yukon-Tanana terrane. *In:* Yukon Exploration and Geology 2011, K.E. MacFarlane and P.J. Sack (eds.), Yukon Geological Survey, p. 115-127.

Reshetov, L., 2008. Technical report of exploration work on the Mineral Project Upper California Creek, YMIP2008-005, 56 p.

Digital Appendices

Appendix A - Ground Geophysics Data

Appendix B - UAV-Mag Geophysics Field Report and Data

2019 Ground magnetometer Survey California Creek

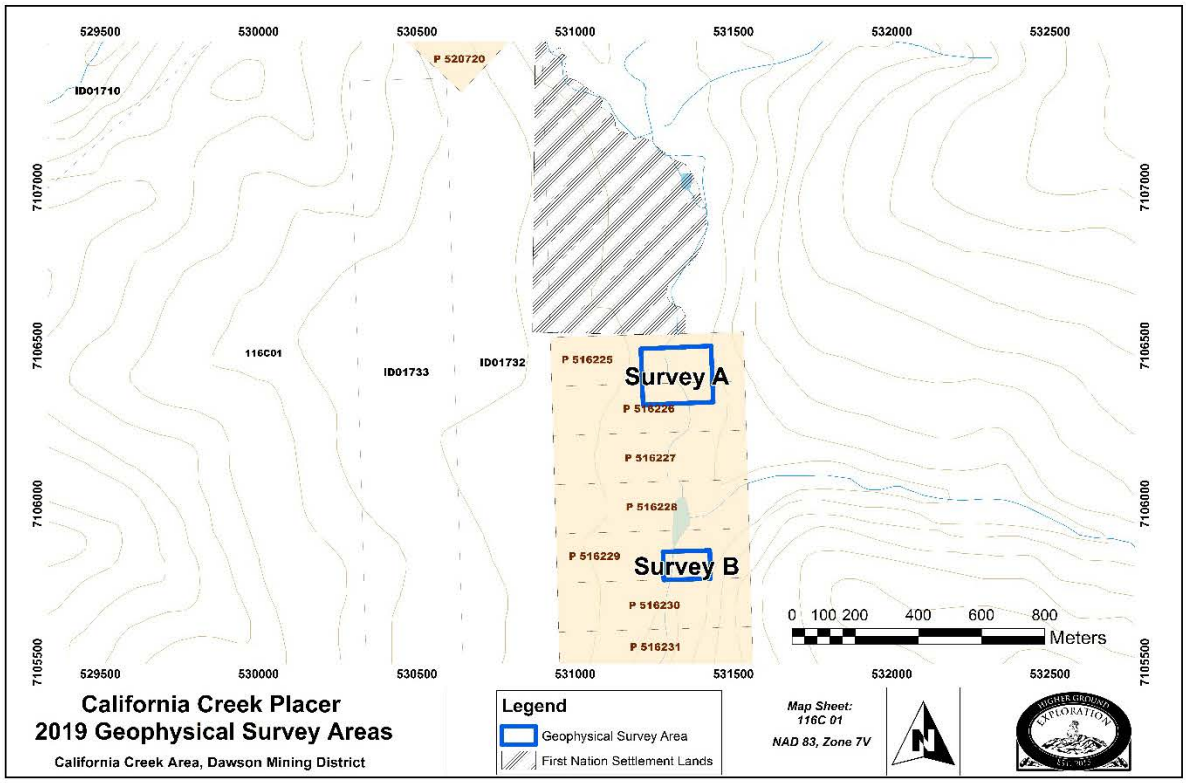
On October 15th and 16th, 2019 a ground magnetometer survey was carried out on California creek at the upstream or north end of the California creek claims (Figure XX). The area was accessed by a long ranger helicopter from Fireweed helicopters base in Dawson city. Due to icing conditions during the survey the second day was reduced and more helicopter time was required to safely access and leave the property. In addition, the shafting crew, camp and equipment had to be evacuated from the site as winter conditions made the road access impassible.

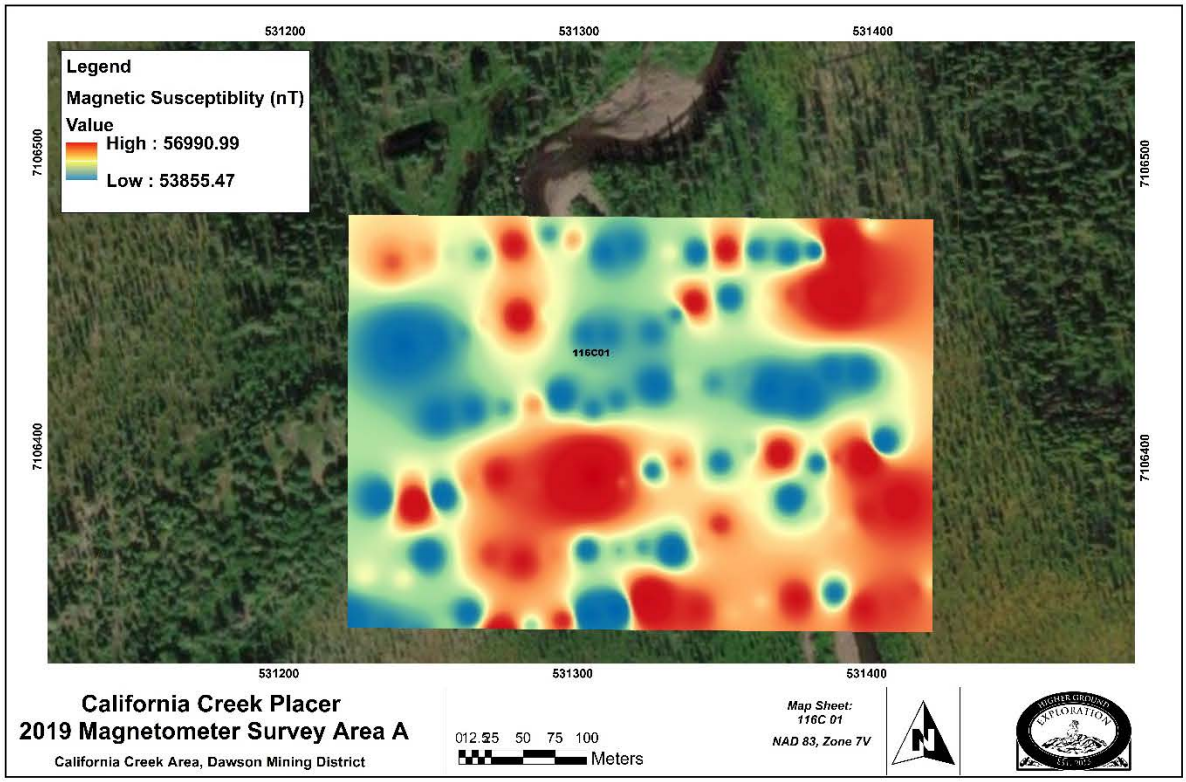
The magnetometer unit is a GEM systems GSM-19 (serial number 7022236) proton precession magnetometer. The unit interface is harnessed to the operator's chest attached with cables to a 2m staff has the attached sensor and gps. The magnetometer survey measures magnetic susceptibility of the subsurface, the greater the accumulation of magnetic minerals the greater the magnetic response. In this case, higher magnetic susceptibility represents potential pay streaks as higher velocity fluvial flows would have concentrated gold and other heavy minerals by washing away lighter minerals (heavy minerals ie: magnetite, ilmenite, platinum, other PGEs, cobalt, Ni-alloy, sheelite, etc). It should be noted that the computer generation of the geophysical maps uses an interpolation between points; therefore, data is extrapolated between readings and has less confidence as distance between reading increases. The smaller the distance between readings the greater the resolution in the projection and the higher the accuracy of the data. To reduce these effects separate maps have been generated for the different areas surveyed.

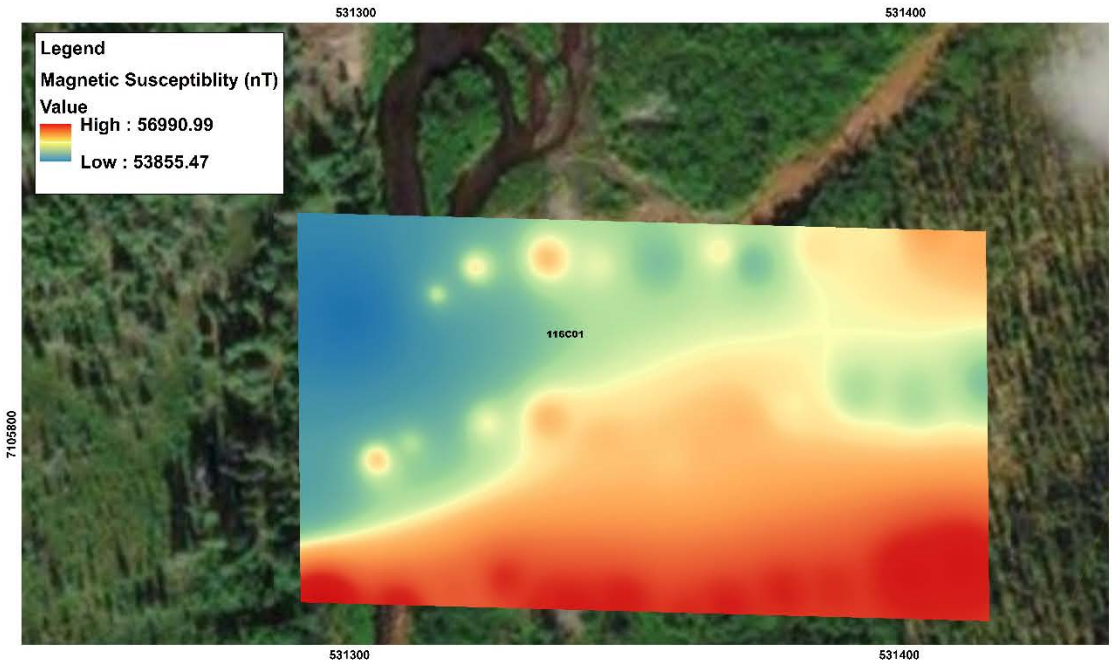
A total of 1.57 line-kilometers was surveyed on the California Creek property; consisting of two grids Survey A on the upstream end that was 1.54 line-kilometer and Survey B that was 0.414 line-kilometers. Magnetometer survey lines were oriented perpendicular to the drainage and spaced 25m apart with readings taken every 10m. Survey areas primarily focused on the creek bottom with only a few readings taken on the edge and on top of benches. Bedrock was observed in the Survey B area along the western edge of the drainage bottom.

Survey A consisted of 105 readings ranging from 56683.27 – 56990.99 nano tesla (nT). Survey A results indicate higher magnetic respond at the edge of the bench and in an immediately east of the creek were a north – south trending high corresponds with recent fluvial incision that is observable in high resolution satellite imagery. Figures XX outlines the magnetometer results.

Survey B was conducted downstream to the south 500m from Survey A. A total of 38 readings were taken and ranged from 53855.47 – 56836.02 nT. The survey appears to have detected more of bedrock response but pinpoints the location of a thrust fault juxtaposing quartzite / quartz-muscovite-chlorite schist to the north and orthogneiss to the south, which is also mapped in the regional bedrock maps for the area. This is illustrated in the broad magnetic high in the southern part of the area and the broad low to the north. This contact would serve a potential ledge or 'gold trap' for any fluvial activity. Bedrock was observed along the western side of the survey area, suggesting shallow bedrock in the area which would account for the survey response. The low magnetic response from the schist unit which occupies Survey A area would suggest that magnetic anomalies from Survey A are likely more a result of fluvial activity and concentrating of heavy minerals. Figures XX outlines the magnetometer results.


529500
530000
530500
531000
531500
532000
532500
7107000
7106500
7106000
7105500
P 520720
ID01710
116C01
ID01733
ID01732
P 516225
Survey A
P 516226
P 516227
P 516228
P 516229
Survey B
P 516230
P 516231
0 100 200 400 600 800
Meters
California Creek Placer
2019 Geophysical Survey Areas
California Creek Area, Dawson Mining District
Legend
Geophysical Survey Area
First Nation Settlement Lands
Map Sheet:
116C 01
NAD 83, Zone 7V
N


531200
531300
531400
7106500
7106400
Legend
Magnetic Susceptiblity (nT)
Value
High : 56990.99
Low : 53855.47
116C01
California Creek Placer
2019 Magnetometer Survey Area A
California Creek Area, Dawson Mining District
012.25 50 75 100
Meters
Map Sheet:
116C 01
NAD 83, Zone 7V
N



California Creek Placer
2019 Magnetometer Survey Area B

California Creek Area, Dawson Mining District

0 12.5 25 50 75 100 Meters

Map Sheet:
116C 01
NAD 83, Zone 7V

LONGFORD EXPLORATION

460 - 688 HASTINGS ST WEST, VANCOUVER BC, V6B 1P1

UAV-MAG™ Survey Logistics Report

GLOBAL UAV TECHNOLOGIES

Pioneer Aerial Surveys Ltd. is a Subsidiary of Global UAV Technologies Ltd., a vertically integrated drone technology company that is publicly traded on the Canadian Securities Exchange under the symbol UAV. For more information refer to www.globaluavtech.com

Table of Contents

Introduction 1

Location 1

Survey Specifications and Procedures 3

Instrumentation and Software 4

Magnetic Base Station 4

Unmanned Aerial Vehicle – Matrice 600 4

UAV-MAG™ Configuration 5

Data Deliverables and Channel Descriptions 5

Magnetic Maps and Derived Data Products 6

Total Magnetic Field 6

First Vertical Derivative 6

3D Analytic Signal 6

Data Processing 7

Data Comments 9

List of Figures

Figure 1: Map of California Creek. Blue lines indicate collected UAV-MAG™ survey lines. Inset, the location of the survey is shown relative to Dawson, 46 km to the east. 2

Figure 2: Map of Catalyst survey area. Blue lines indicate collected UAV-MAG™ survey lines. Inset, the location of the survey is shown relative to Haines Junction, 126 km to the southeast. 3

List of Tables

Table 1: Personnel involved with the project. 1

Table 2: Survey details. 4

Table 3: Database channel descriptions. 5

List of Appendices

Appendix 1: Instrument Specification 10

Appendix 2: Final Maps 16

Introduction

From March 18th, 2020 to March 24th, 2020, Pioneer Aerial Surveys Ltd. (Pioneer) completed two airborne magnetic survey (UAV-MAG™) using an Unmanned Aerial Vehicle (UAV) in Yukon Territory. The surveys were flown at the request of Longford Exploration.

This report covers data acquisition, instrument descriptions, data processing and presentations. The digital data delivery is described later in this report. This report does not include any geological interpretations of the geophysical dataset. Key survey personnel are listed in Table 1.

Table 1: Personnel involved with the project.

Pilot in Command	Andrew Gagnon-Nandram
Ground Crew	David Storm
Data Processing and QA/QC	Kiyavash Parvar

Location

This project consisted of two separate survey areas in western Yukon. The California Creek survey area is located 46 km west of Dawson, YT. The staging locations were accessed by helicopter. The location can be observed in Figure 1. The Catalyst survey area is located 126 km northwest of Haines Junction, in the mountains west of Kluane Lake. The staging locations for this survey were also accessed by helicopter. The location can be observed in Figure 2.

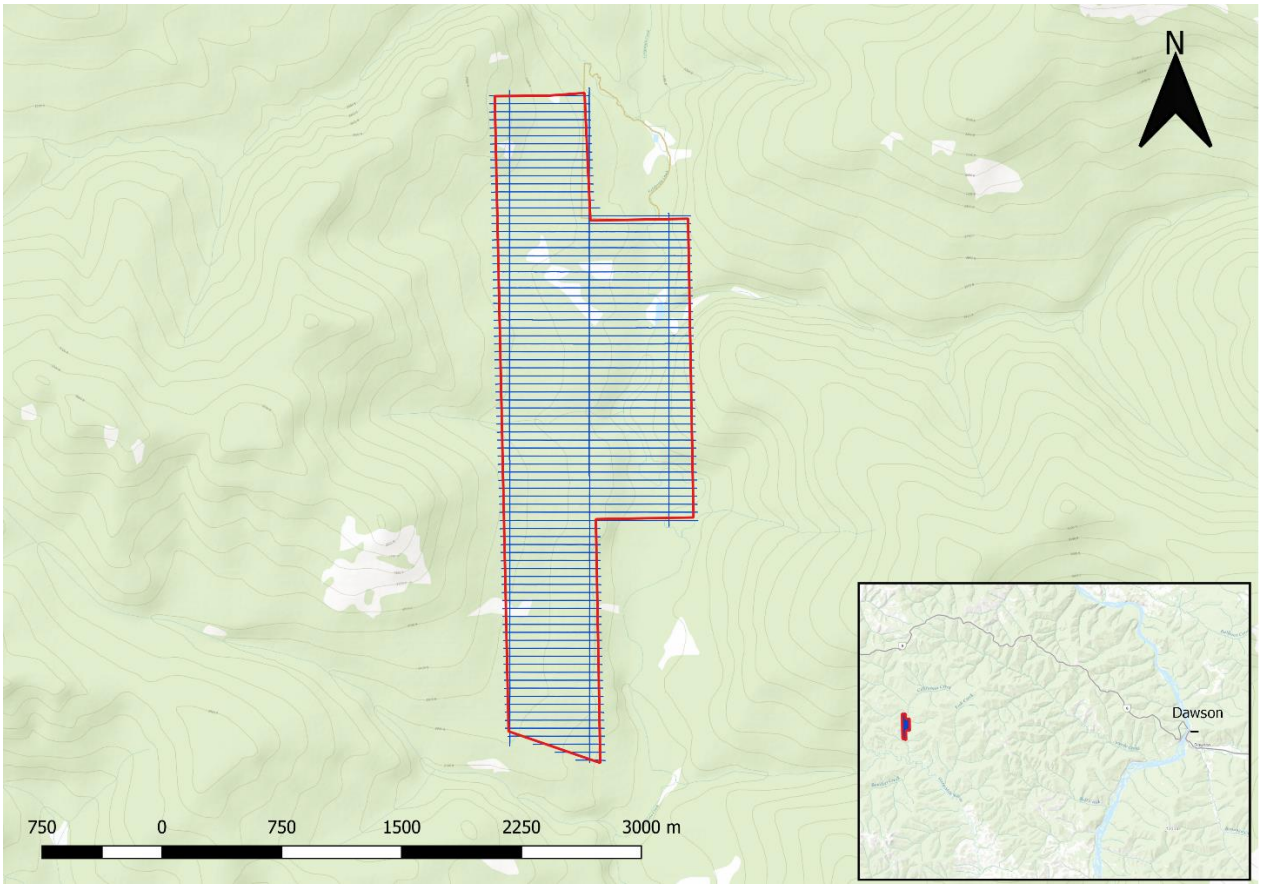


Figure 1: Map of California Creek. Blue lines indicate collected UAV-MAG™ survey lines. Inset, the location of the survey is shown relative to Dawson, 46 km to the east.

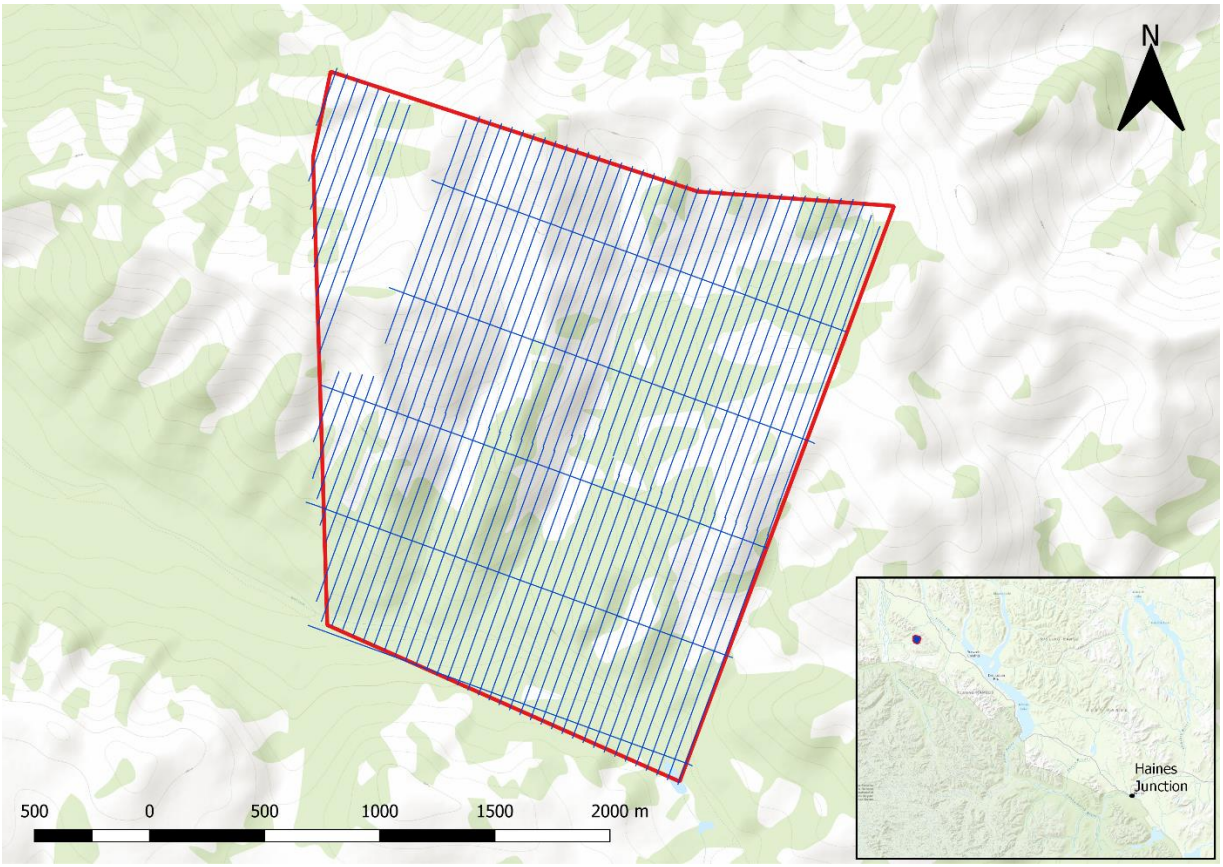


Figure 2: Map of Catalyst survey area. Blue lines indicate collected UAV-MAG™ survey lines. Inset, the location of the survey is shown relative to Haines Junction, 126 km to the southeast.

Survey Specifications and Procedures

The nominal altitude above ground level (AGL) was set to 35 m for the California Creek survey, and 50 m for the Catalyst survey. Elevation data for this survey was sourced from the Airbus 12m WorldDEM™ dataset, provided by Apollo Mapping. The nominal production groundspeed is 10 m/s for flat topography with no wind. The survey speed may vary depending on the terrain and environmental conditions.

The ground crews preformed daily safety meetings and pre-flight checks prior to the start of drone flight operations. The Pilot in Command (PIC) is responsible for the safety of the crew and equipment during the survey operations. Each survey flight is pre-planned using ground control software, then the flight plans are uploaded to the UAV prior to takeoff. The UAV system flies the pre-defined waypoint based flight plans while the ground crew maintains visual line of sight with the craft and the flight telemetry information. Flights are terminated and the UAV returns for landing when the battery voltage reaches a certain limit, or when the flight plan is complete. The survey flights can be manually terminated and taken over with full manual pilot control at anytime. Upon landing, the flight batteries are exchanged and the

sensor is downloaded for QAQC checks. The average distance covered by each flight is approximately 6-10-line kms of data acquisition.

Addition details on the completed survey can be found in Table 2.

Table 2: Survey details.

Area Name	Line Spacing (m)	Line Direction (deg)	Tie Line Spacing (m)	Flight Lines (km)	Tie Lines (km)	Total Line Kilometres (km)
California Creek	50	090	500	75.43	10.25	85.69
Catalyst	50	020	500	98.6	9.72	108.32

Instrumentation and Software

The principal airborne sensor used was a Gem Systems Canada GSMP-35U potassium vapor sensor mounted on a UAV platform. Ancillary equipment included a laser altimeter with a 130m range, Global Positioning Satellite (GPS) system antenna and Inertial Measurement Unit (IMU). A stationary GSM-19 Overhauser magnetometer was used as a base station. Raw aerial magnetometer data was collected at a rate of 10 Hz while base station data was collected at a rate of 0.16 Hz. Total field and GPS UTC time was recorded with each data point, enabling diurnal correction to be applied during final data processing.

Magnetic Base Station

A GSM-19 Overhauser Magnetometer base station was placed in a location of low magnetic gradient, away from electrical transmission lines and moving metallic objects, such as motor vehicles and aircrafts. The data collected from this base station was used to diurnally correct the aeromagnetic data. The GSM-19 Overhauser Magnetometer is supplied by GEM systems of Markham, Ontario. General specifications of the magnetometer are included in Appendix 1: Instrument Specification.

Unmanned Aerial Vehicle – Matrice 600

Pioneer used the Matrice M600 Pro UAV to complete this survey. The Matrice 600 (M600) is DJI's platform designed for professional aerial photography and industrial applications. It is built to closely integrate with a host of powerful DJI technologies, including the A3 flight controller, Lightbridge 2 transmission system, Intelligent Batteries and Battery Management system, for maximum performance and quick setup. As stated by the manufacturer, some of the advantages to using this type of helicopter systems are:

Total Integration: The modular design makes the M600 easy to set up and ready to use in just minutes. Its dust proof propulsion systems simplify maintenance while actively cooled motors make for reliable operation during extended use.

Smart Flight Safety: The M600 uses sine-wave driven, intelligent ESCs to ensure it performs accurately, safely and efficiently while A3's self-adaptive flight systems adjust flight parameters automatically based on different payloads. The A3 can be upgraded with two additional GNSS and IMU units to A3 Pro or with D-RTK GNSS for enhanced accuracy.

Extended Flight Time and Transmission Range: The M600 features an extended flight time and a 5 km long-range, ultra-low latency HD image transmission for accurate image composition and capture. The system uses 6 small DJI Intelligent Batteries, allowing it to be shipped easily to wherever it is needed. A customized battery management system and power distribution board allows all six batteries to be turned on with the press of a single button and keeps the system in flight in the event of a battery failure. It also allows users to check the battery status in real-time during flight.

Powerful App Control: The M600 supports a live HD view, battery status, redundancy status, transmission strength and much more, straight from the tablet application.

UAV-MAG™ Configuration

GEM System's UAV GSMP-35U is a potassium magnetometer providing unmatched sensitivity in addition to a low heading error effect. The GSMP-35U operates on principles similar to other alkali vapor magnetometers however benefits from the unique nuclear properties of potassium. Each GSMP-35U system has 0.0002 nT sensitivity combined with +/- 0.1 nT absolute accuracy over its full operating range. More details on the instrument can be found in Appendix 1: Instrument Specification. The UAV-MAG™ consists of a towed bird configuration with a sensor-aircraft separation distance of either 3 or 5m. The sensor is flown along the survey lines with a fixed heading to maximize the signal amplitude and provide the best sensor orientation for the local conditions. This action minimizes heading errors. The data is both stored on board during acquisition and transmitted in real-time back to the ground control station to monitor the collection during flight and ground clearance of the sensor from the laser altimeter data.

Data Deliverables and Channel Descriptions

All data is typically delivered in either Geosoft Database (GDB) or simple formats such as .txt or csv. The data deliverables are client specific to best suit their needs and software requirements. Regardless of software, a database is supplied to the client with channel descriptions as described in Table 3.

Table 3: Database channel descriptions.

Parameter	Explanation	Units/Format
Date	Flight Date	yyyy/mm/dd
hhmmss_s	GNSS time stamp	hhmmss.ss
lat	Latitude (WGS84)	Decimal degrees
lon	Longitude (WGS84)	Decimal degrees
alt	GPS altitude above the average sea level	metres
utmE	UTM easting (WGS84)	metres

utmN	UTM northing (WGS84)	metres
sat	Number of locked satellites	metres
zone	UTM zone	-
yaw	IMU yaw reading	Degrees
pitch	IMU pitch reading	Degrees
roll	IMU roll reading	Degrees
nT	Magnetic field readings (Raw)	Nanotesla
nT2	Diurnal correction has been applied on the nT channel (Diurnal datum: 56900 nT)	Nanotesla
Final	Final Residual Magnetic Intensity	Nanotesla
Dist	Distance to the first point of the line	metres
Laser	Laser altimeter data	metres

Magnetic Maps and Derived Data Products

The final magnetic data has been presented in the form of several different magnetic maps (Appendix 2: Final Maps). Each of these different data presentations is a useful tool for identifying geological structures and other features.

Total Magnetic Field

Based on the flight lines covered by the drone, the total magnetic field map grid was created by interpolating the filtered magnetic data. The purpose of this data presentation is to highlight geological structures that may be visible in the survey area by their magnetic signature or their magnetic contrast to their surroundings.

First Vertical Derivative

The first order vertical derivative quantifies the rate of change of the magnetic field as a function of elevation. It is an approximation of the vertical magnetic gradient, which could be directly measured with separate magnetometers vertically spaced apart. The purpose of this type of filter is to eliminate the long wavelength signatures and make sharp features more detectable, such as the edges of magnetic bodies. This filter also increases the noise level, which limits the use of higher order derivatives (n=2 for example). The vertical derivative is used to delineate the contacts between large-scale magnetic domains because its value is zero over vertical contacts.

3D Analytic Signal

The analytic signal is the square root of the sum of the squares of the derivatives in the x, y, and z directions:

$$Analytical\ Signal = \sqrt{dx * dx + dy * dy + dz * dz}$$

The analytic signal is useful in locating the edges of magnetic source bodies, particularly where remnant magnetic signals and/or low magnetic latitude complicates interpretation.

Data Processing

In general, all typical magnetic QA/QC and data processing techniques have been applied to the data. All post-field data processing was carried out using Geosoft Oasis Montaj, Python and Microsoft Excel software/ programing languages. Presentation of final maps used ESRI ArcMap and/or Geosoft Oasis Montaj. Results were gridded using minimum curvature method and a grid cell size of approximately 1/3 of flight line spacing.

The geophysical images accompanying this report are positioned using the WGS 1984 datum. The survey geodetic GPS positions have been map projected using the Universal Transverse Mercator (UTM) projection. A summary of the map datum and projection specifications are as follows:

- Datum: WGS 1984 UTM Zone 8N
- Scale Factor: 1:15000
- Linear Unit: Metre (1)

The magnetic data was first quality checked in the field and any points lacking sufficient georeferenced data or which were excessively noisy were removed. The resulting data was processed as mosaics throughout the survey area as data was collected daily. A final combination of all data formed the final results including lines that were re-flown due to weak or insufficient magnetic signal.

The base station readings were initially processed and filtered to remove sudden spikes. The filtered base station dataset was then used to perform a diurnal correction on the magnetic survey data. The diurnally corrected profile data were interpolated into a grid using the minimum curvature technique with a grid size of approximately 1/3 of flight line spacing. All final maps have a normalized color interval.

After finishing interpolation, initial processing subjected the data to a non-linear filter with a wavelength limit of 3-4 fiducials and tolerance of 0.001. This filter removes extra high frequency features which mostly occur because the sensor is in the dead zone. This usually occurs due to sudden changes in sensor orientation, effect of ferro-metallic objects, or the influence of weather conditions on the sensor. This filter smooths out noise and high frequency features.

After leveling the data using the tie lines, the data was microlevelled. This step is performed to mitigate the corrugation effect associated with gaps between the data lines and is completed by applying a high-pass butterworth filter with the threshold of 200 metres (line spacing x 4) followed by a directional cosine filter perpendicular to the line direction. The resulted noise channel was then subtracted from the leveled values to microlevel the data. The final result of the leveling and micro-leveling processes was then put in “Final” Channel of the database.

The following corrections were applied to the airborne magnetic data:

- Correction for diurnal variation using the digitally recorded ground base station magnetic values as described above
- Lag was negligible therefore only a minor lag correction was applied
- Heading biases were negligible therefore no heading correction was applied
- Micro-leveling
- Analytic Signal calculation
- First Vertical Derivative calculation

The final maps are included in Appendix 2: Final Maps.

Data Comments

Pioneer's UAV Mag surveys result in a high quality, high resolution data product. The increased flight line density and lower flight elevation possible with the use of a UAV platform result in superior resolution data products when compared to conventional airborne magnetic data. Using an auto-controlled UAV platform also allows for minimal deviation from pre-planned flight lines, and greatly reduces the impact of human error during data collection.

Logistics remains a major challenge of UAV surveying. In order to operate legally within the guidelines set by Transport Canada, line of sight must be maintained to the UAV and surrounding airspace at all times. This often results in several staging locations being necessary to cover a survey area, and sometimes requires the employment of additional equipment such as an aerial platform or scissor lift in order to achieve unobstructed line of sight beyond surrounding buildings or vegetation. These smaller blocks typically flown in UAV surveys require greater attention in post acquisition processing.

Pioneer makes every effort to identify potential sources of noise and mitigate their impact on our collected survey data. Flight lines are planned with a minimum of 50 m overlap past the survey boundaries so that the magnetic sensor has time to stabilize itself after the UAV has completed its turns. Additionally, weather is carefully monitored and when excessive data inconsistency is noted due to weather conditions, flights area suspended until conditions improve.

Pioneer Aerial is very pleased with the results from this survey, and confirms that the level of errors and noise in the dataset fall below our threshold, which is set based on the Geological Survey of Canada guidelines for airborne magnetometer survey data.

Respectfully submitted,

Kiyavash Parvar, M.A.Sc. Geophysics

Pioneer Aerial Surveys Ltd.

Appendix 1: Instrument Specification

GSM-19 Overhauser Magnetometer

Performance

Sensitivity: Standard
GSM-19 0.022 nT @ 1 Hz
GSM-19PRO 0.015 nT @ 1 Hz
Resolution: 0.01 nT
Absolute Accuracy: 0.1 nT
Dynamic Range: 20,000 to 120,000 nT
Gradient Tolerance: up to 10,000 nT/m
Samples at: 60+, 5, 3, 2, 1, 0.5, 0.2 sec
Operating Temperature: -40°C to +50°C

Operating Modes

Manual: Coordinates, time, date and reading stored automatically at up to 0.2 sec.
Base Station: Time, date and reading stored at 1 to 60 second intervals.
Remote Control: Optional remote control using RS-232 interface.
Input / Output: Input/Output: RS-232 using 6-pin weatherproof connector with USB adapter.

Memory - (# of Readings in millions)

Mobile: 1.4M,
Base Station: 5.3M,
Gradiometer: 1.2M,
Walking Mag: 2.6M

Dimensions

Console: 223mm x 69mm x 240 mm(8.7x2.7x9.5in)
Sensor: 175mm x 75mm diameter cylinder (6.8in long by 3 in diameter)

Weights

Console with Belt: 2.1 kg
Sensor and Staff Assembly: 1.0 kg

Matrice 600

Structure

Diagonal Wheelbase: 1133 mm
Aircraft Dimensions: 1668 mm x 1518 mm x 759 mm (Propellers, frame arms and GPS mount unfolded)
640 mm x 582 mm x 623 mm (Frame arms and GPS mount folded)
Package Dimensions : 620 mm x 320 mm x 505 mm
Intelligent Flight Battery Quantity: 6
Weight (with six TB47S batteries): 9.1 kg
Weight (with six TB48S batteries): 9.6 kg
Max Takeoff Weight: 15.1 kg

Performance

Hovering Accuracy (P-Mode, with GPS) Vertical: ±0.5 m, Horizontal: ±1.5 m
Max Angular Velocity: Pitch: 300°/s, Yaw: 150°/s
Max Pitch Angle: 25°
Max Speed of Ascent: 5 m/s
Max Speed of Descent: 3 m/s
Max Wind Resistance: 8 m/s
Max Flight Altitude above Sea Level: 2500 m
Max Speed: 18 m/s (No wind)
Hovering Time (with six TB47S batteries)* No payload: 35 min, 6 kg payload: 16 min
Hovering Time (with six TB48S batteries)* No payload: 40 min, 5.5 kg payload: 18 min

* The hovering time is based on flying at 10 m above sea level in a no-wind environment and landing with 10% battery level.

Remote Controller

Operating Frequency:

- 920.6 MHz to 928 MHz (Japan)
- 5.725 GHz to 5.825 GHz
- 2.400 GHz to 2.483 GHz

Max Transmission Distance (unobstructed, free of interference) :

- FCC Compliant: 3.1 miles (5 km)
- CE Compliant: 2.1 miles (3.5 km)

EIRP:

- 10 dBm @ 900 M/li>
- 13 dBm @ 5.8 G
- 20 dBm @ 2.4 G

Video Output Port: HDMI, SDI, USB
Dual Users Capability: Master-and-Slave control
Mobile Device Holder: Supports smartphones and tablets
Output Power: 9 W
Operating Temperature: 14° to 104° F (-10° to 40° C)
Storage Temperature:
Less than 3 months: -4° to 113° F (-20° to 45° C)
More than 3 months: 72° to 82° F (22° to 28° C)

Charge Temperature: 32° to 104° F (0° to 40° C)
Built-in Battery: 6000 mAh, 2S LiP
Max Tablet Width: 170 m

Propulsion System

Motor Model: DJI 6010
Propeller Model: DJI 2170

Battery

Model: TB48S
Capacity: 5700 mAh
Voltage: 22.8 V
Type: LiPo 6S
Energy: 129.96 Wh
Net Weight: 680 g
Operating Temperature: 14° to 104° F (-10° to 40° C)
Storage Temperature: Less than 3 months: -4° to 113° F (-20° to 45° C)
More than 3 months: 72° to 82° F (22° to 28° C)
Charge Temperature: 41° to 104° F (5° to 40° C)
Max Charging Power: 180 W

Charger

Model: A14-100P1A
Voltage: Output26.3 V
Power Rating: 100 W

GEM GSMP-35UA: Ultra Light-Weight Potassium Magnetometer

Magnetometer Specifications

Sensitivity: 0.0002 nT @ 1 Hz
Resolution: 0.0001 nT
Absolute Accuracy: +/- 0.1 nT
Heading Error: + / – 0.05 nT
Dynamic Range: 15,000 to 120,000 nT
Gradient Tolerance: 50,000 nT/m
Sampling Intervals: 1, 2, 5, 10, 20 Hz
Operating Temperature: -40°C to +55°C

Orientation

Sensor Angle: optimum angle 35° between sensor head axis & field vector.
Proper Orientation: 10° to 80° & 100° to 170
Heading Error: +/- 0.05 nT between 10° to 80°and 360° full rotation about axis.

Environmental

Operating Temperature: -40°C to +55°C
Storage Temperature: -70°C to +55°C
Humidity:0 to 100%, splashproof

Dimensions & Weight

Sensor: 161mm x 64mm (external dia) with 2m cabling ; 0.43 kg
Electronics Box: 236mm x 56mm x 39mm; 0.46 kg
Option 1 cabling; .125kg
Option 3 light weight battery; .250kg

Power

Power Supply:18 to 32 V DC
Power Requirements: approx. 50 W at start up, dropping to 12 W after warm-up
Power Consumption:12 W typical at 20°C
Warm-up Time: <15 minutes at -40°C

Outputs

20 Hz RS-232 output with comprehensive Windows Personal Computer (PC) software for data acquisition and display.

Outputs UTC time, magnetic field, lock indication, heater, field reversal, GPS position (latitude, longitude altitude, number of satellites)

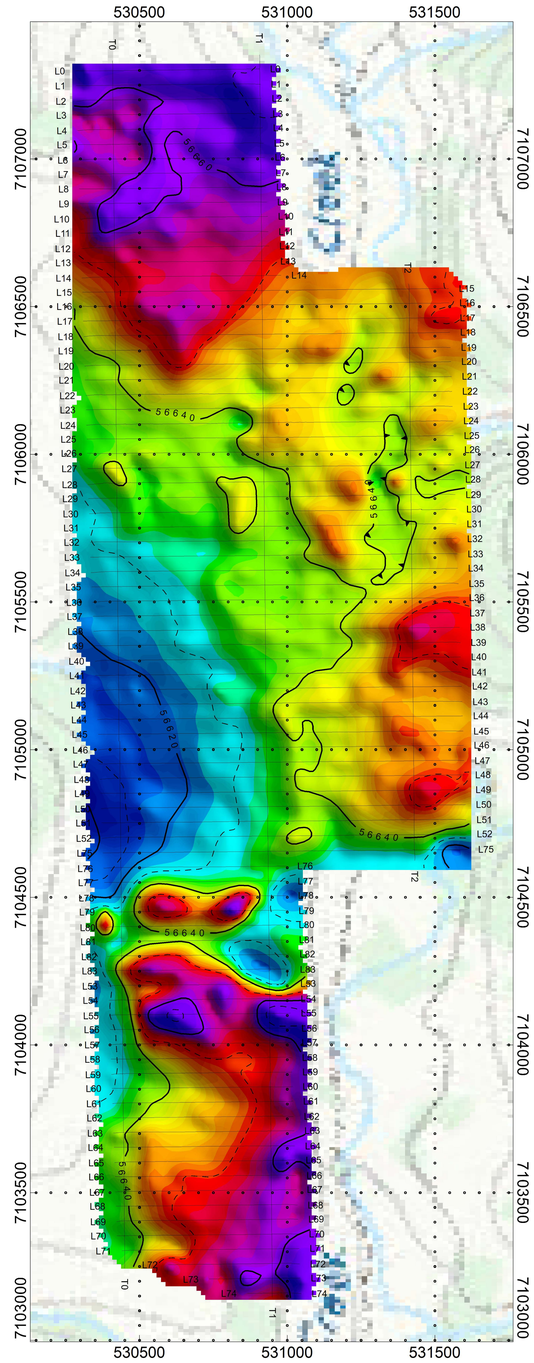
Components

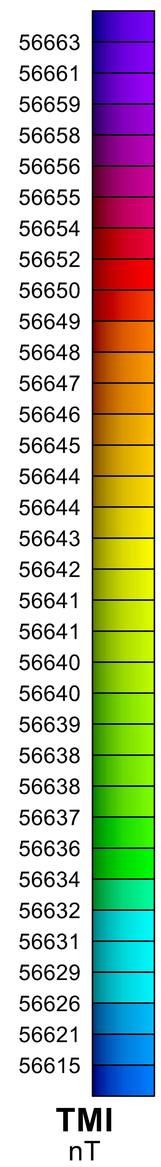
Sensor, pre-amplifier box, 2m sensor /pre-amplifier cable (optional cable 3-5m), manual & shipping case

Appendix 2: Final Maps

PIONEER AERIAL SURVEYS LTD

LONGFORD EXPLORATION SERVICES LTD.





Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 090°N
Tie-line spacing: 500 m
Tie-line direction: 000°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

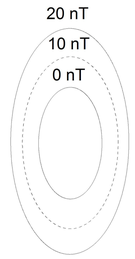
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

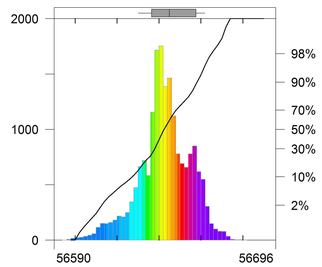
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

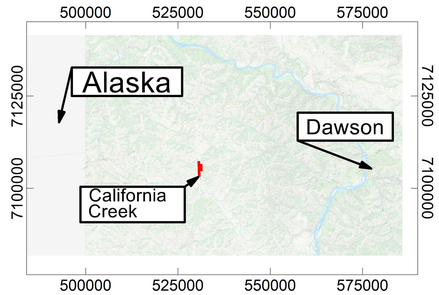
Contour Legend:





Data Distribution

Samples:	18725
Minimum:	56600
Maximum:	56680
Mean:	56640
Geo.Mean:	56640
Median:	56640
Mode:	56640
Std.Dev.:	12.25
Std.Err.:	0.08955
Skew:	-0.4117
Kurtosis:	0.5149



Scale 1:15000

250 0 250

metres

WGS 84 / UTM zone 7N

Pioneer Aerial Surveys Ltd.

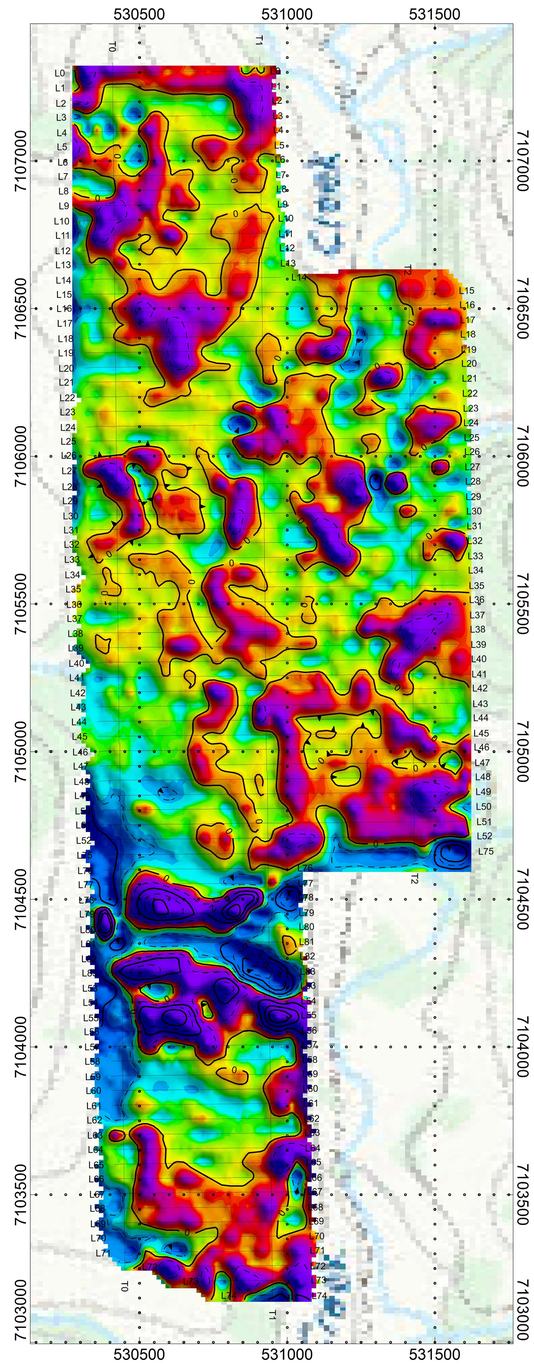
Leveled UAV-MAG™ Survey
Total Magnetic Intensity (TMI)
Units: nT

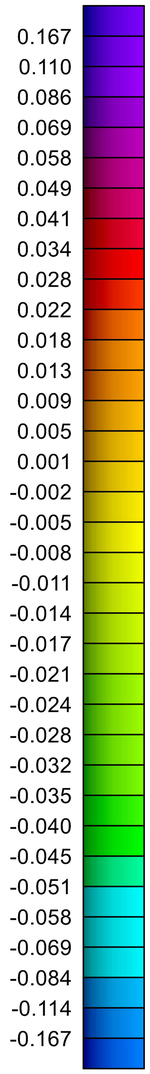
Survey Date: March 2020
Property Name: California Creek

Map Author: Kiyavash Parvar

PIONEER AERIAL SURVEYS LTD

LONGFORD EXPLORATION SERVICES LTD.





Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 090°N
Tie-line spacing: 500 m
Tie-line direction: 000°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

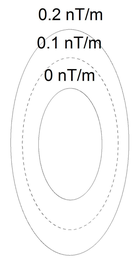
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

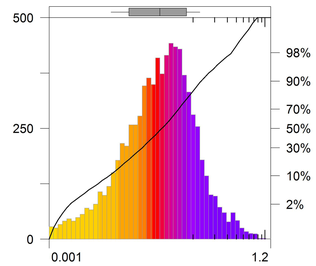
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

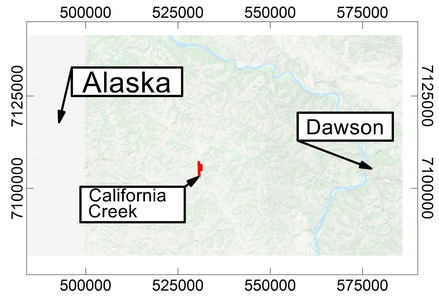
Contour Legend:





Data Distribution

Samples:	18725
Minimum:	-0.717
Maximum:	1.161
Mean:	-0.002323
Geo.Mean:	0.03031
Median:	-0.006788
Mode:	-0.717
Std.Dev.:	0.09176
Std.Err.:	0.0006706
Skew:	0.8677
Kurtosis:	15.1
Log:	
Mean:	-1.482
Median:	-1.435
Skew:	-0.3602



Scale 1:15000
250 0 250
metres
WGS 84 / UTM zone 7N

Pioneer Aerial Surveys Ltd.

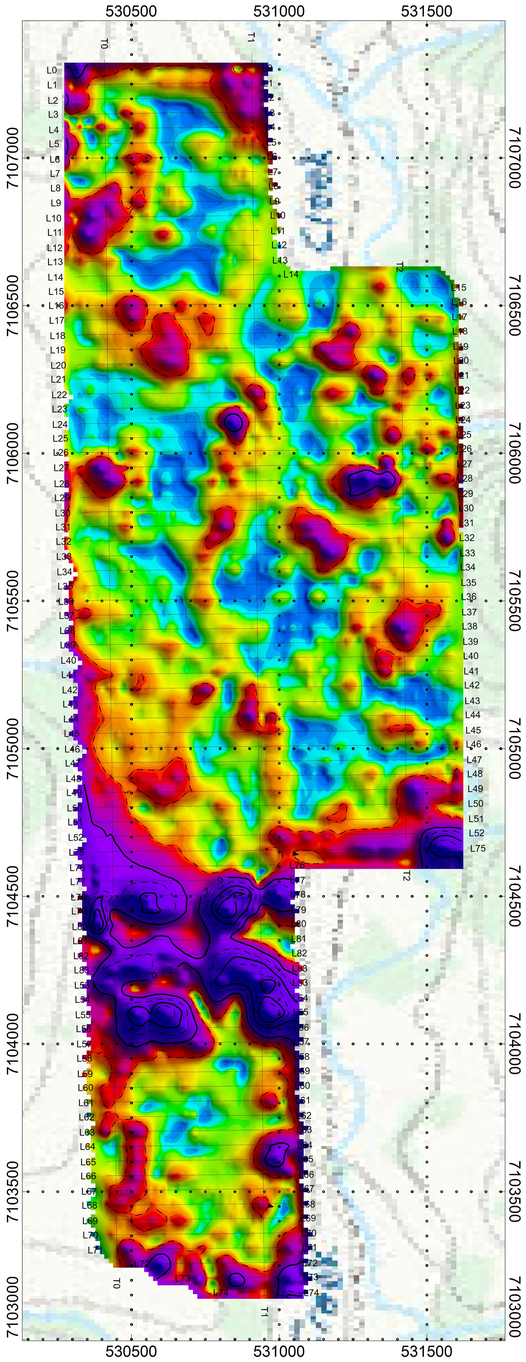
Leveled UAV-MAG™ Survey
1st Vertical Derivative (1VD)
Units: nT/m

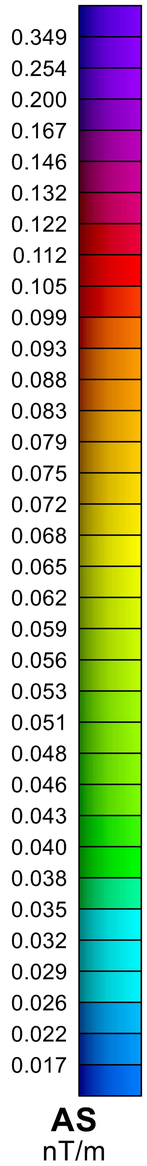
Survey Date: March 2020
Property Name: California Creek

Map Author: Kiyavash Parvar

PIONEER AERIAL SURVEYS LTD

LONGFORD EXPLORATION SERVICES LTD.





Scale 1:15000

250 0 250

metres

WGS 84 / UTM zone 7N

Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 090°N
Tie-line spacing: 500 m
Tie-line direction: 000°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

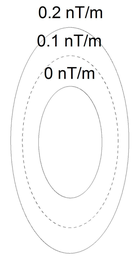
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

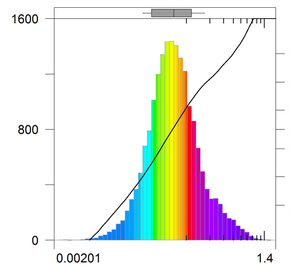
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

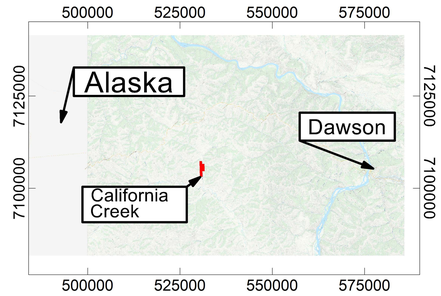
Contour Legend:





Data Distribution

Samples:	18725
Minimum:	0.00201
Maximum:	1.308
Mean:	0.09322
Geo.Mean:	0.06847
Median:	0.06638
Mode:	0.03999
Std.Dev.:	0.09133
Std.Err.:	0.0006674
Skew:	3.28
Kurtosis:	15.54
Log:	
Mean:	-1.164
Median:	-1.178
Skew:	0.1665



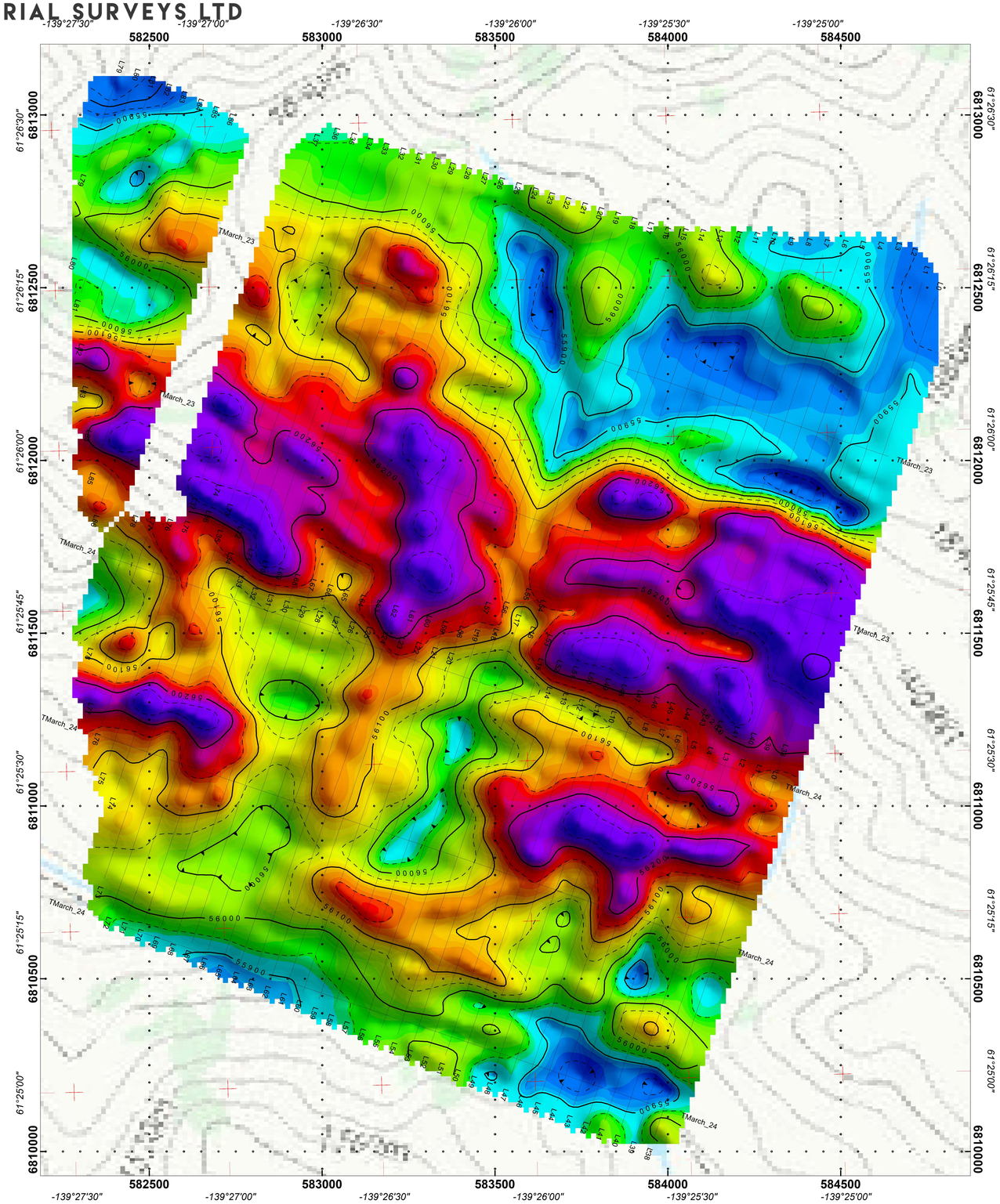
Pioneer Aerial Surveys Ltd.

Leveled UAV-MAG™ Survey
Analytic Signal (AS)
Units: nT/m

Survey Date: March 2020
Property Name: California Creek

Map Author: Kiyavash Parvar

PIONEER AERIAL SURVEYS LTD

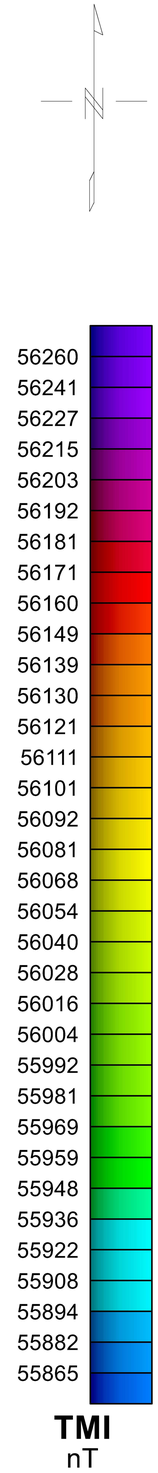


Scale 1:10000

100 0 100 200 300

metres

WGS 84 / UTM zone 7N



LONGFORD EXPLORATION SERVICES LTD.

Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 020°N
Tie-line spacing: 500 m
Tie-line direction: 110°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

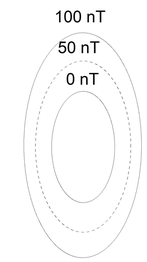
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

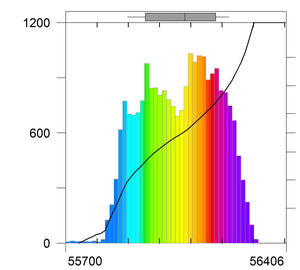
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

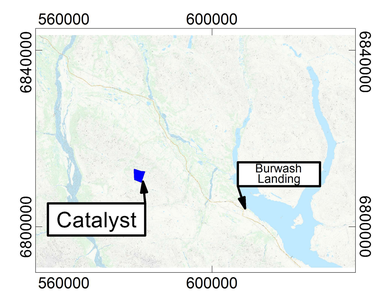
Contour Legend:





Data Distribution

Samples:	24174
Minimum:	55700
Maximum:	56310
Mean:	56070
Geo.Mean:	56070
Median:	56070
Mode:	56240
Std.Dev.:	117.9
Std.Err.:	0.7584
Skew:	-0.1053
Kurtosis:	-0.9996



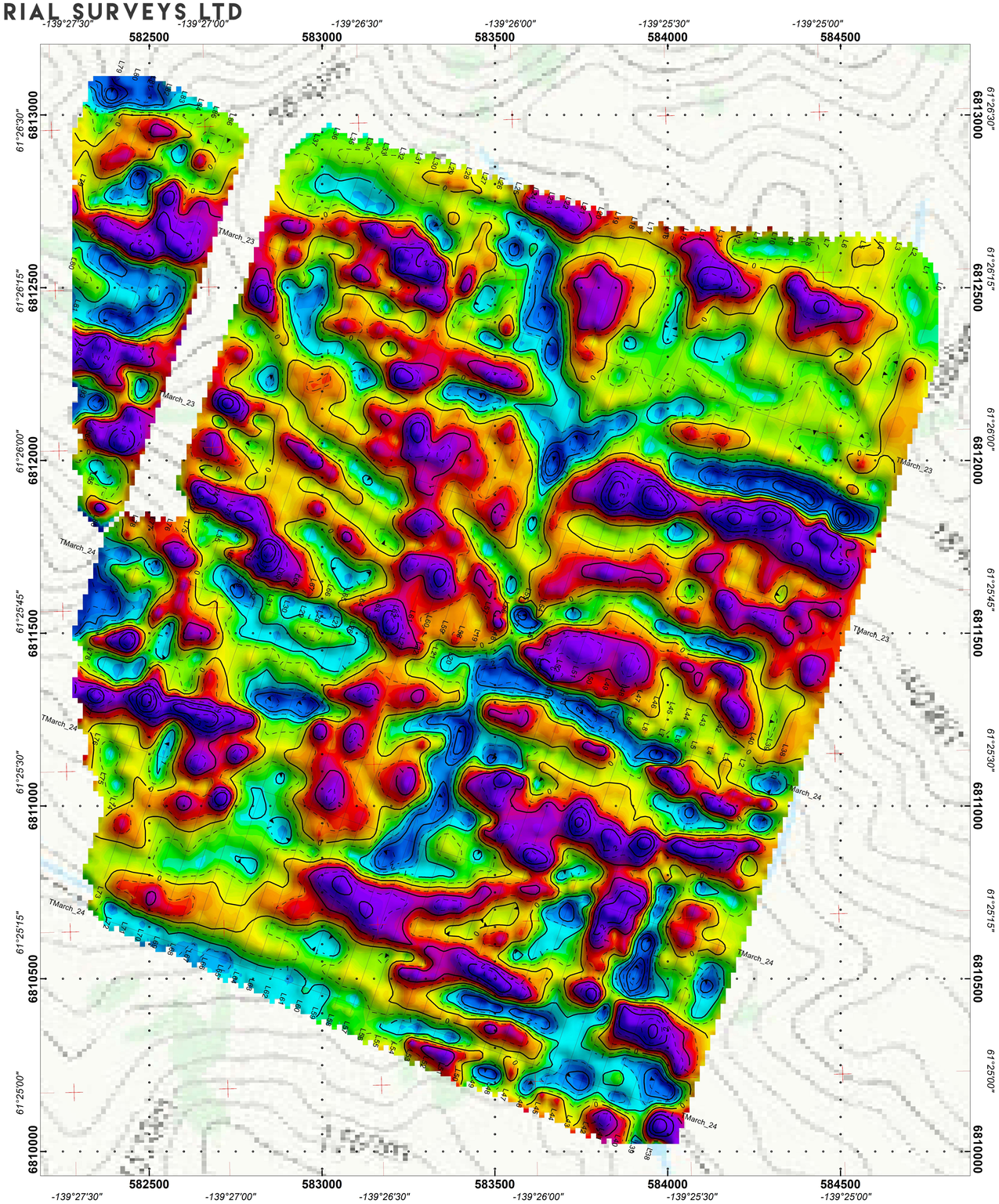
Pioneer Aerial Surveys Ltd.

Leveled UAV-MAG™ Survey
Total Magnetic Intensity (TMI)
Units: nT

Survey Date: March 2020
Property Name: Catalyst

Map Author: Kiyavash Parvar

PIONEER AERIAL SURVEYS LTD

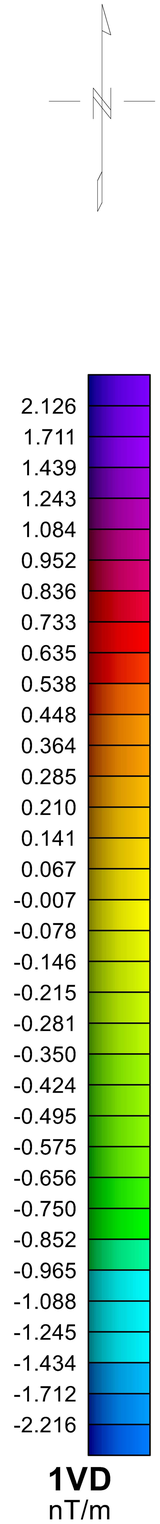


Scale 1:10000

100 0 100 200 300

metres

WGS 84 / UTM zone 7N



LONGFORD EXPLORATION SERVICES LTD.

Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 020°N
Tie-line spacing: 500 m
Tie-line direction: 110°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

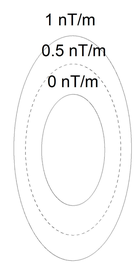
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

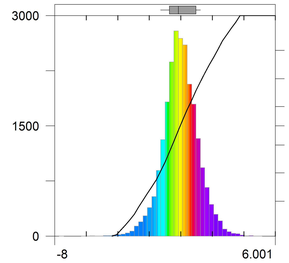
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

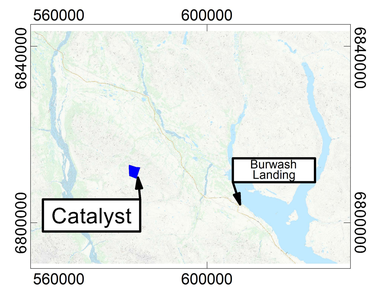
Contour Legend:





Data Distribution

Samples:	24174
Minimum:	-7.44
Maximum:	5.033
Mean:	-0.02355
Geo.Mean:	0.5473
Median:	-0.04079
Mode:	-2.046
Std.Dev.:	1.102
Std.Err.:	0.007087
Skew:	-0.0884
Kurtosis:	1.098



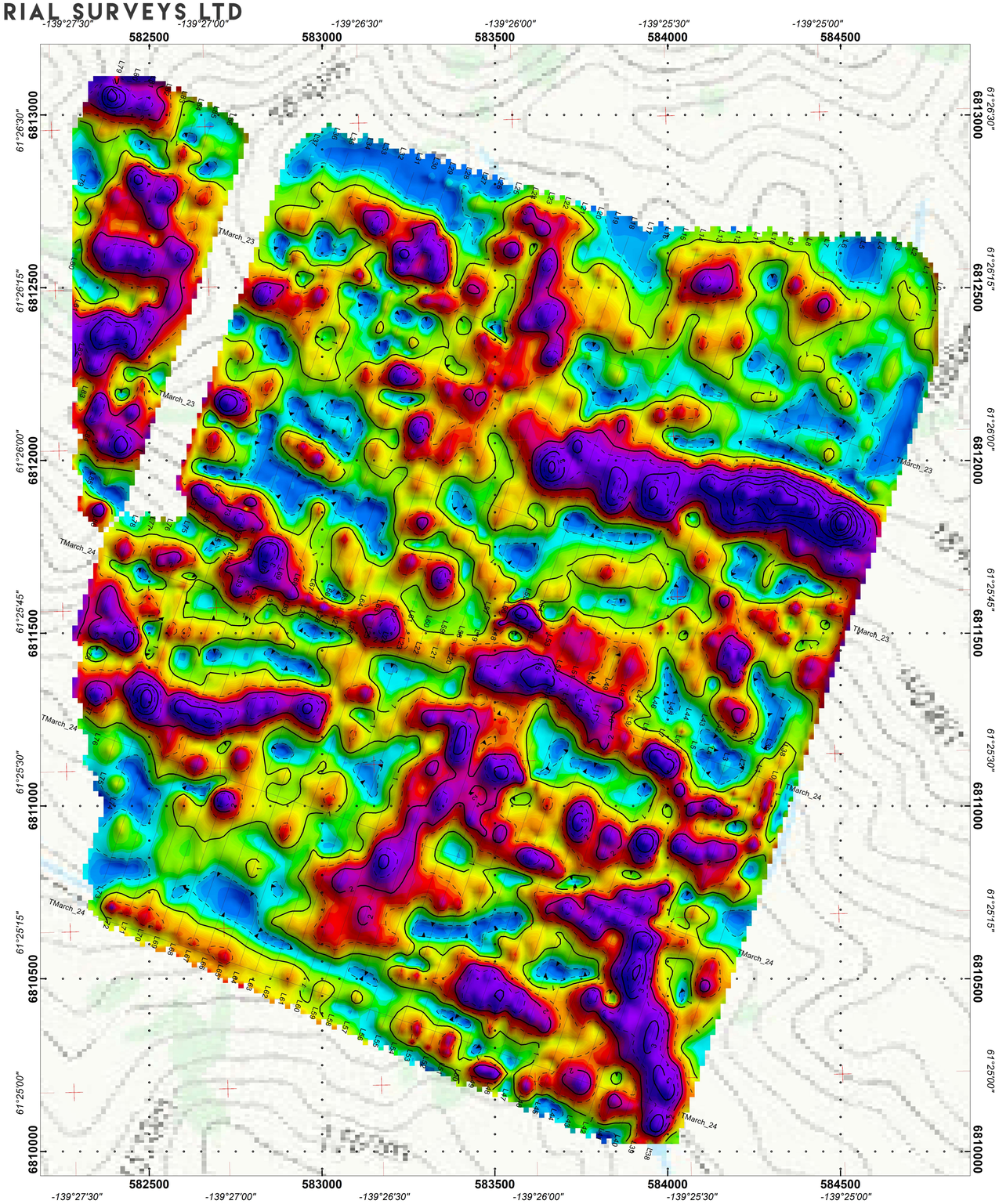
Pioneer Aerial Surveys Ltd.

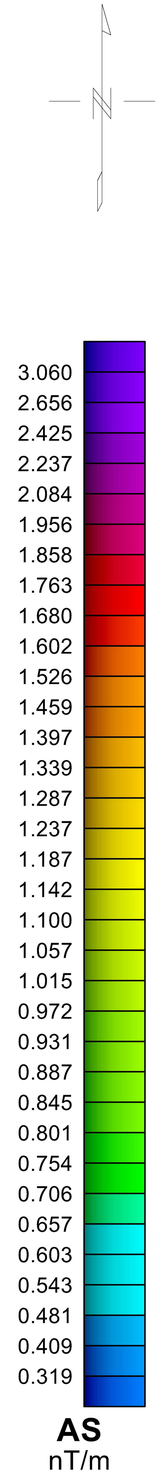
Leveled UAV-MAG™ Survey
1st Vertical Derivative (1VD)
Units: nT/m

Survey Date: March 2020
Property Name: Catalyst

Map Author: Kiyavash Parvar

PIONEER AERIAL SURVEYS LTD





LONGFORD EXPLORATION SERVICES LTD.

Flight Parameters:

Flight line spacing: 50 m
Flight line azimuth: 020°N
Tie-line spacing: 500 m
Tie-line direction: 110°N
Nominal sensor elevation above ground: 40 m

Instrumentation:

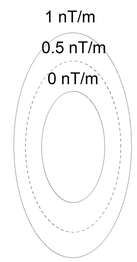
Unmanned aerial vehicle: Matrice 600 UAV
In-flight magnetometer: GEM Systems GSMP-35UA (Potassium vapor)
In-flight sampling lime: 10 Hz (0.1 s)
Ground magnetometers (base station): GEM GSM-19 (Overhauser proton)
Base station sampling rate: 0.16 Hz (6.0 s)

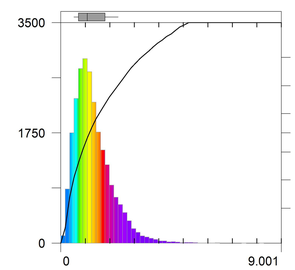
Coordinate system:

Datum: WGS84
Projection: Universal Transverse Mercator Central meridian: (Zone 07N)

Hill shade inclination:045°N
Hill shade declination:045°N (NE-SW)

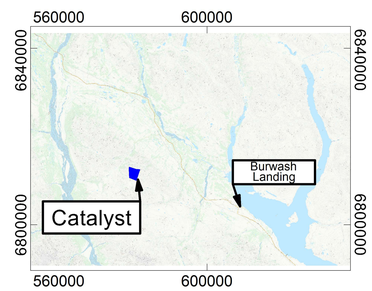
Contour Legend:





Data Distribution

Samples:	24174
Minimum:	0.04398
Maximum:	8.174
Mean:	1.321
Geo.Mean:	1.123
Median:	1.164
Mode:	0.7228
Std.Dev.:	0.7532
Std.Err.:	0.004844
Skew:	1.365
Kurtosis:	3.294



Pioneer Aerial Surveys Ltd.

Leveled UAV-MAG™ Survey
Analytic Signal (AS)
Units: nT/m

Survey Date: March 2020
Property Name: Catalyst

Map Author: Kiyavash Parvar