

**LOGISTICS REPORT**

**GROUND MAGNETOMETER SURVEY**

**FOR**

**SOURDOUGH RESOURCES**

**MAG PROJECT, YUKON TERRITORY**

**CANADA**

SEPTEMBER 2011

REF # 11P112

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## **1. INTRODUCTION**

On behalf of Sourdough Resources of Whitehorse, Yukon, a ground based magnetometer survey was carried out on the company's MAG property near Squanga Lake, 107km south-east of Whitehorse, Yukon Territory, Canada, by McKeown Exploration Services of St John's, NL.

Between September 11<sup>th</sup> and September 14<sup>th</sup>, 2011, 53.7 line kilometers of ground magnetic data were collected on an east-west virtual grid, station spacing was a nominal 100m, in addition 5.9 line-km of north-south tie-line data were also recorded, for a total of 59.6 line-km.

## 2. SURVEY LOCATION AND LOGISTICS

- ❑ *PROJECT ID*                      MAG Project  
  ( MES Reference: 11P112)
  
- ❑ *CLIENT*                              Sourdough Resources Inc.  
  3151C-3rd Avenue  
  Whitehorse YT Y1A 1G1
  
- ❑ *REPRESENTATIVE*                Mr. Kevin Brewer
  
- ❑ *SURVEY TYPE*                      Ground Based Magnetometer Survey, with  
  Integrated GPS

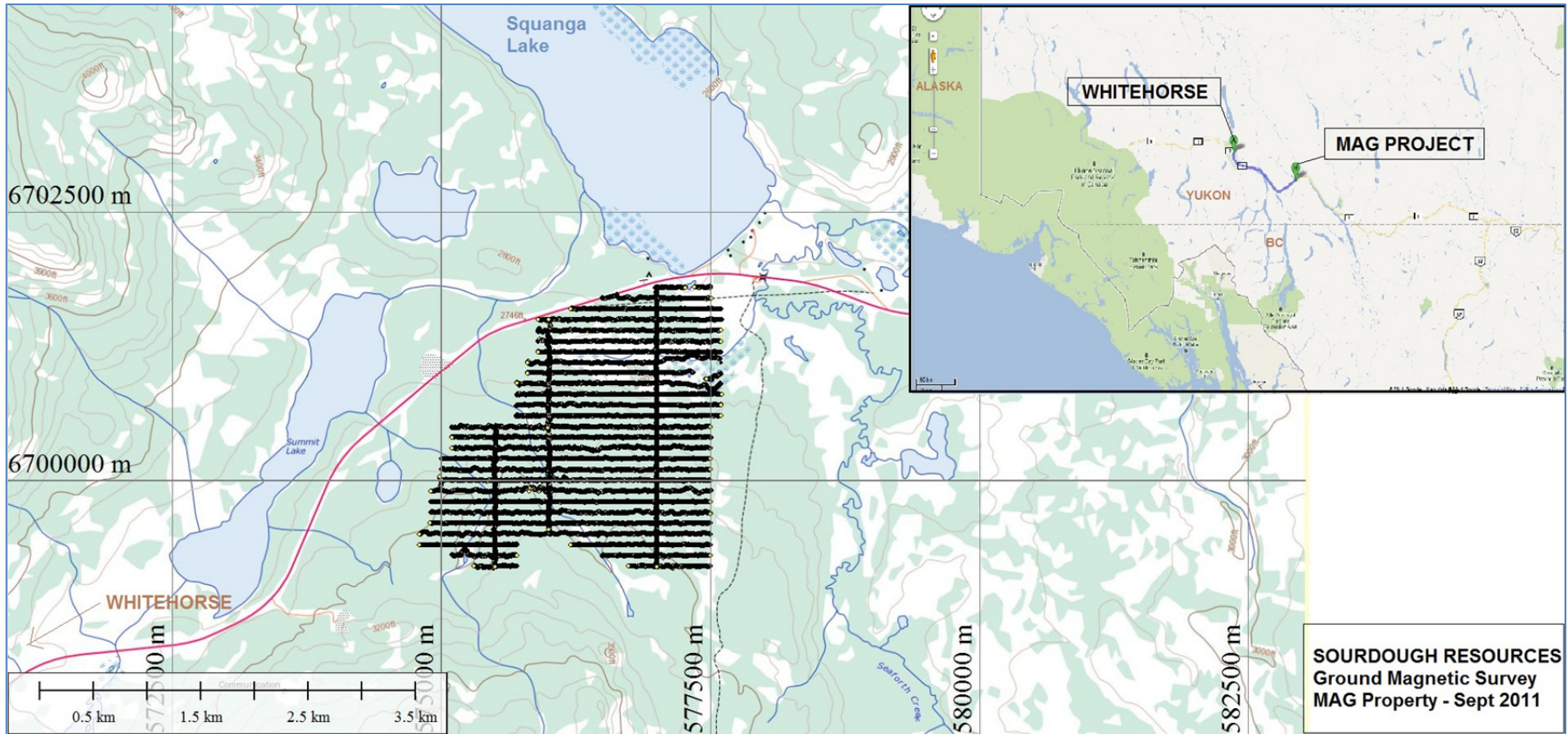


Figure 1 – MAG Project Ground Magnetic Survey Location Map

- ❑ *LOCATION*

Δ Yukon Territory, Canada  
 Δ Grid Centre 60° 26.0'N, 133°36.5'W  
 Δ UTM, WGS84/NAD83, Zone 8N  
 Δ NTS map sheets: 105C/05
  
- ❑ *NEAREST MAJOR SETTLEMENTS*

Δ 107 KM SE of Whitehorse, Yukon on HWY 1  
 Δ 20 KM W of Johnson's Crossing, Yukon on HWY 1
  
- ❑ *ACCESS & ACCOMMODATION*

Δ by truck from Whitehorse, 107km drive south-east on HWY 1  
 Δ access to grid on foot  
 Δ crew stayed in motel in Whitehorse and drove daily to grid by truck
  
- ❑ *CULTURAL FEATURES*

Δ HWY 1 bounds grid to north (see figure 1)  
 Δ minor forest access roads/trails  
 Δ no power lines observed on/near survey grid.
  
- ❑ *MINING LAND TENURE*

Δ the claims encompassed in the present survey are owned and/or licensed by Sourdough Resources/K.Brewer  
 Δ claim numbers: see map Appendix B
  
- ❑ *COORDINATE SYSTEM*

Δ projection: UTM  
 Δ zone: 08N  
 Δ datum: WGS84/NAD83
  
- ❑ *SURVEY GRIDS*

Δ 100m spaced lines running east-west (see Figure 1.), totalling 53.7 line-km  
 Δ three tie lines running north-south, 5.9 line-km  
 Δ total surveyed 59.6 line-km
  
- ❑ *TERRAIN*

Δ between Dawson and Pelly ranges, ~800m-900m MSL.  
 Δ boreal cordillera; sparsely treed boreal forest, spruce with wetland shrub and sedge, with krummholz and arctic alpine flora above tree-line.

- *PERSONNEL*

Rob McKeown, P.Geo	QC, Processing, Report
Dave Bruce	Geophysicist, Crew Chief
Rowan Laver	Geophysical Technician
  
- *SURVEY COVERAGE*

59.6 line-km
  
- *DATA ACQUISITION*

September 11<sup>th</sup>- 14<sup>th</sup>, 2011  
(see Appendix A for production summary)

### 3. SURVEY EQUIPMENT AND PROCEDURE

- *FIELD  
MAGNETOMETERS*

Two GEM Systems GSM-19W, V7 (s/n 9083347, 9063313)  
Proton precession magnetometers with overhauser effect

Resolution:	0.01 nT
Absolute accuracy:	0.2 nT
Gradient tolerance:	>10 000 nT/m
GPS accuracy:	<1.5m (WAAS)
Read Frequency:	2Hz (2 readings per second)
Sensor Height:	1.9 m above ground level

(see Appendix C for detailed specifications)
  
- *BASE  
MAGNETOMETER*

One GEM Systems GSM-19GW, V6 (s/n 1101114)  
Proton precession magnetometer with overhauser effect

Resolution:	0.01 nT
Absolute accuracy:	0.2 nT
Gradient tolerance:	>10 000 nT/m
Read frequency:	0.2Hz (1 reading every 5 seconds)
Base Field:	58,000 nT
Sensor Height:	1.65 m above ground level
Base Location:	574449E, 6700191N, Z08N

(see Appendix C for detailed specifications)

❑ *SOFTWARE*

- Δ Geosoft Oasis Montaj 7.2 mapping, processing, and visualisation software
- Δ Gem Systems GemLink 5.2 data transfer software
- Δ Global Mapper v13 GIS software

❑ *SURVEY PROCEDURE*  
*DATA ACQUISITION*

- Δ base magnetometer time synced via GPS, field mags in-turn synced by sync-cable
- Δ base tune field 58,000nT
- Δ base location 574449E, 6700191N, Z08N
- Δ two roving field units employed, operators walked even UTM northing (east-west lines) on a 'virtual' grid collecting magnetometer data at an interval of two readings per second in "walk mag" mode
- Δ GPS data observed at even one second intervals , position interpolated internally within magnetometer to match sample interval
- Δ operators "demagnetised" each morning
- Δ client-supplied labourer carried radio, lunches, water, etc, while walking in between two magnetometer operators
- Δ average production of 7.5km/day per magnetometer



Figure 2 - Mag Base Station setup



#### 4. DATA TRANSFER, PROCESSING, AND DELIVERABLES

##### □ DATA TRANSFER

Δ base and field magnetometer data were transferred to the field computer from the GSM19 base station via USB cable at the end of the day using Gem Systems Gemlink data transfer software

##### □ DATA PROCESSING

Δ diurnal correction performed by Gemlink software  
Δ diurnal correction linearly interpolated from 5 second base sample rate to 0.5 second rate to match 2Hz survey data  
Δ preliminary and final data processing performed in Geosoft Oasis Montaj 7.2.

Δ mag dropouts removed (lack of sensor lock typically caused by minimum coupling of sensor with local magnetic field, caused by operator stumbling and/or bending over while climbing or descending hills)

Δ GPS dropouts removed (lack of GPS data due to low number of satellites or high PDOP, typically occurs in steep walled canyons or while under thick forest canopy)

##### □ HEADING ERROR

Δ east-west heading error test was performed with each instrument on a 100m section of the grid, and the means were compared, instrument "A" (s/n 9083347) read an average of 1.4nT lower when reading in the westerly direction, and instrument "B" (s/n 9063313) read an average of 3.2nT lower when reading in the westerly direction. On average, instrument "A" read 5.6nT lower than instrument "B"

Δ overall data range of the dataset: min 55937nT, max 59821nT, (range 3884nT), mean 57076nT, standard deviation 616nT, number of records 170828, average station spacing ~0.8m

Δ as max heading error (5.6nT) represents approx 0.15% of total range of data, a heading error correction was not performed on the dataset and tie lines were not used to level the dataset

□ MAPS

<i>MAP</i>	<i>DESCRIPTION</i>	<i>SCALE</i>
1	Total Magnetic Field – random gridded (25m cell size) colour shaded image of total field data and topography, unfiltered	1:20000
2	Survey Coverage Plot with Topography	1:20000
3	Claim Boundary Map (from <a href="http://www.yukonminingrecorder.ca">www.yukonminingrecorder.ca</a> )	1:50000

□ *DIGITAL DATA CD*

Δ Included data CD contains raw ASCII data as well as all Montaj databases and relevant grid files, a pdf of this report, PDF files of attached maps, and manufacturers equipment specifications sheets as pdf files

Respectfully Submitted,  
Robert L McKeown  
Consulting Geophysicist  
2011/11/15

# APPENDIX A

## PRODUCTION SUMMARY

# Ground Magnetics Survey for Sourdough Resources

MAG Project, Yukon  
MES GEOPHYSICS

JOB # 11P112

Date 2011	Crew 1 Walk Mag D.Bruce							Crew 2 Walk Mag R.Laver							Summary				Production		Notes				
	Line	St From	St To	Coverage Metres	Repeat Metres	Total Metres	Billable Production	Line	St From	St To	Coverage Metres	Repeat Metres	Total Metres	Billable Production	Total New Metres	Total Repeat	Total Metres	Billable Standby	Non Billable S/B	# Days		# Man Days			
110909																				1.0		-RL and DB demobe from Castilian camp late afternoon			
110910																				1.0		-day off in Whitehorse -picked up truck in afternoon			
110911	6701700	576500	577500	1000	0	1000		6701800	577000	577500	500	0	500		1500	0	1500			1.0	2.0	-scouted grid access			
	6701500	575900	577800	1700	0	1700		6701600	576200	577800	1400	0	1400		3100	0	3100						-setup base		
	6701300	575900	577800	1700	0	1700		6701400	575900	577800	1700	0	1700		3400	0	3400							-gap in line 6701800 due to lakt	
	6701100	575800	577800	1800	0	1800		6701200	575900	577800	1700	0	1700		3500	0	3500							-skirted around lake at east end of line 6701100	
						6200		6200						5300		5300									
110912	6700900	575700	577800	1900	0	1900		6701000	575800	577800	1800	0	1800		3700	0	3700			1.0	2.0	-walk in to grid from highway			
	6700700	575700	577800	1900	0	1900		6700800	575700	577800	1900	0	1900		3800	0	3800							-skirting ponds and gap on line 6701000	
	6700500	575100	577500	2400	0	2400		6700600	575700	577800	1900	0	1900		4300	0	4300							-skirting ponds on line 6700900	
	6700300	575100	577500	2400	0	2400		6700400	575100	577500	2400	0	2400		4800	0	4800								
						8600		8600						8000		8000									
110913	6700100	575000	577500	2500	0	2500		6700200	575000	577500	2500	0	2500		5000	0	5000			1.0	2.0	-walked in to grid from highway			
	6699900	574900	577500	2600	0	2600		6700000	575000	577500	2500	0	2500		5100	0	5100								
	6699700	574900	577500	2600	0	2600		6699800	574900	577500	2600	0	2600		5200	0	5200								
	6699500	574800	577500	2700	0	2700		6699600	574900	577500	2600	0	2600		5300	0	5300								
						10400		10400						10200		10200									
110914	6699300	575100	575700	600	0	600		6699400	574800	575700	900	0	900		1500	0	1500			1.0	2.0	-heading error test 6701700 576650 - 576750 (100m)			
	6699200	575300	575700	400	0	400		6699400	576200	577500	1300	0	1300		1700	0	1700							-576700 6701600 - 6701700 (100m)	
	575500	6699200	6700500	1300	0	1300		6699300	576500	577500	1000	0	1000		2300	0	2300							-three NS tie lines done: 575500E, 576000, 577000	
	576000	6699500	6701500	2000	0	2000		6699200	576700	577500	800	0	800		2800	0	2800							-survey complete	
								577000	6699200	6701800	2600	0	2600		2600	0	2600							-packed up equipment for shipping	
						4300		4300						6600		6600									
110915																				1.0					-D.Bruce demobe to St John's -R.Laver demobe to Nanaimo
SUM						D.Bruce 29500							R.Laver 30100	59600	0	59600	0.0	3.0	4.0	8.0					

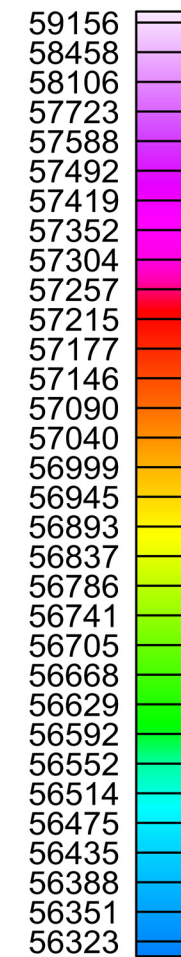
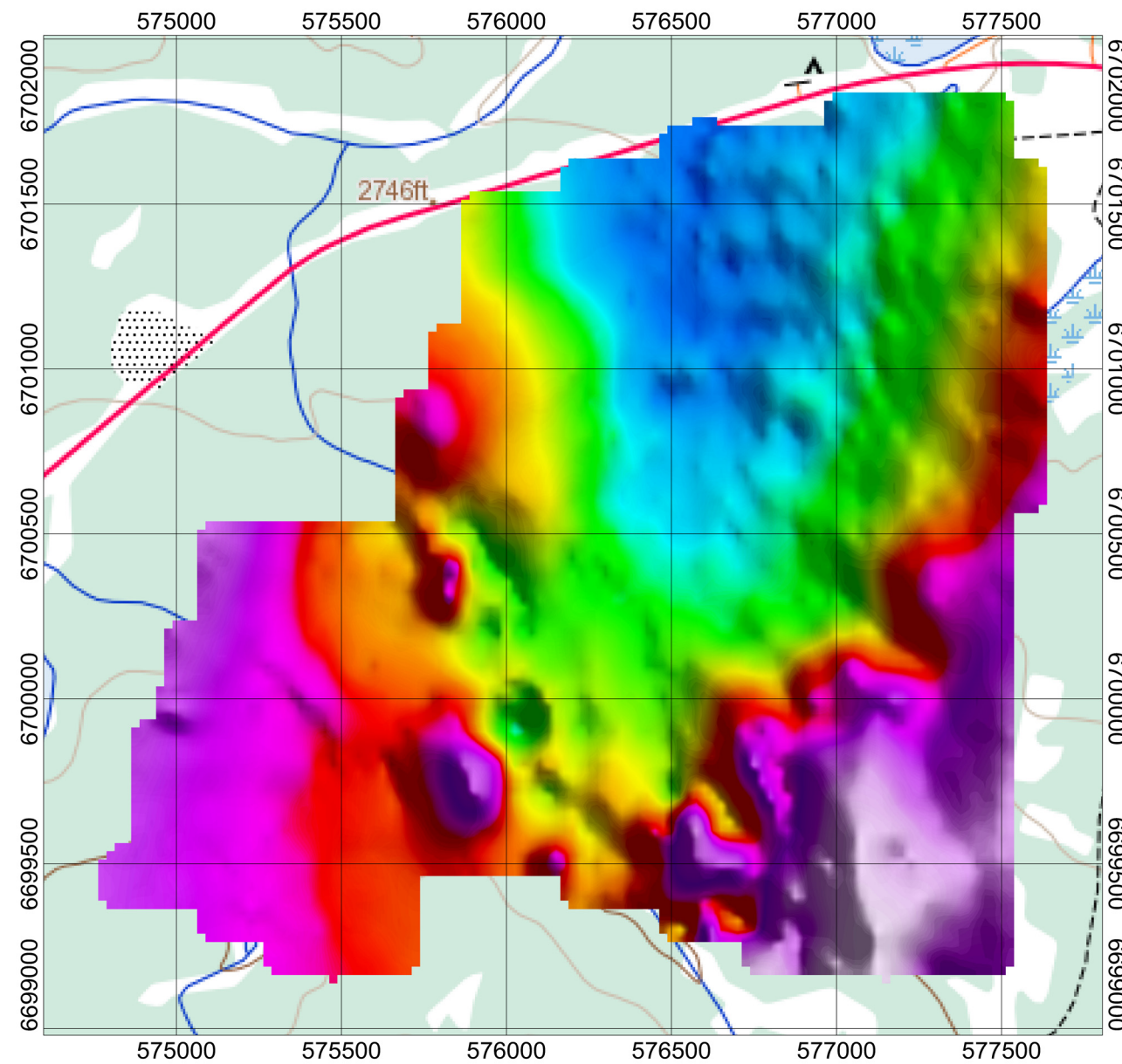
**SUMMARY STATS**

Survey Total KM	59.6
Surveyed KM	59.6
Percent Complete	100.0
Production Man Days	8.0
Average Daily Production / km/day	7.5
Man Days Remaining	0.0
Production Days Remaining	0.0

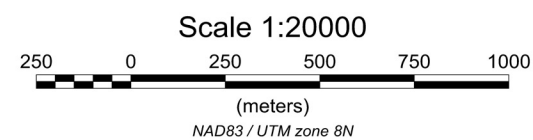
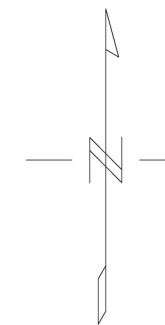
\*\* (includes 5.9km of NS tielines, 53.7km EW grid lines)

# APPENDIX B

## MAPS



nT

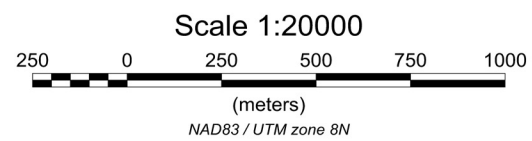
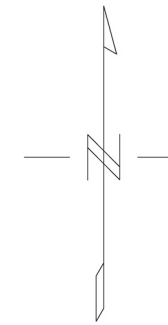
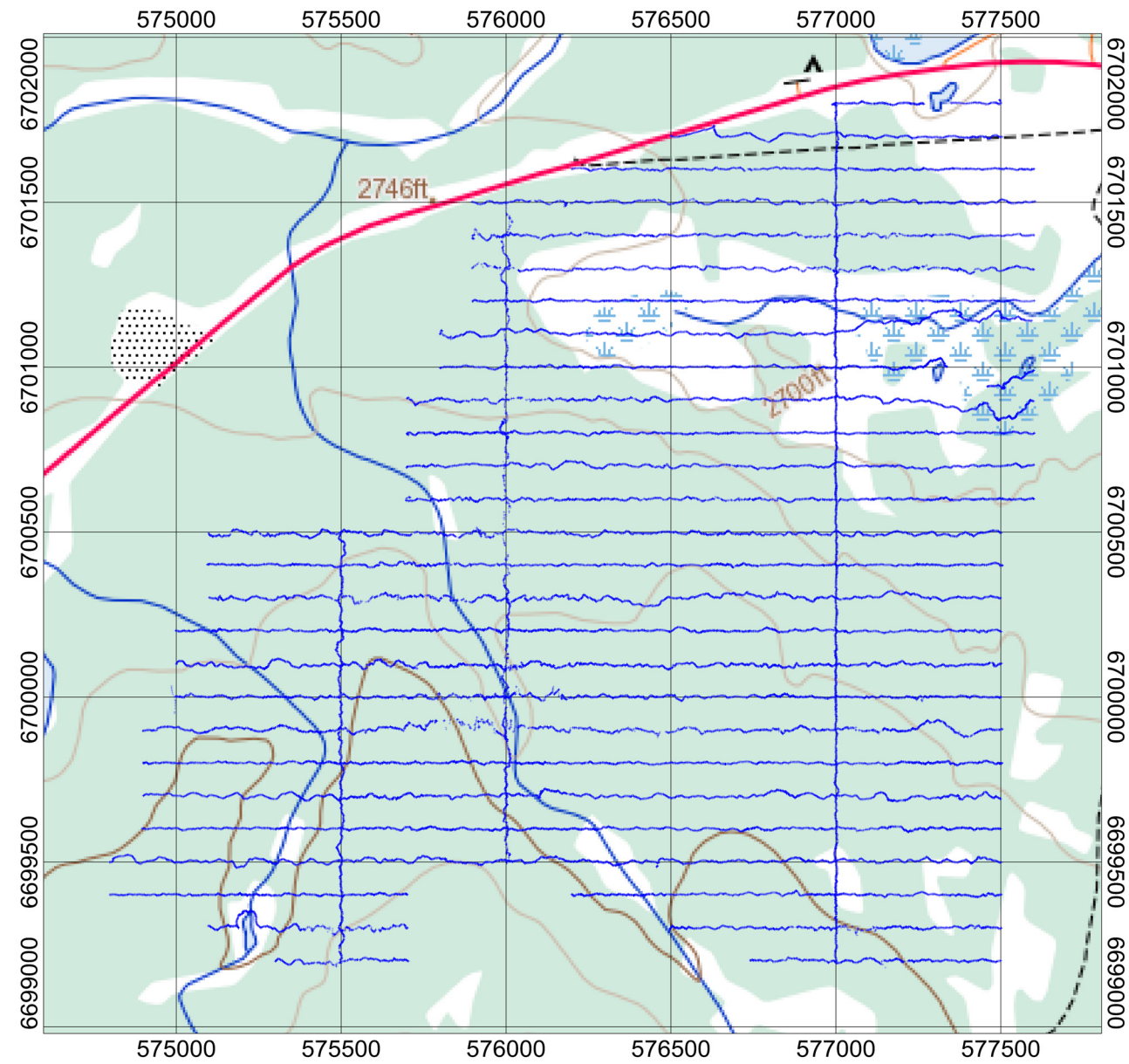


**Sourdough Resources**

**Colour Shaded Total Magnetic Field  
MAG Project - September 2011  
Yukon Territory, Canada**

GEM GSM19W V7  
Base Field 58,000 nT  
Diurnally Corrected, UNFILTERED  
Grid Cell Size 25m

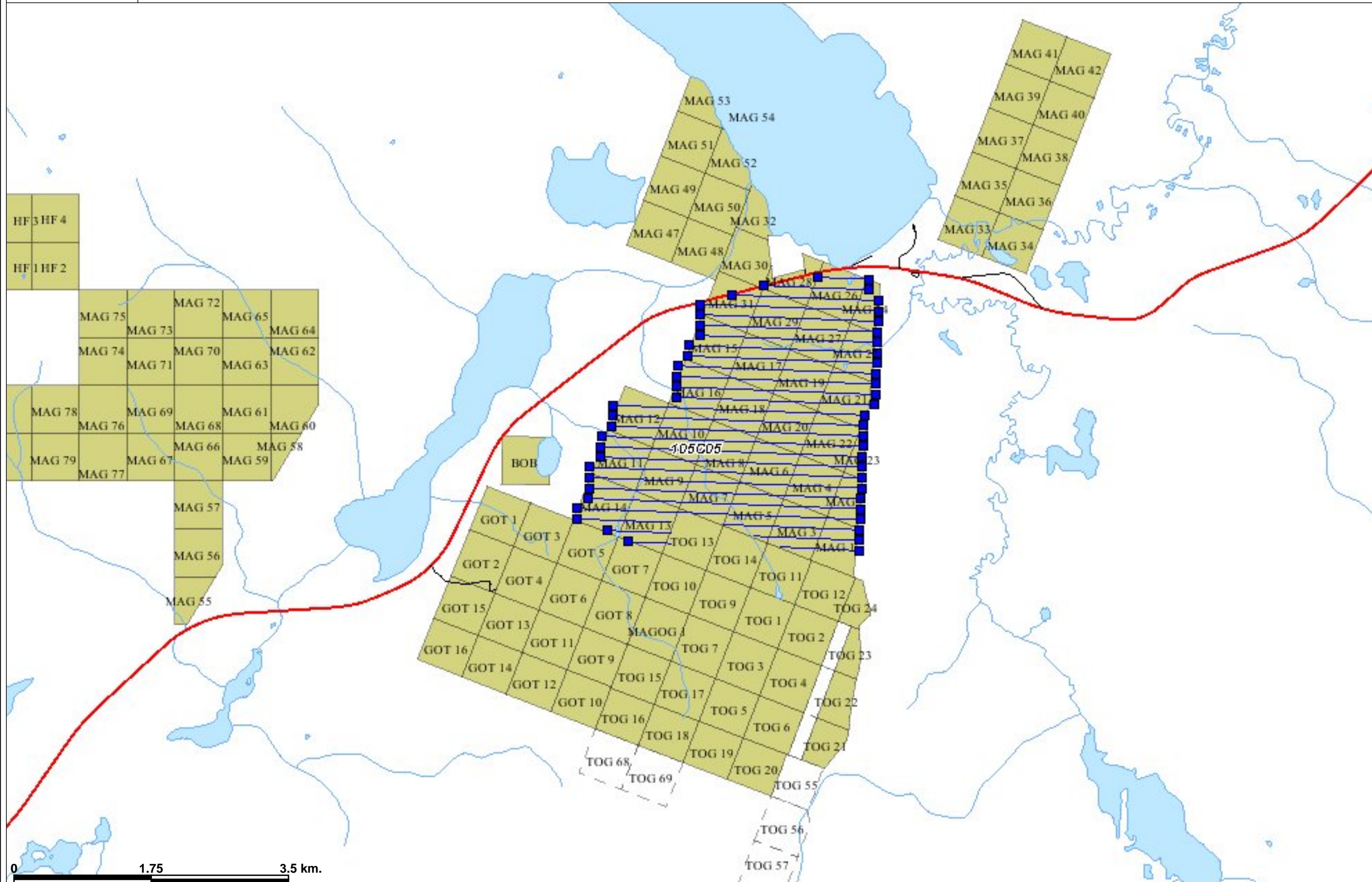
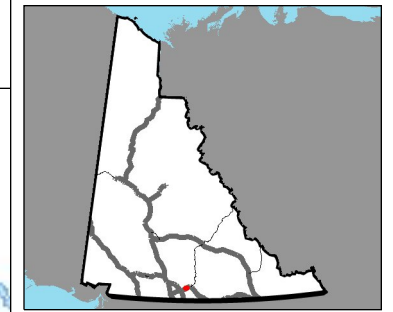
**NTS 105C/05**



Sourdough Resources

Survey Coverage  
MAG Project - September 2011  
Yukon Territory, Canada

NTS 105C/05



### Legend

- Yukon Border - Surveyed
- National Road Network - All Roads
- Expressway / Highway
- Arterial
- Collector
- Ramp
- Resource / Recreation
- Local / Street
- Local / Strata
- Local / Unknown
- Alley or Service Lane
- Service Lane
- Winter
- Waterbodies (50k)**
- Dry river bed
- Navigable canal
- Sand
- Water disturbance
- Waterbody
- Waterbody
- Places (All)**
- City
- Town
- Municipality
- Village
- Community
- Settlement
- Native Settle
- Hamlet
- Historic Site
- CSW\_QUARTZ\_ADJOINING\_PA-RCEL
- CSW\_QUARTZ\_CLAIM**
- Active
- Expired

0 1.75 3.5 km.

Scale: 1:50,000

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.  
Date Printed: 15-Nov-2011 9:42:48 AM

Notes: Ground Magnetic Survey - Ideal Line Locations



# APPENDIX C

## EQUIPMENT SPECIFICATIONS

# Overhauser

Magnetometer / Gradiometer / VLF (GSM-19 v7.0)

Our World is **Magnetic**.

**GEM's unique Overhauser system combines data quality, survey efficiency and options into an instrument that takes the leading place in the industry.**

**And the latest v7.0 technology upgrades provide even more value:**

Data export in standard XYZ (i.e. line-oriented) format for easy use in standard commercial software programs

Programmable export format for full control over output

GPS elevation values provide input for geophysical modeling  
Enhanced GPS positioning resolution

Standard GPS:  
<1.5m SBAS (WAAS, EGNOS, MSAS)  
High resolution CDGPS Option:  
<0.6m SBAS (WAAS, EGNOS, MSAS)  
<0.6m CDGPS (Canada, USA, Mexico)  
<0.7m OmniStar VBS2

Multi-sensor capability for advanced surveys to resolve target geometry

Picket and line marking / annotation for capturing related surveying information on-the-go

**And all of these technologies come complete with the most attractive savings and warranty in the business!**



Overhauser (GSM-19) console with sensor and cable. Can also be configured with additional sensor for gradiometer (simultaneous) readings.

The GSM-19 v7.0 Overhauser instrument is the total field magnetometer / gradiometer of choice in today's earth science environment -- representing a unique blend of physics, data quality, operational efficiency, system design and options that clearly differentiate it from other quantum magnetometers.

With data quality exceeding standard proton precession and comparable to costlier optically pumped cesium units, the GSM-19 is a standard (or emerging standard) in many fields, including:

- **Mineral exploration**  
(ground and airborne base station)
- **Environmental and engineering**
- **Pipeline mapping**
- **Unexploded Ordnance Detection**
- **Archeology**
- **Magnetic observatory measurements**
- **Volcanology and earthquake prediction**

### Taking Advantage of the Overhauser Effect

Overhauser effect magnetometers are essentially proton precession devices - except that they produce an order-of-magnitude greater sensitivity.

These "supercharged" quantum magnetometers also deliver high absolute accuracy, rapid cycling (up to 5 readings / second), and exceptionally low power consumption.

The Overhauser effect occurs when a special liquid (with unpaired electrons) is combined with hydrogen atoms and then exposed to secondary polarization from a radio frequency (RF) magnetic field.

The unpaired electrons transfer their stronger polarization to hydrogen atoms, thereby generating a strong precession signal -- that is ideal for very high-sensitivity total field measurements.

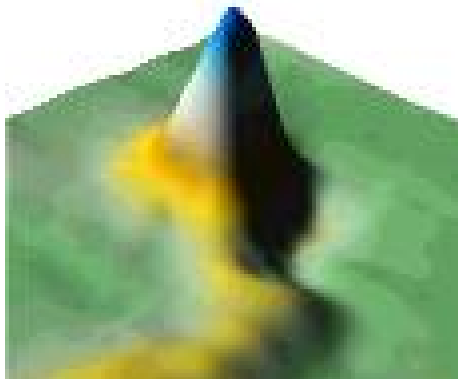
In comparison with proton precession methods, RF signal generation also keeps power consumption to an absolute minimum and eliminates noise (i.e. generating RF frequencies are well out of the bandwidth of the precession signal).

In addition, polarization and signal measurement can occur simultaneously - which enables faster, sequential measurements. This, in turn, facilitates advanced statistical averaging over the sampling period and/or increased cycling rates (i.e. sampling speeds).

Other advantages are described in the section called, "GEM's Commercial Overhauser System" that appears later in this brochure.

## Maximizing Your Data Quality with the GSM-19

Data quality is a function of five key parameters that GEM has taken into consideration carefully in the design of the GSM-19. These include sensitivity, resolution, absolute accuracy, sampling rates and gradient tolerance.



**Data from Kalahari Desert kimberlites. Courtesy of MPH Consulting (project managers), IGS c. c. (geophysical contractor) and Aegis Instruments (Pty) Ltd., Botswana.**

**Sensitivity** is a measure of the signal-to-noise ratio of the measuring device and reflects both the underlying physics and electronic design. The physics of the Overhauser effect improves sensitivity by an order of magnitude over conventional proton precession devices. Electronic enhancements, such as high-precision precession frequency counters (see the v6.0 & v7.0 - New Milestones section) enhance sensitivity by 25% or more.

The result is high quality data with sensitivities of  $0.02 \text{ nT} / \sqrt{\text{Hz}}$ . This sensitivity is virtually the same as the sensitivity of costlier optically-pumped cesium systems.

**Resolution** is the minimum step of the counter used to measure precession frequency and its conversion into magnetic field. It is generally higher than the sensitivity to avoid a contribution of the counter to overall system noise. The GSM-19 has unmatched resolution (0.01 nT).

This level of resolution translates into well-defined, characteristic anomalies; improved visual display; and enhanced numerical data for processing and modeling.

**Absolute accuracy** defines maximum deviation from the true value of the measu-

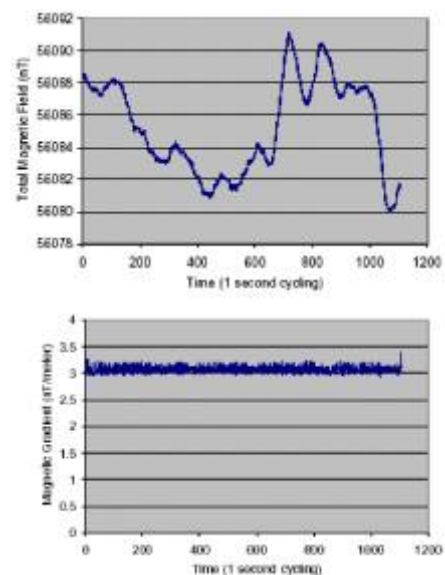
knows the true value of the field, absolute accuracy is determined by considering factors involved in determining the field value and their accuracy, including the gyromagnetic constant, maximum offset of the time base frequency, etc.

With an absolute accuracy of  $\pm 0.1 \text{ nT}$ , the GSM-19 is ideal for total field work and gradient measurements maintain the same high standard of quality. Both configurations are also specially designed to minimize overall system noise, so you can be sure that results truly reflect the geologic signal that is of most interest to you.

**Sampling rates** are defined as the fastest speed at which the system can acquire data. This is a particularly important parameter because high sampling rates ensure accurate spatial resolution of anomalies and increase survey efficiency.

GEM's Overhauser system has 3"measurement modes" or maximum sampling rates - "Standard" (3 sec. / reading), "Walking" (0.5 sec. / reading) and "Fast" (0.2 sec. / reading). These rates make the GSM-19 a versatile system for all ground uses (including vehicle-borne applications).

Gradient tolerance is the ability to obtain reliable measurements in the presence of extreme field variations. GSM-19 tolerance is maintained through internal

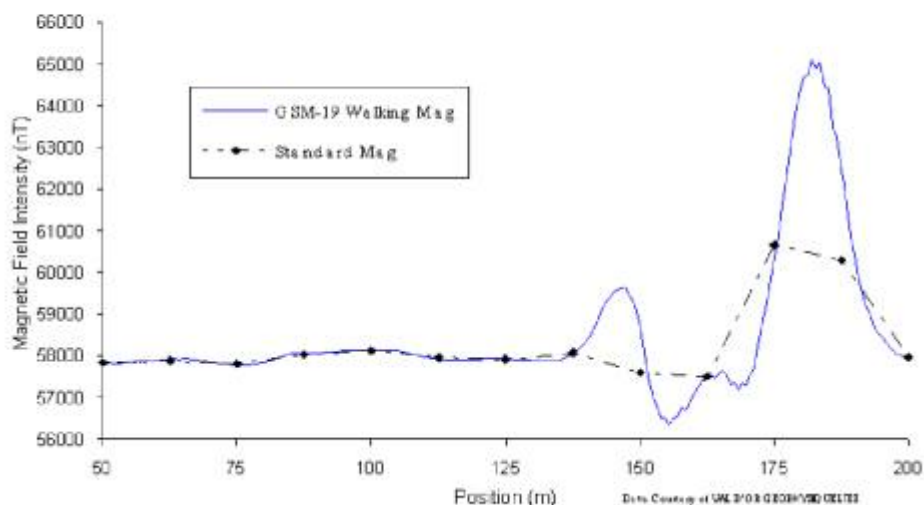


**Total Field and Stationary Vertical Gradient showing the gradient largely unaffected by diurnal variation. Absolute accuracy is also shown to be very high (0.2 nT/meter).**

signal counting algorithms, sensor design and Overhauser physics. For example, the Overhauser effect produces high amplitude, long-duration signals that facilitate measurement in high gradients.

The system's tolerance (10,000 nT/m) makes it ideal for many challenging environments, such as highly magnetic rocks in mineral exploration or near cultural objects in environmental, UXO or archeological applications.

## Near-Continuous Surveys Improve Definition of Magnetic Anomalies



**Much like an airborne acquisition system, the GSM-19 "Walking" magnetometer option delivers very highly-sampled, high sensitivity results that enable very accurate target location and / or earth science decision-making.**

## Increasing Your Operational Efficiency

Many organizations have standardized their magnetic geophysical acquisition on the GSM-19. This reflects enhancements such as memory capacity; light weight; GPS and navigation; no warm-up time; no dead zones or heading errors; easy dumping and processing.

**Memory capacity** controls the efficient daily acquisition of data, acquisition of positioning results from GPS and the ability to acquire high volumes of data to meet daily survey objectives.

V7.0 upgrades have established the GSM-19 as the commercial standard for memory with over 838,000 readings (based on a basic configuration of memory, a survey with time, coordinate and field values).

Optional increments of memory to over 2 million readings making the GSM-19 an ideal system for acquisition of data with integrated GPS readings (when required).

**Portability characteristics** (ruggedness, light weight and power consumption) are essential for operator productivity in both normal and extreme field conditions.

GEM's Overhauser magnetometer is established globally as a robust scientific instrument capable of withstanding temperature, humidity and terrain extremes. It has the reputation as the lightest and lowest power system available, reflecting Overhauser effect and RF polarization advantages.

In comparison with other systems, the GSM-19 is the choice of operators as an easy-to-use and robust instrument

**GPS and navigation options** are very important for earth science professionals. GPS technologies are revolutionizing data acquisition, productivity, increasing spatial resolution and providing a new level of data quality for informed decision-making.

GEM has made GPS a cornerstone of its magnetic R&D program. Real time GPS and DGPS options are now available in different survey resolutions. For more details, see the GPS and DGPS section.

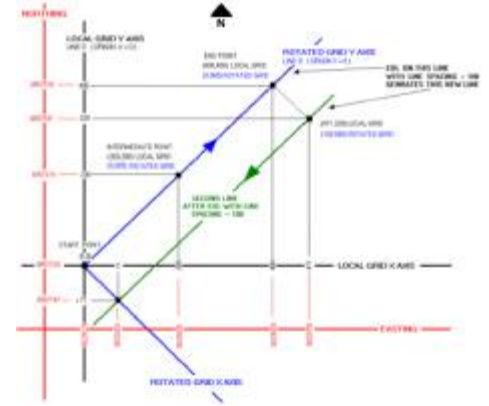
GEM has also developed a GPS Navigation feature with real-time coordinate transformation to UTM, local X-Y coordinate rotations, automatic end-of-line flag, guidance to the next line, and survey "lane" guidance with cross-track display and audio indicator.

Other enhancements include way point pre-programming of up to 1000 points. Professionals can define a complete survey on PC and download points to the magnetometer via RS-232 before leaving for the field.

The operator performs the survey using the way points as a survey guide. This capability decreases survey errors, improves efficiency and ensures more rapid survey completion.

Dumping and processing effectiveness is also critical consideration. Historically, up to 60% of an operator's "free" time can be spent on data dumping. Data dumping times are significantly reduced through GEM's implementation of high-speed, digital data links (up to 115 kBaud).

This functionality is facilitated through a new RISC processor and GEM's proprietary GEMLinkW acquisition/display software. This software serves as a bi-directional RS-232 terminal. It also has integrated processing functionality to streamline key processing steps, including diurnal data reduction. GEMLinkW is provided free to all GSM-19 customers. Regular updates are



## Navigation and Lane Guidance

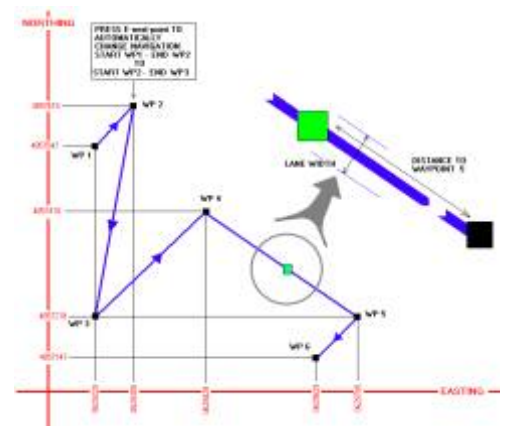
The figure above shows the Automatic Grid (UTM, Local Grid, and Rotated Grid). With the Rotated Grid, you can apply an arbitrary origin of your own definition. Then, the coordinates are always in reference to axes parallel to the grid. In short, your grid determines the map, and not the NS direction.

The Local Grid is a scaled down, local version of the UTM system, and is based on your own defined origin. It allows you to use smaller numbers or ones that are most relevant to your survey.

The figure below shows how programmable waypoints can be used to plan surveys on a point-by-point basis.

Initially, you define waypoints and enter them via PC in the office or via PC in the field or office. When you perform your survey, the unit guides you to each point.

While walking between waypoints, lane guidance keeps you within a lane of pre-defined width using arrows (< - or - >) to indicate left or right. The display also shows the distance (in meters) to the next waypoint.



## Adding Value through Options

When evaluating the GSM-19 as a solution for your geophysical application we recommend considering the complete range of options offered by GEM. These options can be added at time of original purchase or later to expand capabilities as your needs change or grow.

GEM's approach with options is to provide you with an expandable set of building blocks:

- o Gradiometer
- o Walking Magnetometer / Gradiometer
- o Fast Magnetometer / Gradiometer
- o VLF (3 channel)
- o GPS (built-in or external)

## GSM-19G Gradiometer Option

The GSM-19 gradiometer is a versatile, entry level system that can be upgraded to a full-featured "Walking" unit (model GSM-19GW) in future. The GSM-19G configuration comprises 2 sensors and a "Standard" console that reads data to a maximum of 1 reading every 3 seconds.



An important GEM's design feature allows gradiometer sensors measure the 2 magnetic fields concurrently to avoid any temporal variations that could distort gradiometer readings. Other features, such as single-button data recording, are included for operator ease-of-use.

## GSM-19W / GW "Walking" Magnetometer / Gradiometer Option

GEM Systems pioneered the innovative "Walking" option that enables the acquisition of nearly continuous data on survey lines. Since introduction, the GSM-19W and GSM-19GW have become one of the most popular magnetic instruments in the world.

Similar to an airborne survey in principle, the system records data at discrete time intervals (up to 5 readings per second) as the instrument is carried along the line.

At each survey picket (fiducial), the operator touches a designated key. The system automatically assigns a picket coordinate to the reading and linearly interpolates the coordinates of all intervening readings (following survey completion during post-processing). A main benefit is that the high sample density improves definition of geologic structures and other targets (UXO, archeological relics, drums, etc.).

It also increases survey efficiency because the operator can record data almost continuously. Another productivity feature is the instantaneous recording of data at pickets. This is a basic difference between the "Walking" version and the GSM-19 / GSM-19G (the "Standard" mode version which requires 3 sec. to obtain a reading each time the measurement key is pressed).

## GSM-19W / GW Magnetometer

The GSM-19 reads up to 5 readings per sec. (sensors and console are the same as other models.) This system is ideal for vehicle-borne surveys, such as UXO, archaeological or some mineral exploration applications, where high productivity is required.

## GSM-19 "Hands-Free" Backpack Option

The "Walking" Magnetometer and Gradiometer can be configured with an optional backpack-supported sensor. The backpack is uniquely constructed - permitting measurement of total field or gradient with free hands.

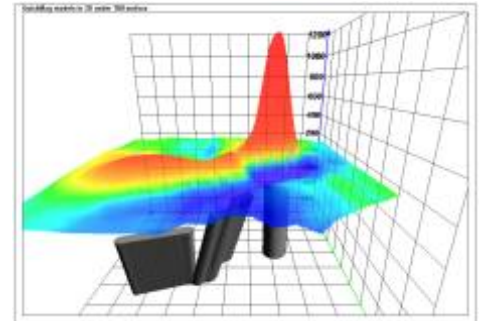
This option provides greater versatility and flexibility, which is particularly valuable for high-productivity surveys or in rough terrain.

## GSM-19V / GV "VLF" Option

With GEM's omnidirectional VLF option, up to 3 stations of VLF data can be acquired without orienting. Moreover, the operator is able to record both magnetic and VLF data with a single stroke on the keypad.

## 3rd Party Software - A One-Stop Solution for Your Potential Field Needs

Now it's even easier to take data from the field and quality control stage through to final map preparation and modeling.



**GEM-VIS provides links to fast 3D modeling via Encom's professional QuickPro software.**

GEM provides very comprehensive solution available for working with magnetometer data:

- o Free GEMLinkW Transfer and Internet Upgrade software
- o Optional, low-cost GEM-VIS Quality Control, Visualization and Analysis
- o Optional Data Processing
- o Optional QuickMag Pro Automated Modeling and Inversion



## V7.0 and V6.0 - Technology Developments

One of the main differences between GEM and other manufacturers is GEM's 30 years consistent focus on developing leading-edge magnetic technologies.

This commitment has led to many innovations in sensor technology; signal counting; firmware and software; and hardware and console design, culminating in the release of v7.0.

v7.0 and the previous release (v6.0) of the GSM-19 system provides many examples of the ways in which GEM continues to advance magnetics technologies for its customers.

### Enhanced data quality:

- o 25% improvement in sensitivity (new frequency counting algorithm)
- o new intelligent spike-free algorithm (in contrast to other manufacturers, GEM does not apply smoothing or filtering to achieve high data quality)

### Improved operational efficiency:

- o Enhanced positioning (GPS engine with optional integrated / external GPS and real-time navigation)
- o 16 times increase in memory to 32 Mbytes standard
- o 1000 times improvement in processing and display speed (RISC microprocessor with 32-bit data bus)
- o 2 times faster digital data link (115 kBaud through RS-232)

### Innovative technologies:

- o Battery conservation and survey flexibility (base station scheduling option with 3 modes - daily, flexible and immediate start)
- o Survey pre-planning (up to 1000 programmable waypoints that can be entered directly or downloaded from PC for greater efficiency)
- o Efficient GPS synchronization of field and base units to Universal Time (UTC)
- o Cost saving with firmware upgrades

## GEM's Proven Overhauser System

In a standard Proton magnetometer, current is passed through a coil wound around a sensor containing a hydrogen-rich fluid. The auxiliary field created by the coil (>100 Gauss) polarizes the protons in the liquid to a higher thermal equilibrium.

When the current, and hence the field, is terminated, polarized protons precess in the Earth's field and decay exponentially until they return to steady state. This process generates precession signals that can be measured as described below. Overhauser magnetometers use a more efficient method that combines electron-proton coupling and an electron-rich liquid (containing unbound electrons in a solvent containing a free radical). An RF magnetic field that corresponds to a specific energy level transition, stimulates the unbound electrons.

Instead of releasing this energy as emitted radiation, the unbound electrons transfer it to the protons in the solvent. The resulting polarization is much larger, leading to stronger precession signals.

Overhauser and proton precession, measure the scalar value of the magnetic field based on the proportionality of precession frequency and magnetic flux density (which is linear and known to a high degree of accuracy). Measurement quality is calculated using signal amplitude and its decay characteristics. Values are averaged over the sampling



As the world's experienced manufacturer of commercial Overhauser systems, GEM's technical focus on the GSM-19 has resulted in a superior magnetic measuring device with high sensitivity, high cycling speed, low noise, and very low power consumption over a wide temperature range.

With minor software modifications (i.e. addition of a small auxiliary magnetic flux density while polarizing), it can be easily configured for high sensitivity readings in low magnetic fields (for equatorial work).

## GPS - Positioning You for Effective Decision Making

The use of GPS technology is increasing in earth science disciplines due to the ability to make better decisions in locating anomalies, and in improving survey cost effectiveness and time management.



Examples of applications include:

- o Surveying in remote locations with no grid system (Arctic for diamond exploration)
- o High resolution exploration mapping
- o High productivity ferrous ordnance (UXO) detection
- o Ground portable magnetic and gradient surveying for environmental and engineering applications
- o Base station monitoring for observing diurnal magnetic activity and disturbances with integrated GPS time

GEM addresses requests for GPS and high-resolution Differential GPS (DGPS) through internal and external options. Customer units can also be integrated. GPS surveys return a variety of real data to the user, including Time, Latitude and Longitude, UTM, Elevation and # of Satellites. This data is available to be applied in various ways by the user. The table below shows GPS modes, ranges and services.

Description	Range	Services
GPS Option A		Time reception only
GPS Option B	< 1.5m	DGPS*
GPS Option C	< 0.6m	DGPS*, OmniStar
GPS Option D	< 0.6m < 0.6m < 0.7m	CDGPS, DGPS*, OmniStar
Output		
Time, Lat / Long, UTM, Elevation and number of Satellites		
*DGPS with SBAS (WAAS / EGNOS / MSAS)		

## Key System Components

Key components that differentiate the GSM-19 from other systems on the market include the sensor and data acquisition console. Specifications for components are provided on the right side of this page.

### Sensor Technology

GEM's sensors represent a proprietary innovation that combines advances in electronics design and quantum magnetometer chemistry.

Electronically, the detection assembly includes dual pick-up coils connected in series opposition to suppress far-source electrical interference, such as atmospheric noise. Chemically, the sensor head houses a proprietary hydrogen-rich

liquid solvent with free electrons (free radicals) added to increase the signal intensity under RF polarization.

From a physical perspective, the sensor is a small size, light-weight assembly that houses the Overhauser detection system and fluid. A rugged plastic housing protects the internal components during operation and transport.

All sensor components are designed from carefully screened non-magnetic materials to assist in maximization of signal-to-noise. Heading errors are also minimized by ensuring that there are no magnetic inclusions or other defects that could result in variable readings for different orientations of the sensor.

Optional omni-directional sensors are available for operating in regions where the magnetic field is near-horizontal (i.e. equatorial regions). These sensors maximize signal strength regardless of field direction.

### Data Acquisition / Console Technology

Console technology comprises an external keypad / display interface with internal firmware for frequency counting, system control and data storage / retrieval. For operator convenience, the display provides both monochrome text as well as real-time profile data with an easy-to-use interactive menu for performing all survey functions.

The firmware provides the convenience of upgrades over the Internet via the GEMLinkW software. The benefit is that instrumentation can be enhanced with the latest technology without returning the system to GEM -- resulting in both timely implementation of updates and reduced shipping / servicing costs.



## Specifications

### Performance

Sensitivity:	0.022 nT / $\sqrt{\text{Hz}}$
Resolution:	0.01 nT
Absolute Accuracy:	+/- 0.1 nT
Range:	20,000 to 120,000 nT
Gradient Tolerance:	< 10,000 nT/m
Samples at:	60+, 5, 3, 2, 1, 0.5, 0.2 sec
Operating Temperature:	-40C to +50C

### Operating Modes

Manual: Coordinates, time, date and reading stored automatically at minimum 3 second interval.

Base Station: Time, date and reading stored at 1 to 60 second intervals.

Remote Control: Optional remote control using RS-232 interface.

Input / Output: RS-232 or analog (optional) output using 6-pin weatherproof connector.

### Storage - 32 MB (# of Readings)

Mobile:	1,465,623
Base Station:	5,373,951
Gradiometer:	1,240,142
Walking Mag:	2,686,975

### Dimensions

Console:	223 x 69 x 240 mm
Sensor:	175 x 75mm diameter cylinder

### Weights

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

### Standard Components

GSM-19 console, GEMLinkW software, batteries, harness, charger, sensor with cable, RS-232 cable and USB adapter, staff, instruction manual and shipping case.

### Optional VLF

Frequency Range: Up to 3 stations between 15 to 30.0 kHz. Parameters: Vertical in-phase and out-of-phase components as % of total field. 2 components of horizontal field amplitude and total field strength in pT.

Resolution:	0.1% of total field
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## Our World is Magnetic.

### About GEM Advanced Magnetometers

GEM Systems, Inc. delivers the world's only magnetometers and gradiometers with built-in GPS for accurately positioned ground, airborne and stationary data acquisition. The company serves customers in many fields including mineral exploration, hydrocarbon exploration, environmental and engineering, Unexploded Ordnance Detection, archeology, earthquake hazard prediction and observatory research.

Key products include the Proton Precession, Overhauser and Optically-Pumped Potassium instruments.

Each system offers unique benefits in terms of sensitivity, sampling, and acquisition of high-quality data. These core benefits are complemented by GPS technologies that provide metre to sub-metre positioning.

With customers in more than 50 countries globally and more than 25 years of continuous technology R&D, GEM is known as the only geophysical instrument manufacturer that focuses exclusively on magnetic technology advancement.

**GEM**  
SYSTEMS  
ADVANCED MAGNETOMETERS

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# APPENDIX D

## STATEMENT OF QUALIFICATIONS



## **STATEMENT OF QUALIFICATIONS**

I, ROBERT L MCKEOWN, OF 53 PINE BUD AVENUE, ST JOHN'S, NEWFOUNDLAND AND LABRADOR, DO HEREBY DECLARE:

- 1) I am a Registered Professional Geoscientist (P.Ge.), licensed by the Professional Engineers and Geoscientists of Newfoundland and Labrador, and the Association of Professional Geoscientists of Ontario.
- 2) That I have been actively practicing my profession as geophysicist full time since 1995
- 3) I graduated from McMaster University in Hamilton, Ontario with a BSc (Geology) in 1995.
- 4) I hold no interest, direct or indirect, neither in the claims that are subject of this report nor in the securities of Sourdough Resources.

Signed in the City of St John's on this day, 15<sup>th</sup> November, 2011

Robert L McKeown  
Consulting Geophysicist