

**EL 32 / 2001  
SCOTIA  
NORTH EAST TASMANIA**

**ANNUAL REPORT**

**FOR THE YEAR ENDING**

**19<sup>TH</sup> APRIL 2007**

**VOLUME 3**

**APPENDICES**

**VAN DIEMAN MINES PTY LIMITED**

**28<sup>TH</sup> February 2007**

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Exploration and Development

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11.4 GEOPHYSICAL SURVEY, SEISMIC & TOTAL MAGNETIC FIELD SURVEYS,  
ENDURANCE AND SCOTIA MINE SITES

# Geophysical Services for the Environmental, Engineering and Ordnance Industries



**PROJECT:**                    **GEOPHYSICAL SURVEY**  
Seismic and Total Magnetic Field Survey

**AREA:**                        **Gladstone, N-E Tasmania,**  
**Australia.**  
Endurance and Scotia mine sites

**CLIENT:**                    **Van Dieman Mines Ltd.**

**PROJECT NO:**            **AG-143**

**CLIENT P/O:**            **Email of 17/12/06**

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**REPORT**

**Geophysical Survey  
Gladstone N-E Tasmania, Australia**

for

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Date: 17 December 2006

Date: 17 December 2006

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## 1 INTRODUCTION

Alpha Geoscience Pty. Limited (Alpha), based in Sydney, NSW, was contracted by Van Dieman Mines Limited to undertake a Seismic Refraction and Total Field Magnetic study at two of the company's mining leases near Gladstone, N-E Tasmania, Australia.

The objectives of the study were to determine:

- If seismic techniques would be useful in delineating basement structures within the Deep Leads in the area, particularly the interface between the compacted gravel, alluvium layer and the weathered basement material.
- If a total field magnetic signature existed that would allow mapping of the extent of the Deep Leads.

## 2 AUTHORITY

Mr. Graeme McIntyre of Van Dieman Mines provided the authority to proceed with this project by way of email on September 28, 2006.

## 3 SURVEY RATIONALE

### *3.1 Refraction Seismic Survey*

The deep leads are deposits of gravels, sands and clays, high in tin and heavy metals. The deep leads have formed along the course of an ancient river system (Keuneke, O., 1957). These paleochannels hence confine the mineral deposit to depressed zones in the weathered basement material. Whilst direct delineation of the mineral deposits may not be possible using geophysical techniques, detection of paleochannels would define the extent of the regions of the deposits.

### *3.2 Total Field Magnetic Survey*

Current technology in total field magnetic surveying is acknowledged for producing accurate magnetic map images at very high production rates. The method does depend on averaging the magnetic signature over large subsurface volumes and thus cannot accurately image internal geological bedding structures. The advantage is that, if a magnetic signature exists over the deep leads, mapping of the extent of the zone could be achieved at a minimal cost.

The use of total field magnetic surveying may be attractive to Van Dieman Mines as a way of mapping the extent of the deep leads within the prospect. If the technology is proven to be useful in the local environment and geology, it will significantly reduce the cost of the overall geophysical mapping program across the Van Dieman Mines mining tenements. Not only are the production rates very rapid, local Van Dieman Mines personnel with very limited training can also acquire the data.

## 4 EQUIPMENT

### *4.1 Seistronix RAS-24 Seismic Acquisition System*

Data collection was achieved using a Seistronix RAS-24 seismic system, acquiring 48 active channels. Eight and 30Hz geophones were trailed. A 2.5m geophone spacing was employed at the Scotia site and 5m used at the Endurance site.

Various seismic energy sources were employed, 50gr of cartridge explosive, 12 gauge shotgun and stacking of 5, 20 lb sledgehammer blows.

#### **4.2 GPS Positioning**

A Trimble DGPS AG114 Global Positioning System Receiver, employing real time correction from the Omni Star satellite system, was used for positioning of the individual survey lines. The GPS provides accurate positioning in the field and was used for marking waypoints at one second intervals along the individual lines.

With an accuracy of better than +/- one metre, the backpack mounted unit provides a reasonable level of accuracy.

#### **4.3 Geometrics G-858 MagMapper**

The G-858 MagMapper uses a graphical interface to make survey design and data acquisition quick and efficient. Various modes of operation allow the user to custom design a survey grid for their particular needs. The operator also has the ability to view his/her position on the grid and the current data profile during the survey. Sensitivity, resolution, and recording rate of the cesium magnetometer are user selectable (<http://www.geometrics.com/858-d.html>).

G-858 data acquisition offers either continuous or discrete station recording. The high sampling rate of the instrument in continuous mode allows the operator to survey an area at a fast walking pace. (<http://www.geometrics.com/858>).

Datasheets for all instruments are available in Appendix 1.

### **5 SURVEY AND DATA PROCESSING**

#### **5.1 Survey Areas**

Two survey lines were selected for the evaluation of the refraction seismic method; Line 1 at both the Endurance and Scotia sites were investigated.

Maps showing the location of the seismic lines the two magnetic survey areas and are available in Appendix 2.

The Endurance site was wet and boggy underfoot, in the Eastern portion, with up to 500mm of standing water in places. This site was generally open with low bushes and tall grass.

The Scotia survey site was dry, with a hard packed clay pan. Generally the site is heavily vegetated with a mix of large solid trees and relatively dense undergrowth. Some areas had very dense tea tree vegetation, which was almost impossible to penetrate. Recent bushfires had cleared some areas, which improved access.

There were no major topographic features within either survey area.

#### **5.2 Survey Parameters**

Seismic data was collected along predefined lines at the Endurance and Scotia sites as documented in the maps in Appendix 2.

The total field magnetic survey at the Endurance site was conducted along five lines, as shown on the Endurance site magnetic survey results.

At the Scotia site the total field magnetic survey was conducted along four lines, as shown on the Scotia site magnetic survey results.

Positioning on each magnetic data line was recorded using a DGPS, collecting continually along each survey line. DGPS data was recorded directly into the digital magnetic data file.

### **5.3 Field Procedures**

#### **5.3.1 Seismic Refraction Profiling**

A geophone spacing of 2.5m was employed at the Scotia site, with 5m spacing used at the Endurance site.

Seismic energy sources trialled were

- 50gr of cartridge explosive,
- 12 gauge shotgun,
- and stacking of 5, 20 lb sledgehammer blows.

#### **5.3.2 Total Magnetic Survey**

The following outlines the field procedures deployed during the magnetic survey.

- a) The individual instrument components were assembled and tested.
- b) GPS waypoints were recorded at one second intervals along the magnetic data lines.
- c) The data was filtered and evaluated on the fly for quality and consistency.
- d) The raw data was saved to the Magnetometers Data logger for positioning of the data points.
- e) Post collection processing was carried out in our Sydney office.

### **5.4 Data Processing**

The following steps were taken in the processing of the data:

#### **5.4.1 Seismic Profiling**

- a) Data was downloaded from the seismograph.
- b) Data was checked for integrity.
- c) First arrivals were picked.
- d) Refraction modelling was preformed.
- e) Tomographic modelling was preformed.
- f) The resulting image was printed in hard copy and electronic copy.
- g) Reflection processing was preformed.

#### **5.4.2 Total Magnetic Survey**

- h) Data was downloaded from the data logger.
- i) Data was checked for integrity.
- j) Data was checked for data spikes and drop-outs.
- k) Data was gridded and plotted using Surfer Software.
- l) The resulting image was printed in hard copy and electronic copy.

## 6 RESULTS

### 6.1 Reflection Seismics

The data from all energy sources is of reasonable quality, with the shotgun appearing to give less high frequency noise. This is of interest, as the explosive source would normally be expected to return the best results.

Reflection processing of the data from both sites was undertaken. The fold of the data was too low to alleviate the strong ground roll and enable the removal of refractions from the data.

A possible reflector is present in the Scotia line, but with the low fold of the data (4 to 5), and the strong ground roll it is likely to be an artefact of the processing.

### 6.2 Refraction Seismics

#### 6.2.1 Endurance Site

There is evidence of only three refractors in the seismic data acquired on the Endurance site.

1. A shallow slow velocity layer, ~ 600 to 700m/sec - interpreted as recent sedimentation and topsoil, 0.5 to 5m thick.
2. A faster layer, ~ 1700m/sec – interpreted as alluvium and weathered basement material, 10 to 55m thick.
3. A fast base layer ~ 3000 to 3500m/sec – interpreted as the unweathered basement granite material.

The alluvium and weathered basement material appear to both have similar seismic velocities. Hence the boundary between the two is not delineated in the seismic line acquired.

A second approach used on the data for this site is seismic tomography. This form of data interpretation uses arrival times, and involves plotting the velocities of materials to a cross section and gridding and smoothing the data.

The tomographic section shows correlation with the results of the drill holes along this line.

Both modelled cross sections and travel time plots are presented in Appendix 3 below.

#### 6.2.2 Scotia Site

There is evidence of only three refractors in the seismic data acquired on the Endurance site.

1. A shallow slow velocity layer, ~ 700 to 800m/sec - interpreted as recent sedimentation, alluvium and topsoil, 0.5 to 30m thick.
2. A faster layer, ~ 1200 to 1300m/sec – interpreted as Tertiary gravels, clays and sands, 1 to 30m thick.
3. A fast base layer ~ 2300 to 2600m/sec – interpreted as the weathered shale and sandstone.

Tomographic modelling was performed on this seismic line. Both modelled cross sections and travel time plots are presented in Appendix 4 below.

Both the standard refraction modelling and tomographic section show correlation with the results of the dill holes along this line.

### 6.3 Total Field Magnetics

#### 6.3.1 Endurance Site

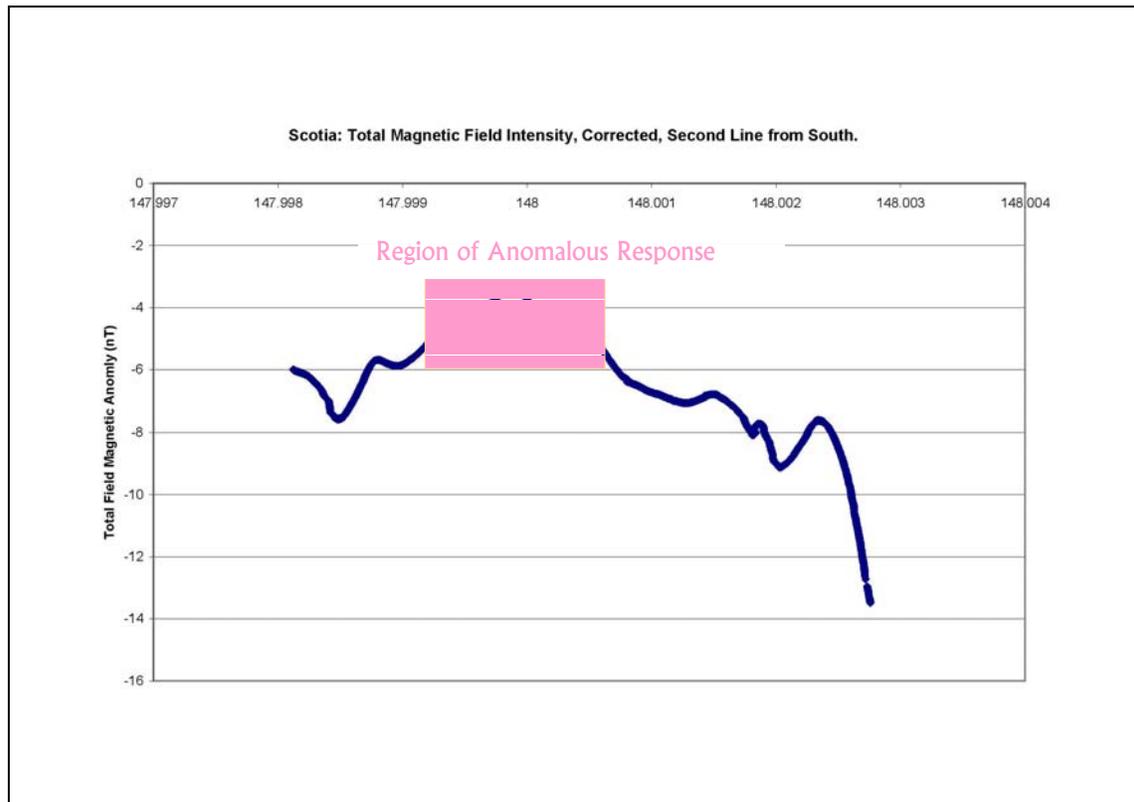
The magnetic data acquired across the Endurance site does not appear to show a mappable anomaly. The results are consistent with regional magnetic trend related to the regional geology, rather than localized geomorphologic palaeo-processes.

Gridded data plot is presented in Appendix 5 below.

#### 6.3.2 Scotia Site

The gridded magnetic data from the Scotia site shows a subtle anomaly. This aligns with the deep lead plotted from drill results. The anomalous region is wider than the mapped deep lead at this location. An example of the response is shown below. As can be seen the response is only two nT.

**Example of the magnetic response across the Scotia site:**



Gridded data plot is presented in Appendix 6 below.

## 7 COMMENTS ON RESULT

### 7.1 Refraction Seismics

The interpretation of the current data set is in agreement to previous seismic work conducted on this site. The current testing programme revealed a layered model, with velocities that are similar to those found by Keunecke in the survey conducted in 1957.

Tomographic sections show isovelocity layers with sharp increases of velocity as depth increases; these are interpreted as layer boundaries. This approach appears to give a correlation with the borehole logs. More data and fully documented logs would be required to gain a definitive answer as to the advantages, if any, over traditional seismic refraction methods for either of these sites.

#### 7.1.1 Endurance Site

The alluvium and weathered basement material appear to both have similar seismic velocities. Hence the boundary between the two is not delineated in the seismic line acquired on the Endurance site.

The unweathered basement material is not defined in the data set

The refraction seismic technique relies on the existence of a seismic velocity contrast between materials of the earth. Some limitations of the technique are:

- One requirement for successful modelling is that seismic velocities increase with depth. That there is a discrete velocity contrast present, not a zone of variation. (Department of the Army. 1979).
- Dips of layers (or subsurface features) must be in the order of 15 degrees or less (Department of the Army. 1979).
- Zones of saturated material may present with a unrealistically high velocity e.g. saturated sands and alluvium may have a recorded seismic velocity of 1500m to 2000m/sec, whilst dry unconsolidated sands and alluvium will have a seismic velocity of 350 to 600m/sec (Reynolds. 1997).
- A blind zone exists above each layer. This zone is dependent on the depth and velocity distribution (Department of the Army. 1979).
- Hidden layers may exist that cannot be detected by the use of refraction seismic techniques. These hidden layers may be present within each blind zone (Reynolds. 1997).

Also thin layers will not be detected. The thickness of the layer that can be discerned is from one quarter to one half of the transmitted wavelength (Reynolds. 1997).

The investigation at the Endurance site was hampered by a high watertable, this would increase the seismic velocity of the subsurface materials, and may be the cause of the lack of variation between the layers defined in the drilling operations.

#### 7.1.2 Scotia Site

The interpretation of the current data set is in agreement to previous seismic work conducted on this site. The current testing programme revealed a layered model, with velocities that are similar to those found by Longman in the survey conducted in 1969. However this investigation did not define the unweathered basement material.

Tomographic modelling of these seismic lines has produced results that are in reasonable agreement with the boreholes undertaken along these lines.

The surface along the seismic line acquired on the Scotia site was a hard packed pan. The presence of the pan resulted in a higher than normal surface wave. With the offsets utilized during this phase of data collection and the high velocity ground roll reflections from deeper structures were obscured.

## **7.2 Total Field Magnetics**

### **7.2.1 Endurance Site**

The magnetic survey did not map the position of the deep leads on the Endurance site. Only two of the traverses crossed the entire site. Tighter line spacing and longer profile lengths may resolve an anomaly. But as stated above the results appear to be consistent with regional rather than localized geology.

### **7.2.2 Scotia Site**

The limited survey undertaken at the Scotia site has shows a subtle anomaly. The anomaly trends in the direction of the inferred deep lead in this portion of the site. With a measured response of two nT the anomaly prove to be the result of a deep lead, but may also be the result of localized near surface processes.

## **8 CONCLUSIONS**

### **8.1 Seismics**

Traditional refraction modelling and interpretation do not, and have not in the past, successfully mapped the top of the weathered basement profile at the Endurance site. At the Scotia site where the top of the weathered basement has been defined, correlation with the results of drilling is fair.

Seismic tomography has enabled isovelocity regions to be mapped, at both locations, and demonstrates the presence of regions displaying steeply increasing velocity with depth. This technique has enabled a layer to be defined that correlates in part to the borehole results.

Increasing the fold of the data by employing different acquisition geometry, increased shot offsets with more internal shots, may enable processing as seismic reflection data, as well as refraction data.

Another approach that may be worth investigating is to use surface wave frequency analysis, (SASW).

The use of a shotgun seismic source proved to be successful on both sites. Good coupling was achieved and good energy transmission resulted.

### **8.2 Total Field Magnetics**

The Endurance site may warrant a small scale data collection undertaking, to evaluate if the lack of mappable anomalies are the result of limited data, or as a result of the deep leads not having a measurable magnetic response.

The Scotia site appears to have mineralization associated with the deep leads that has a, albeit it subtle, response that will enable the surface mapping of the deep leads on this site.

## **9 LIMITATIONS OF REPORT**

This report has been prepared for the use of **Van Dieman Mines** in accordance with general accepted Consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has not been prepared for the use by parties other than the client,

the owner and their respective consulting advisors. It may not contain sufficient information for purposes of other parties or for other uses.

This report was prepared on completion of the field work and is based on conditions encountered and reviewed at the time of preparation. Alpha Geoscience disclaims responsibility for any changes that might have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue; conditions on the site (including the depositing and removal of contamination) can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

## **10 APPENDIX 1 – INSTRUMENT DATA SHEETS**

SEISTRONIX RAS-24 Seismic Acquisition System

TRIMBLE DGPS AG 114 Global Positioning System Receiver.

GEOMETRICS G-858 MagMapper

-Attached

The RAS-24 is a modular 24-channel, high resolution, signal enhancement seismograph designed for shallow refraction and reflection surveys. The system combines state-of-the-art 24-bit conversion with a flexible, expandable architecture that provides the ease of use of a conventional system with the advantages of a distributed system.

Whether you're looking for a 12-channel seismograph for small refraction jobs or a 240-channel system for 3D reflection, the RAS-24 has the data quality, features and performance you need for the most demanding jobs.

## Easy to use

Operating under Windows 98, the RAS-24 system software has a familiar point and click interface which is easy to learn and operate. With buttons, scroll bars and single key commands for commonly used functions, the RAS-24 user interface is designed to allow direct access to important system functions.

And setting up the RAS-24 couldn't be easier. Select the type of survey you want to perform - refraction, 2D reflection with roll, or 3D - and the RAS-24 configures itself.

## Consistent Data Quality

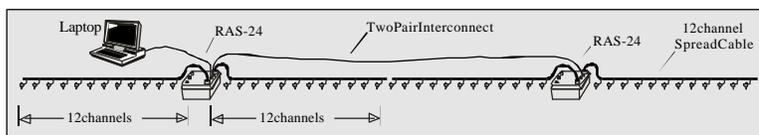
The RAS-24 provides an extensive array of tests to ensure that data is accurately recorded. Tests include amplifier noise, dynamic range, A/D offsets, amplifier pulse, CMR, timing accuracy, crosstalk, phase similarity, and gain similarity. Tests can be performed individually or a complete system test can be performed automatically with the test results logged to disk.

## Reduced Field Setup Time

Finding marginal geophones and intermittent spread cables can be a real chore in the field. But with geophone resistance, geophone pulse, geophone similarity, and cable leakage tests, the RAS-24 can easily locate geophone and cable problems before they affect your data.

## Expandable

The RAS-24 provides unique expandability not found in other systems. Connect one RAS-24 to a laptop and you have a very portable 24-channel seismograph for refraction or reflection. Connect ten units together in a line and you have a 240-channel, 2D line complete with roll. Rearrange those ten units and you have a ten line, 24 channel/line 3D spread. No special hardware is required, and you can use standard 12-channel spread cables for all configurations.



48 Channel Line



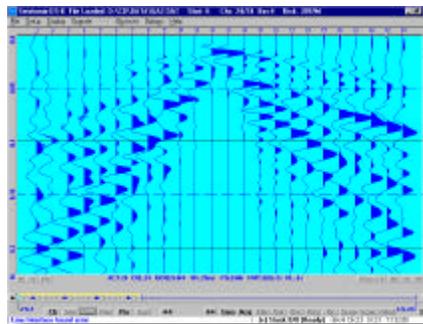
## Advanced System Software

The RAS-24 system software provides a broad range of features to aid in collecting quality data in the field. For refraction or reflection surveys, data may be previewed, filtered, AGC'd, stacked or unstacked as desired.

For 2D reflection shooting, the RAS-24 offers line management with autoroll, and a line geometry display showing the shot point, roll direction, total number of channels on line, and active channel positions. For 3D surveys, the RAS-24 has an integrated 3D script editor for specifying how the RAS-24s are connected and which portion of the spread is active for each shot.

Intuitive display options allow you to view the data the way you prefer. With a single click, you may expand or contract the display in the time or channel direction, display all the even or all the odd traces, or zoom in on an individual channel.

Other features include an observers log, recorded with each record, and a time stamped shot log which provides a continuous log of recording activity allowing you to retrace events in the field. And when you're back in the office, you can review the observers log and view, pick and print records on your office system using the same software that you ran in the field.



Typical 24Channel Record

- Available with 12 or 24 channels
- 24-Bit Delta-Sigma A/D conversion
- Wide dynamic range (117db @ 2ms)
- Lightweight - 10 lbs
- Connect up to 10 boxes (240 channels)
- 3D on up to 10 lines
- Automated system performance tests
- Operates with any laptop
- Intuitive operation under Windows 98
- Uses standard 12-channel spread cables

# RAS-24 Specifications

## SYSTEM

Number of Channels:	12 or 24 per RAS, ten 24-channel RAS modules (240 channels) per system
Sample Intervals:	0.125, 0.25, 0.5, 1, 2 and 4 ms
Record Length:	4 ms - 64 sec, 2 ms - 32 sec, 1 ms - 16 sec, .5 ms - 8 sec, .25 ms - 4 sec, .125 ms - 2 sec
Multiline Operation:	10 lines
CD Operation:	Automatic or manual rolloff of tires spread
Stacking:	Vertical stack
Cable:	One standard 12 takeout cable for 12 channel system Two for 24 channel system
Max RAS Interval:	2800 ft
Recording Format:	SEG-2, SEG-D8038, SEG-D8058
RAS Data Cable:	Two twisted pairs (CAT-3 or equivalent)

## RAS MODULE

Channels:	12 or 24
A/D Resolution:	24 Bits
Preamp Gain (PG):	12db, 24db, 36db or 48db, remotely selectable
Frequency Response:	.125 ms: 2-2000 Hz, .25 ms: 2-1650 Hz, .5 ms: 2-825 Hz, 1 ms: 2-412 Hz, 2 ms: 2-206 Hz, 4 ms: 2-103 Hz
Dynamic Range:	112 db @ 2 ms PG=36db, 117 db @ 2 ms PG=12db (typ)
Distortion (THD):	.005% at 25 Hz, 2 ms sample interval (typ)
Crosstalk:	Greater than 90db
CMR:	Greater than 90db @ 60 Hz
Max Input Signal:	.88 VRMS @ 12db, 55 mVRMS @ 36db
Input Noise:	.21 $\mu$ VRMS @ 2 ms PG=36db, 1.6 $\mu$ VRMS @ 2 ms PG=12db (typ)
Anti-Alias Filters:	4 ms 103 Hz, 2 ms 206 Hz, 1 ms 412 Hz, .5 ms 825 Hz, .25 ms 1650 Hz, .125 ms 3300 Hz
Test Oscillator:	10, 25, 50, 60, 100, 125, 200, 250 Hz Amplitude adjustable in 10 mV steps
Instrument Tests:	Internal digital tests, battery voltage, internal voltage, crosstalk, amplifier pulse, CMR, amplifier noise, dynamic range, gain & phase similarity, communications, and trigger verification
Line Tests:	Geophone pulse, geophone similarity, geophone resistance, leakage
Connectors:	Two 27-pin NK-27-21C connectors for geophone spread cable, 3-pin Bendix for trigger, two 6-pin Bendix for data, 3-pin Cannon for power
Power:	12 volts nominal. 12 Chs: 1A, 24 Chs: 2A
Physical:	11.5" x 13.25" x 5.75", 10 lbs
Operating Temp:	-30 to 70°C

## OPTIONS

HS-200 High Speed PCMCIA-II Serial interface for laptop. Permits higher data transfer rates.

## ACCESSORIES

Geophones  
 HS-1 hammer switch with 5M cable and mating connector  
 Striker plate 9" x 9" x 1"  
 BP-1 12 volt battery pack and charger  
 12 Channel spread cable (specify geophone interval)  
 Trigger extension cable  
 RAS Interconnect cable(s)  
 Portable printer

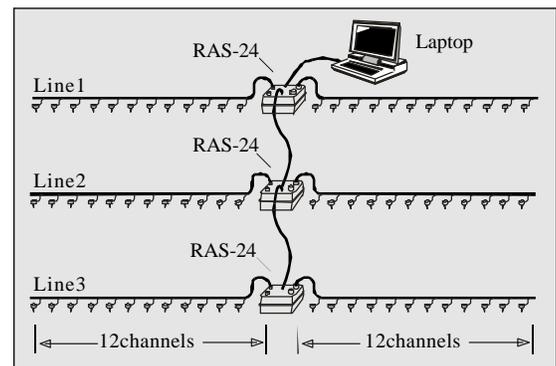
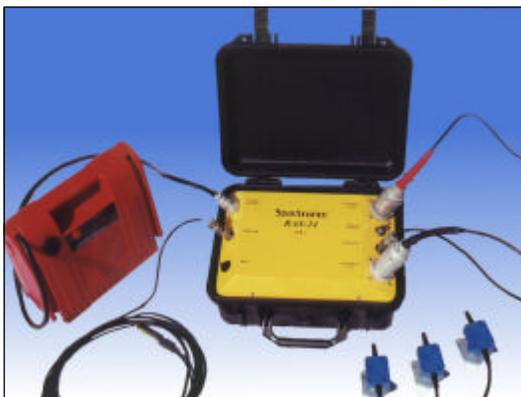
### Portable Ruggedized Computer

The A740 notebook computer is housed in a die cast magnesium alloy enclosure and is intended specifically for harsh environments. The internal hard disk is shock mounted and the tire unit is designed to survive a three-foot drop to a concrete floor.

The computer features a bright, daylight readable display, and three accessory bays which can hold a K56 modem, SCSI-II module, or additional batteries, hard disks, PCMCIA ports, and serial ports. With sealed access doors and a water proof/dust proof keyboard and touchpad, the A740 is the ideal companion for the RAS-24.

CPU:	233 MHz Pentium, 266 MHz optional
Display:	11.3" 800x600 SVGA, active matrix high contrast
Storage:	3.5" floppy, >2.1 GB hard disk
Memory:	32 MB RAM expandable to 128 MB
External Connections:	Two serial, parallel, PS/2 keyboard, PS/2 mouse, SVGA video, external power, and 200 pin docking port
Line Connections:	One 55 pin for single line, two 55 pin for multiline
PCMCIA:	Two type I/II or one type III
Keyboard:	87-Key, waterproof and dustproof
Battery:	Removable & rechargeable main Ni-Mh battery pack
Power:	12 volts nominal (10-20 VDC)
Physical:	12.2" x 10.0" x 4.2" 11 lbs, sealed magnesium alloy die cast case
Operating Temp:	0 to 50°C
Options:	266 MHz CPU, SCSI-II module, K56 modem, 13.3X GATFT display, 1024x768 64K colors

Specifications subject to change



72 Channels on Three Lines



# Portable Cesium Magnetometer/ Gradiometer

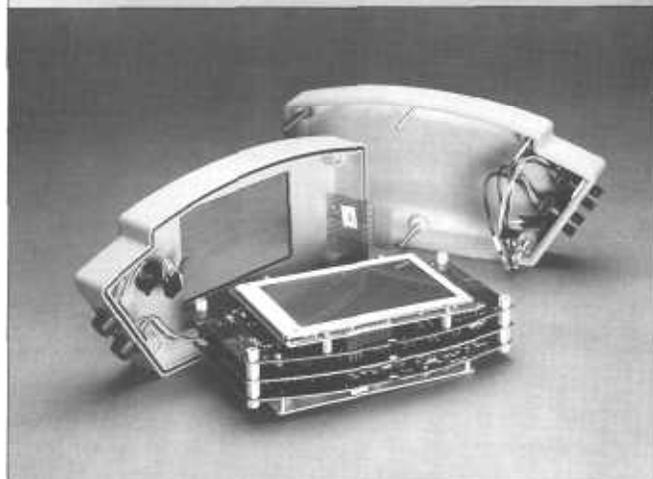
Model G-858

## A Professional Magnetic Mapping System

For Minerals, Petroleum and Environmental/Search



G-858 Electronic  
Console



G-858 Electronic Console showing internal layout  
and watertight "O" ring seal of the case

- High Sensitivity — Easily Detect a Single Drum Buried 6 Meters
- Very Fast — Cover Two Acres per Hour at 2 Meter Line Spacing
- **Immediate User Feedback** — Display Earth's Field Survey Grid, Position and 5 Stacked Survey Profiles
- Easy-to-use — Produce Hard Copy Maps at Base Site within Minutes, Uses Standard IBM-Compatible Computers, Printers/ Plotters
- Options for Simultaneous Vertical or Horizontal Gradiometer, Differential GPS Positioning, Target Analysis Software

The G-858 MagMapper™ system comprises a belt-mounted display/logging console connected to a cesium sensor mounted on a hand-held counterbalanced staff. The console contains electronics to acquire magnetic field data with position and display it on an LCD screen for review and edit. The console stores high volumes of data in memory and transmits it at high speed to a processing computer for detailed analysis.

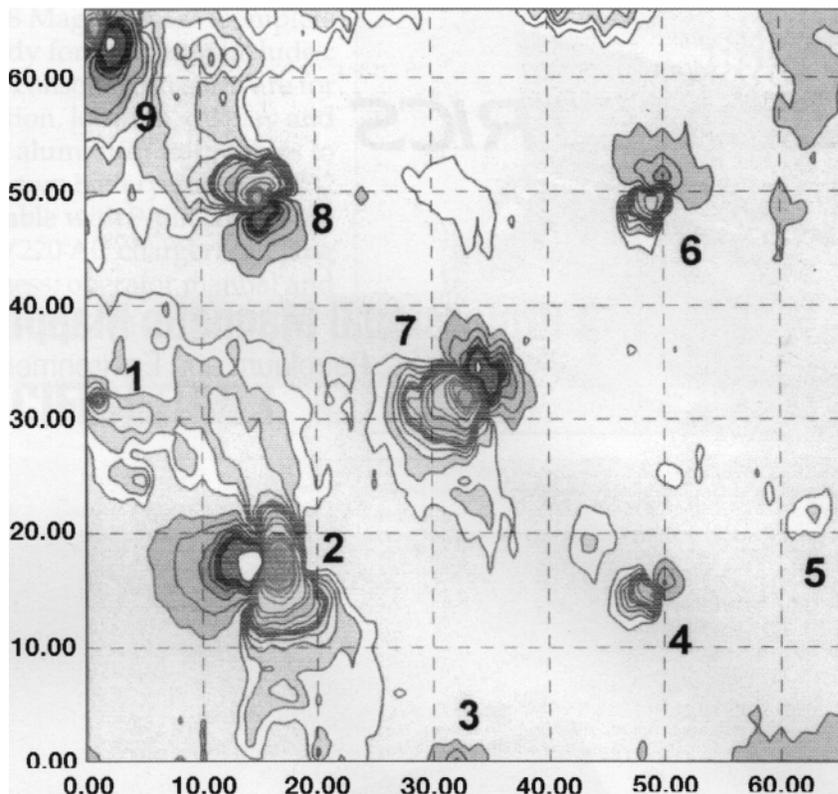
## Operation

The MagMapper™ uses a graphical interface to make survey design and data acquisition quick and efficient. A simple survey mode uses line numbers and known "marks" to define the map parameters. Or the user may define the survey by setting up complete grid boundaries in "Map" Mode. During the survey, the operator can see the portion of the grid that has been completed, i.e. his position on the grid and the current data profile. Position information may come from an external GPS or from regularly spaced fiducial marks input by the operator. At any time, the user may switch to "profile" mode to observe the last 5 data lines as stacked profiles.

Data are collected in up to 5 separate survey files and transferred via high speed RS232 data link to a computer for further analysis and map generation. A full featured graphical data editing program is provided to allow repositioning, realignment and interpolation of the data. After editing, the data is formatted in either Surfer for Windows or Geosoft formats for gridding and contouring.

## SPEED AND EFFICIENCY

G-858 data acquisition offers either continuous or discrete station recording. Data quality is uniformly high and lower costs are inherent for most projects due to the high sampling rate of the instrument in continuous mode. This allows the operator to survey an area at a fast walking pace, covering as much as 10 times more area in a given time period as previous magnetometers. Under certain conditions even lower costs may be achieved by the use of a gradiometer to widen the search radius.



### MAGNETIC ANOMALY MAP - FIREARM TEST SITE

Several different types of firearms together with ammunition, were laid out at a test site. A densely spaced survey of magnetometer measurements (1 foot line spacing) was conducted over the site to determine the typical detection thresholds of these common firearms and to ascertain the time required from the start of the layout to a finished map. The map clearly shows the spatial relationship and the relative size of all magnetic objects.

The site measured 66 x 66 ft. and was covered with a series of parallel lines with 1 ft. separation between lines. The sensor was held 2 ft. above the ground and the data was collected along each line at a rapid walking speed. The instrument sensitivity was selected to be 0.05 nT at 10 measurements per second. This resulted in a measurement being made each 5 inches along the line or approximately 11,000 individual measurements. The total time required to layout the survey grid is estimated to be 0.5 hour and the time to collect the data was 34 minutes. Thus 4356 sq. feet were surveyed in a little over 1 hour with 2.5 measurements per square foot. Downloading the data into the computer and producing a map required an additional 0.5 hour. A commercially available software program, "Surfer for Windows", was used to plot the data.

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For example, a horizontal transverse gradiometer (dual sensor array held orthogonally to the survey profile) provides twice the density of coverage on tightly spaced survey grids. Alternatively, only half the number of profiles are required to obtain normal coverage at 50% savings in time.

Since standard and readily available computers, printers/ plotters, and tape storage/backup units are employed, Geometrics encourages clients to provide their own processing hardware. Upon request, Geometrics will provide a complete and fully integrated processing station at a nominal price.

## APPLICATIONS

The G-858 MagMapper™ may be used to locate buried drums or underground storage tanks; to find pipelines, well-heads and other utilities; to search for unexploded ordnance, discarded weapons or magnetic mines; to locate graves or archaeological sites and assist in forensic investigations; to study geological structure associated with oil bearing rock and faulting; to find mineral deposits and aid in the siting of mines and quarries; and in research and education.

## DIGITAL QUALITY

The G-858 system produces raw data of the highest quality. Data are digitally recorded in compressed form in high capacity RAM and later transferred to the base site computer for permanent storage and processing. Sensitivity, resolution and recording rate of the cesium magnetometer are user-selectable as well as mapped survey grid coordinates and display parameters. The system is ruggedly packaged for extreme field conditions. Battery life is a minimum 6 hours for the Magnetometer and 3 hours for the Gradiometer with GPS logging.

## BASIC SOFTWARE

A basic software package MagMap™ is supplied as an integral part of the G-858 system and provides:

- Transfer of the raw magnetometer, base station and other survey data to the client PC;
- \*Standard corrections for position errors, transients, and time varying errors (diurnal)
- Repositioning, linear interpolation and format of corrected data into X,Y,Z ASCII columnar values for use with Surfer for Windows, Geosoft or other client-supplied contouring programs.

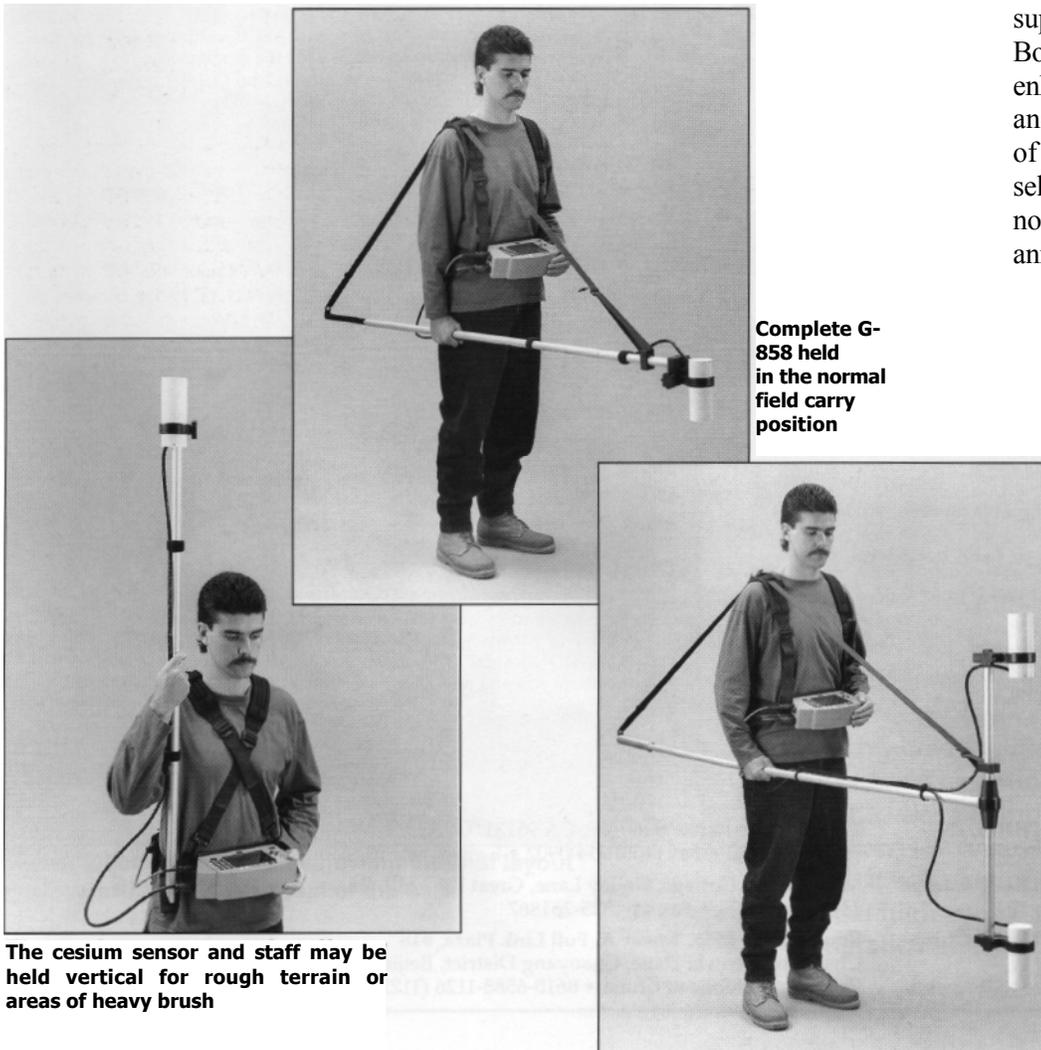
Surfer for Windows™ by Golden Software can be employed to grid the data and to generate 2D and 3D color contour maps with full text annotations. See examples in this data sheet.

## OPTIONAL SOFTWARE

Geometrics is proud to announce the introduction of a new tool in target identification and location. Our recently developed maximum likelihood dipole pattern matching software MagAID™ allows the user to generate estimations of object x-y position, size and depth using an interactive Windows™ graphical interface. Data is input from Surfer for Windows contour maps and output takes the form of informative icons placed in to the map as well as itemized target lists.

## OPTIONAL GRADIOMETER AND GPS

An optional gradiometer configuration (horizontal or vertical) is available with the addition of a second cesium sensor and staff. The G-858 includes an RS232 port to interface to customer supplied GPS or other data source. Both gradiometer and GPS can enhance the precision of the survey and the definition and delineation of small magnetic anomalies. A selection of user definable field notes describing site conditions can annotate the stored data.

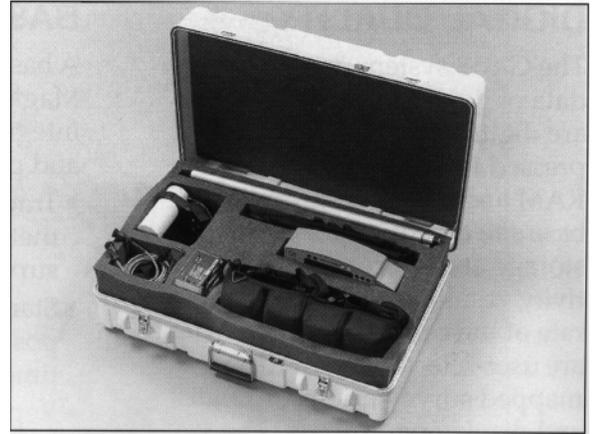


Complete G-858 held in the normal field carry position

The cesium sensor and staff may be held vertical for rough terrain or areas of heavy brush

G-858 Gradiometer with the sensors located in the vertical position

The G-858 MagMapper™ complete and ready for operation includes: electronic console with software for data acquisition, location, display and transfer; aluminum staff; cables to sensor(s), two battery packs, RS232 output cable with 9-pin connector; 110/220 AC charger; carrying harness; operator manual and reusable shipping container.



## G-858 MAGMAPPER SPECIFICATIONS

### MAGNETOMETER/ELECTRONICS

Operating Principle: Self-oscillating split-beam Cesium Vapor (non radioactive Cs133) with automatic hemisphere switching.

Operating Range: 17,000 nT to 100,000 nT

Operating Zones: For highest signal-to-noise ratio, the sensor long axis should be oriented at 45°, ±30' to the earth's field angle, but operation will continue through 45°, ±35'. Sensor is automatic hemisphere switching.

Sensitivity: 90% of all reading will fall within the following Peak-to Peak envelopes:

0.05 nT at 0.1 sec cycle rate

0.03 nT at 0.2 sec cycle rate

0.02 nT at 0.5 sec cycle rate

0.01 nT at 1.0 sec cycle rate

Information Bandwidth: < 0.004 nT / √HzRMS)

Heading Error: < ± 1 nT

Gradient Tolerance: > 500 nT / inch >20,000 nT / meter

Temperature Drift: 0.05 nT per °C

Cycle Rate: Variable from 0.1 sec to 1 hr in 0.1 sec steps or by external trigger.

Data Storage: Nonvolatile RAM with capacity for 8 hrs of Magnetometer time, event marks, field notes, location, or 3 hrs of Gradiometer and GPS at maximum sample rates.

Audio Output:

1. Audio tone of earth's field variation, pitch and volume adjustable. (Search)

2. Audio pulse each 1 second (Pace metronome).

3. Alarm for loss of signal, low battery or Quality Control setting exceeded

Data Output: Three wire RS232 standard serial port, optional continuous real time transmittal of data via RS232 to PC. Total memory output transfer time less than 5 min. at 115,200 KBaud.

Visual Output: 320 x 200 graphic liquid crystal display, day light visible with selectable outputs for:

1. Data display: Up to 5 stacked profiles, real time or review mode.

Survey grid showing boundaries and position.

2. All system setup functions, e.g., memory status, data transfer, sample time.

3. All Survey setup functions, e.g., survey profile number and direction, station or GPS number, test line number.

4 Survey monitoring functions, e.g., total field, noise level, profile number x or xy coordinates.

5. System diagnostics e.g., lamp brightness, signal level, battery state.

Internal Clock: Resolution of 0.1 sec, drift: < 1 sec/day

Battery Life:

1. 12 VDC rechargeable gel cell, 6 hrs Magnetometer or 3 hrs Gradiometer usage.

Magnetic effect less than 1 nT at 4 ft. 2. Internal backup battery for clock and nonvolatile RAM

Software: Supplied as part of the basic system and including functions for:

Operating Software:

1. Survey Modes:

a. Search survey b.

Simple survey

c. Map survey, station or continuous d.

Base station

2. Data acquisition/ display:

a. Acquire and store data and survey functions.

b. Display profiles, total field to 0.1 nT resolution, gradient (differential)

to 0.1 nT, survey/map parameters and diagnostics.

PC Support Software for installation on customer or Geometrics supplied data processing computer:

1. Data transfer and corrections:

a. Transfer of data from the field Magnetometer, Gradiometer, Differential GPS, or Base station to PC.

b. Diurnal correction using base station data.

c. Processing the corrected data into ASCII values of XYZ for the magnetometer and/or X,Y,Z1,Z2,Z3 for the gradiometer.

2. Optional bundled "Surfer for Windows" by Golden. Provides data presentation/plotting into a contour map or 3D isomagnetic map with Text annotation and color blends.

### MECHANICAL

Sensor: 23/8" dia., 63/4" long, 12 ounces (6cm x 15 cm, 340 grams) Staff/Harness: Staff for Magnetometer or Gradiometer, 1.5 lb to 2.5 lb (0.9 kg to 1.1 kg).

Nylon chest harness with cables attached, 2 lb to 3 lb (1 kg to 1.3 kg) Battery: 3" H, 5" W, 8" L, 3.5 lbs (8 cm x 13 cm x 20 cm, 1.6 kg) attaches to harness.

Console: 6" W, 3" H, 11" L, 3.5 lbs. (15 cm x 8 cm x 28cm, 1.6 kg), attaches to harness. Magnetic effect less than 1 nT at 4 ft

### ENVIRONMENTAL

Operating Temperature: -25°C to +50°C (-13°F to +122°F)

Storage Temperature: -35°C to +60°C (-30°F to +140°F) Water

Tight: To 3 ft (0.9 m) depth Shock: Drop 3 ft on a hard surface without damage

### OPTIONS

1. Gradiometer, horizontal and/or vertical configuration

2. GPS navigation (real time differential with radio link to GPS base station or FM-transmitted RTCM codes)

3. MagAID Anomaly Identification Software, for use in estimating position, size and depth of source bodies and buried objects.

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# AgGPS 114 DGPS

## *Real-time DGPS Smart Antenna*

### Key Features and Benefits

- GPS and DGPS receivers and antennae in one tough, compact package
- Submeter accurate, real-time DGPS operation
- Easy magnetic mounting
- Control from either AgGPS 70 RDL or Windows 95/98 computer

The AgGPS® 114 DGPS Smart Antenna is intended for agricultural users requiring the highest level of convenience in an L-band differential GPS (DGPS) receiver. The unit integrates a high-performance GPS receiver and L-band satellite differential correction receiver with a combined GPS/L-band DGPS antenna in a single, compact, waterproof housing.

### The DGPS Receiver for System Integration

The AgGPS 114 outputs submeter-accurate DGPS positions using NMEA or TSIP data messages to precision agricultural equipment, such as yield monitors and field mapping computers. It is fully compatible with all components of the AgGPS Field Management System.

The AgGPS 114 receiver operates in real-time DGPS using a subscription from either the Omnistar or Racal-Landstar satellite DGPS correction service. Both of these services provide corrections that do not degrade with distance from a base station. In addition, the receiver can use an external source of differential correction in RTCM-104 format. The unit can be upgraded to receive the FAA WAAS and European EGNOS corrections when these services become operational.

The receiver operating parameters are controlled with either the AgGPS 70 Remote Display and Logger (RDL) or the Remote Display Interface (RDI) program running on a Windows 95/98 computer. The user can set all



*The AgGPS 114 DGPS Smart Antenna*

receiver operating parameters as well as configure and control swathing operations, including setting swath patterns, swath width, start points and end points.

### Accurate Field Guidance with the AgGPS Parallel Swathing Option

The AgGPS 114 receiver and the AgGPS Parallel Swathing Option (PSO) work together to provide accurate field guidance, pass after pass, and can eliminate the need for conventional foam markers. The AgGPS 114 receiver controls the display on the AgGPS PSO lightbar, providing guidance over the field, and minimizing overlap and skip. It also enables operation beyond normal daylight hours so that jobs can be finished in a single day.

### As-Applied Mapping with the AgGPS 170

Using the AgGPS 114 receiver with the AgGPS 170 Field Computer

enables you to control and log the actual application rate of the fertilizer or crop protection material. The AgGPS 170 Field Computer uses an agricultural prescription map to control the application rate. As the material is being applied, the AgGPS 170 Field Computer records both the GPS position and the applied rate in a data file. Meanwhile, the daylight-readable color display shows the vehicle's drive path.

The user also can create permanent vehicle drive paths, reducing the effects of soil compaction caused by uncontrolled vehicle traffic over the field. These permanent vehicle drive paths can be used, for example, to minimize damage to underground drip tape of a drip irrigation system.

Trimble

# AgGPS 114

## Real-time DGPS Smart Antenna

### STANDARD FEATURES

- Completely self-contained in a tough plastic housing
- 12-channel DGPS receiver
- Positioning based on high-performance GPS engine design
- Internal L-band satellite differential receiver
- World-wide operation with both Omnistar and Racal subscriptions
- External RTCM correction input
- Sub-meter differential accuracy
- Two programmable RS-232 serial ports
- CAN bus J1939 compatible
- 1-PPS output
- Outputs GPS position in either NMEA or TSIP data messages
- Configuration software
- Magnetic mount
- Remote Display Interface (RDI) software for Windows 95/98
- WAAS/EGNOS upgradable
- AgGPS 170 Field Computer compatible
- AgGPS 70 Remote Display and Logger compatible

### OPTIONS

- 10-Hz positioning
- Everest multipath reduction
- Parallel Swathing Option

### PHYSICAL CHARACTERISTICS

#### AgGPS 114 Receiver

Weight:	22 oz. (0.52 kg)
Power:	3.1 W, 9 to 32 volts
Operating Temp:	-30°C to +60°C (-22F to +140F)
Storage Temp:	-40°C to +80°C (-40F to +176F)
Humidity:	100% condensing
Casing:	UV-resistant Plastic 6 in. D X 5 in. H (152 mm D X 127 mm H)
Compliance:	FCC Class B, CE, EP 455

### PERFORMANCE CHARACTERISTICS

#### GPS Receiver

General:	12 channel L1 code phase receiver
Update Rate:	1 Hz Standard; 10 Hz Optional
Position Accuracy:	sub-meter differential
Time to First Fix:	<30 sec, typical
NMEA Messages:	GGA, GLL, GRS, GST, VTG, RMC, GSA, GSV, XTE, ZDA, ALM, MSS
Communication ports:	2 ea. RS-232, 1 ea. J1939 (CAN 2.0B)

### RECOMMENDED AgGPS 114 SYSTEM CONFIGURATIONS

1. AgGPS 114 used with customer supplied Precision Agriculture Equipment: Order 38200-00
2. AgGPS 114 with AgGPS 70 RDL for adding logging and user display I/O: Order 38200-00 and 39600-00
3. AgGPS 114 with AgGPS PSO Plus for guidance and logging: Order 38200-00, 34623-40
4. AgGPS 114 with AgGPS 170 Field Computer with Guidance: Order 38200-00, 38381-00, and 34623-00

### ORDERING INFORMATION

38200-00	AgGPS 114 receiver complete
33176-10	10 Hz positioning upgrade for AgGPS114
33176-40	Everest Multi-path reduction for AgGPS 114

### ORDERING INFORMATION FOR OTHER AgGPS COMPONENTS/SYSTEMS

34623-20	AgGPS PSO for AgGPS 114 and AgGPS 70 (new model) Includes AgGPS 21 LightBar and cable 39350 for direct connection to AgGPS 114 and AgGPS 70. This model is intended for users who wish to add guidance to the AgGPS 114 with the AgGPS 70 RDL.
34623-40	AgGPS PSO Plus The AgGPS 114 PSO Plus includes the AgGPS 21 LightBar, the AgGPS 70 RDL, and cable 39350. This option is configured for the AgGPS 114. Order 34623-30 for the AgGPS PSO Plus for the AgGPS 124/132 users who wish to add guidance and logging.
38381-00	AgGPS 170 Field Computer
39600-00	AgGPS 70 Remote Display and Logger

Specifications and descriptions are subject to change without notice



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## **11 APPENDIX 2 – LOCATION OF SEISMIC LINES AND MAGNETIC TEST AREAS**

Endurance Seismic Line Layout

Scotia Seismic Line Layout

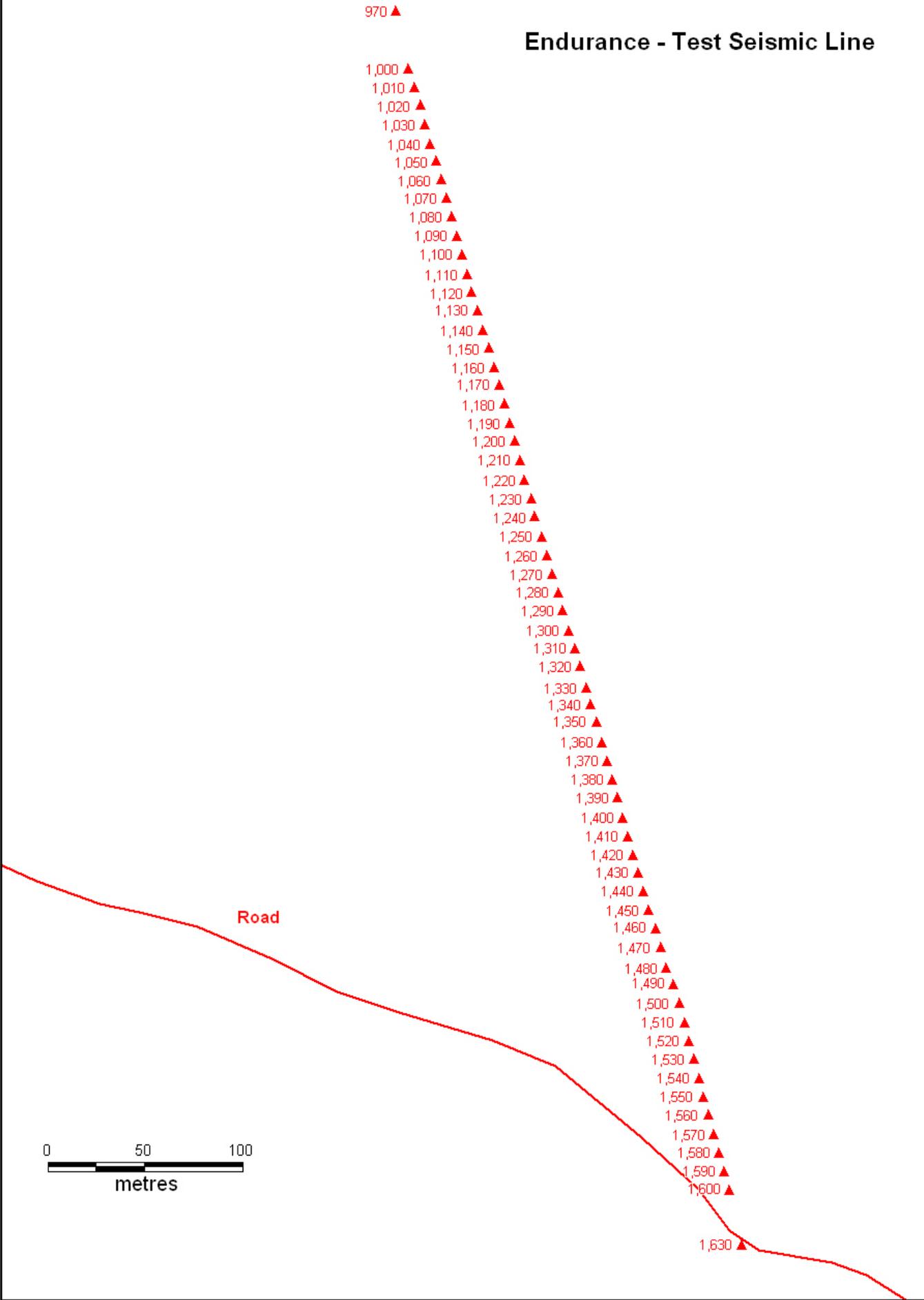
Endurance Map

Scotia Map

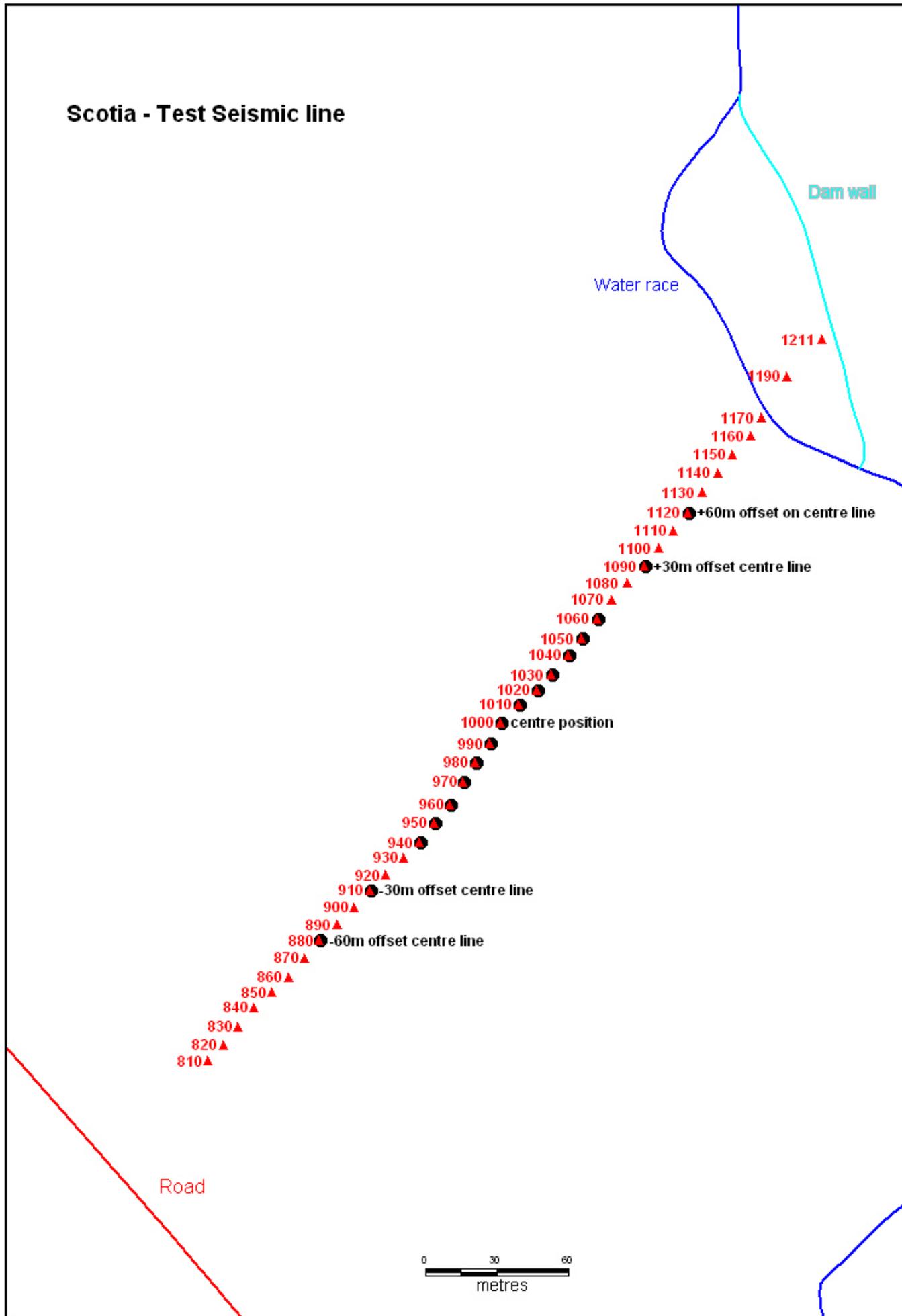
-Attached

(Map material provided by Van Dieman Mines)

# Endurance - Test Seismic Line



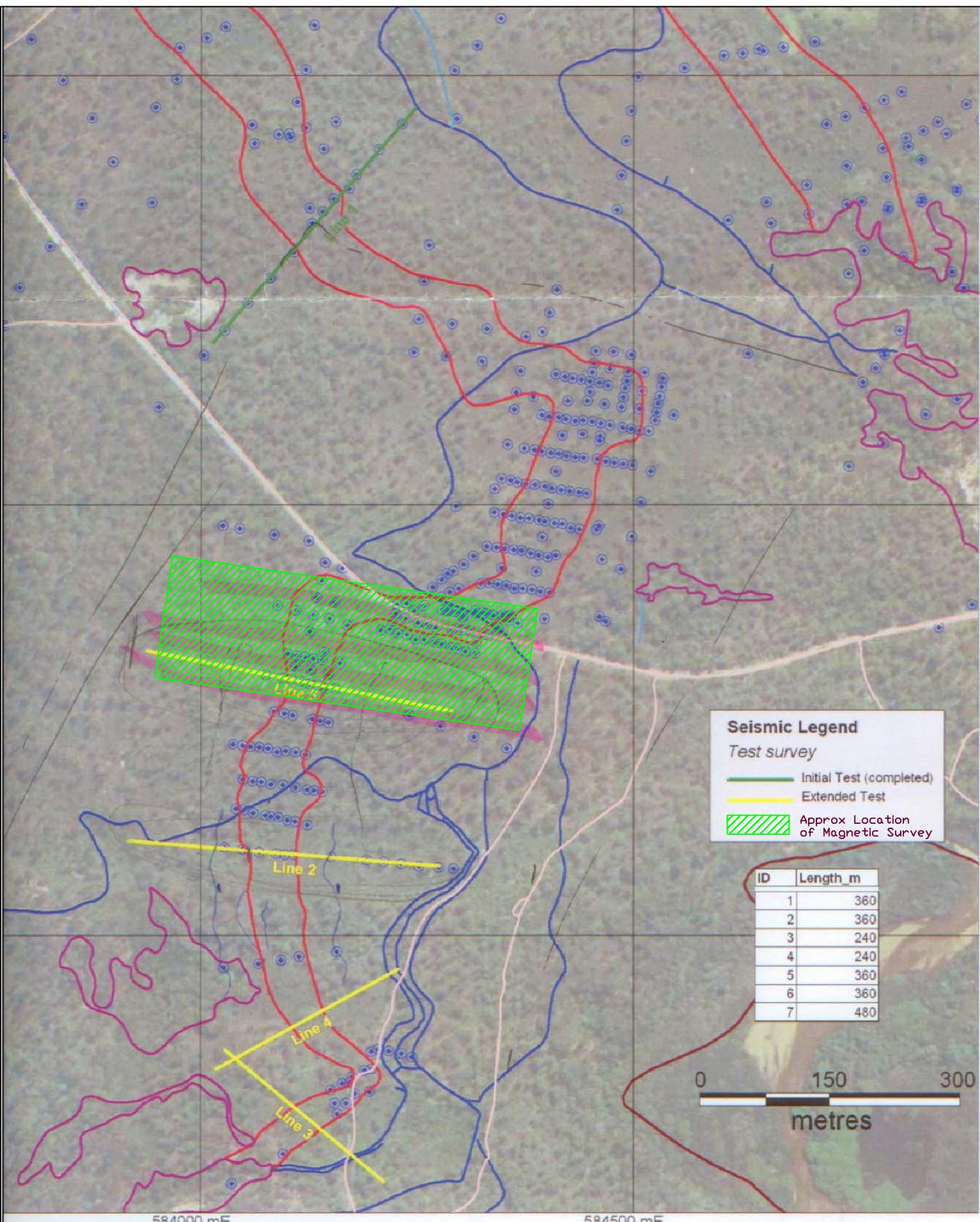
# Scotia - Test Seismic line



5468000 mN

5467500 mN

5467000 mN



**Seismic Legend**  
*Test survey*

- Initial Test (completed)
- Extended Test
- Approx Location of Magnetic Survey

ID	Length_m
1	360
2	360
3	240
4	240
5	360
6	360
7	480



584000 mE

584500 mE

## **12 APPENDIX 3 –ENDURANCE SEISMIC INTERPRTATIONS**

Modelled Refraction Seismic Section

Tomographic Seismic Section

Travel Time Plot

-Attached

### **13 APPENDIX 4 – SCOTIA SEISMIC INTERPRTATIONS**

Modelled Refraction Seismic Section

Tomographic Seismic Section

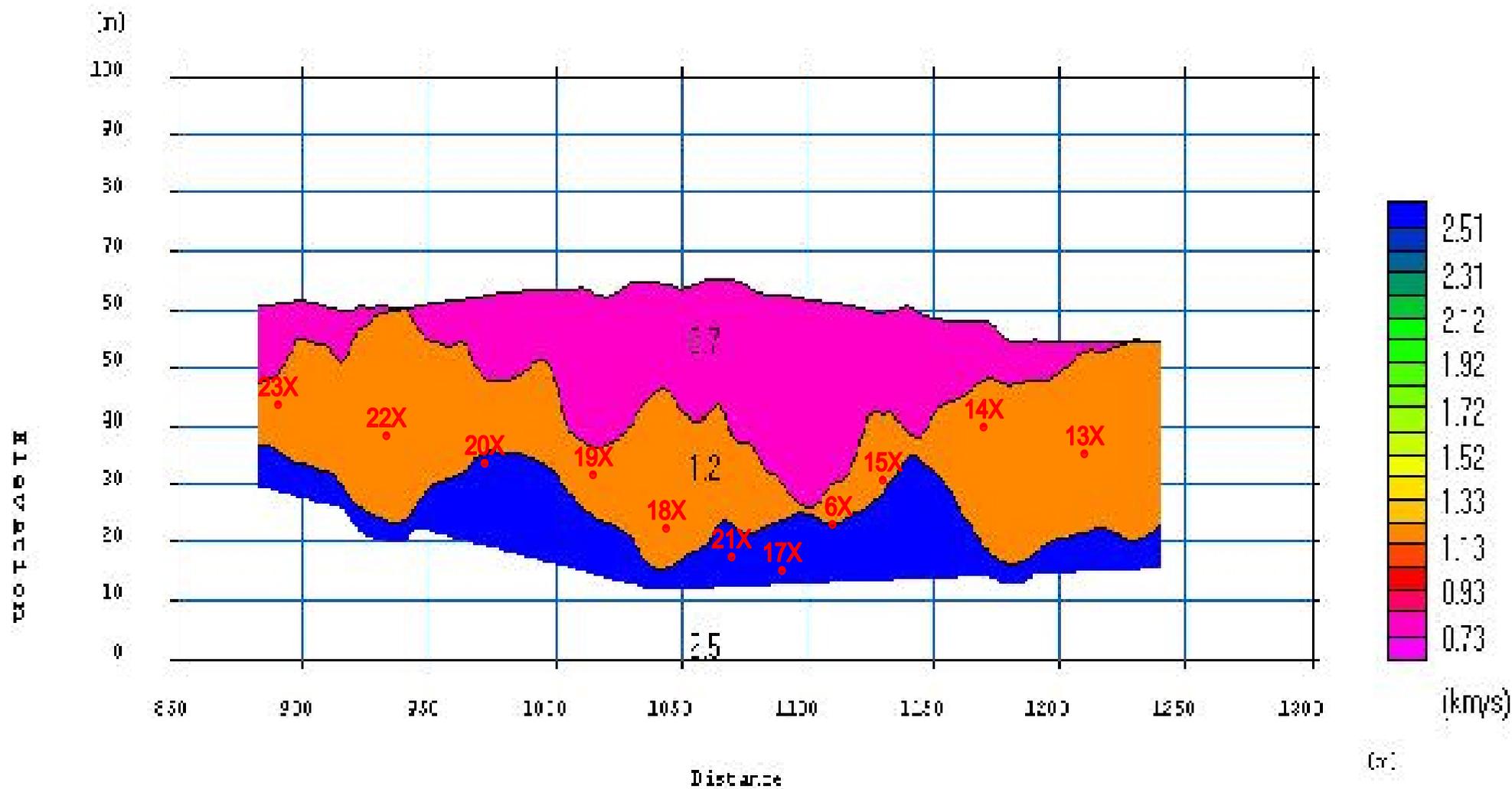
Travel Time Plot

-Attached

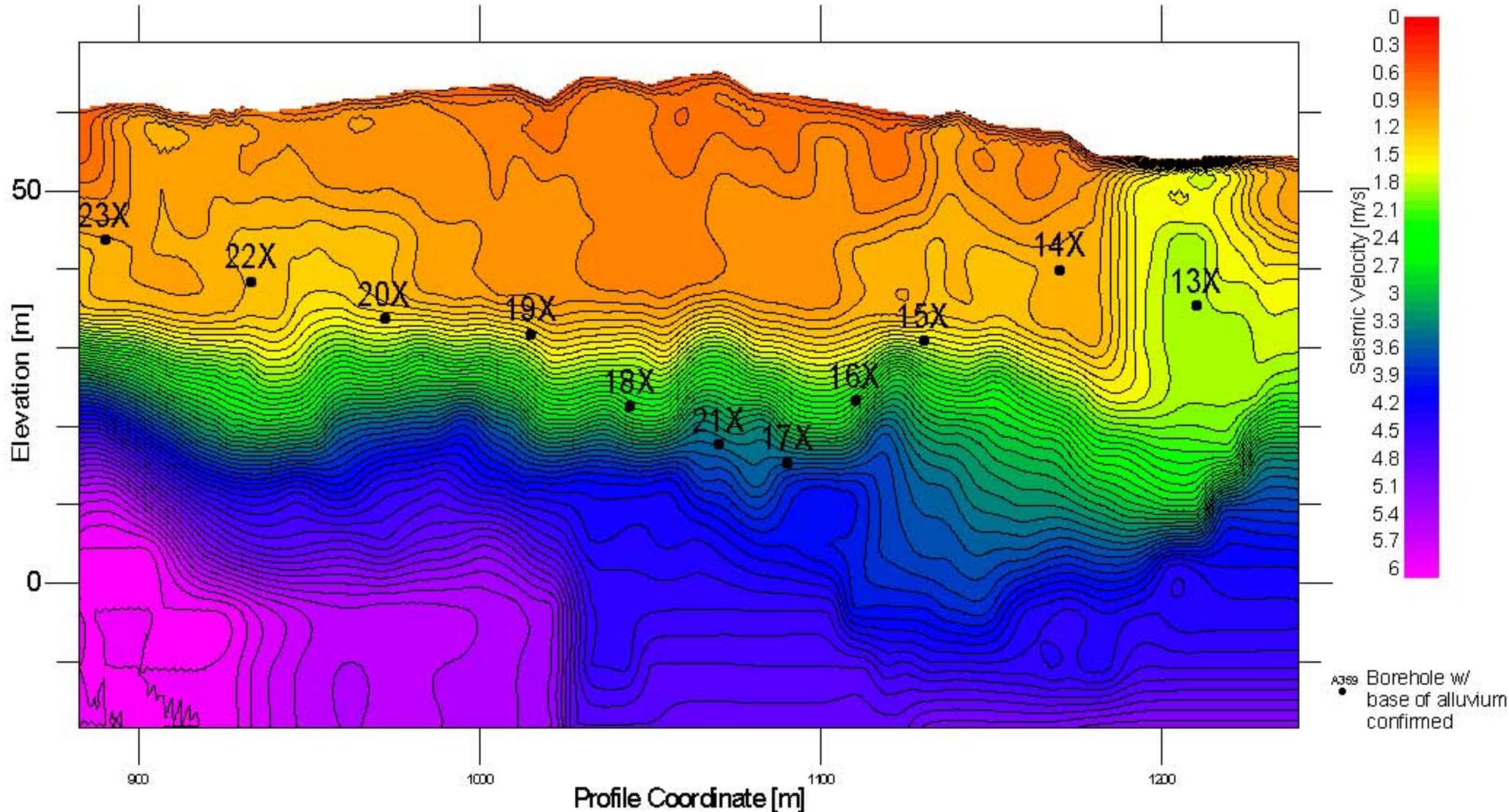
South

# Line 1 Scotia Seismic Test Line - Refraction Time Inversion

North



Scale = 1 / 3000



**Alpha  
GeoScience**

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Unit 1, 43 Stanley Street  
Peak District, NSW 2210  
Australia  
Phone +61 2 9584 7555  
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E-mail [info@alpha-geo.com](mailto:info@alpha-geo.com)  
Website: [www.alpha-geo.com](http://www.alpha-geo.com)

Site:

SCOTIA, LINE 1

NOTES: 2.5m geophone spacing, 8g pipe gun @ 80cm depth every  
10 metres, 30Hz geo-phones.

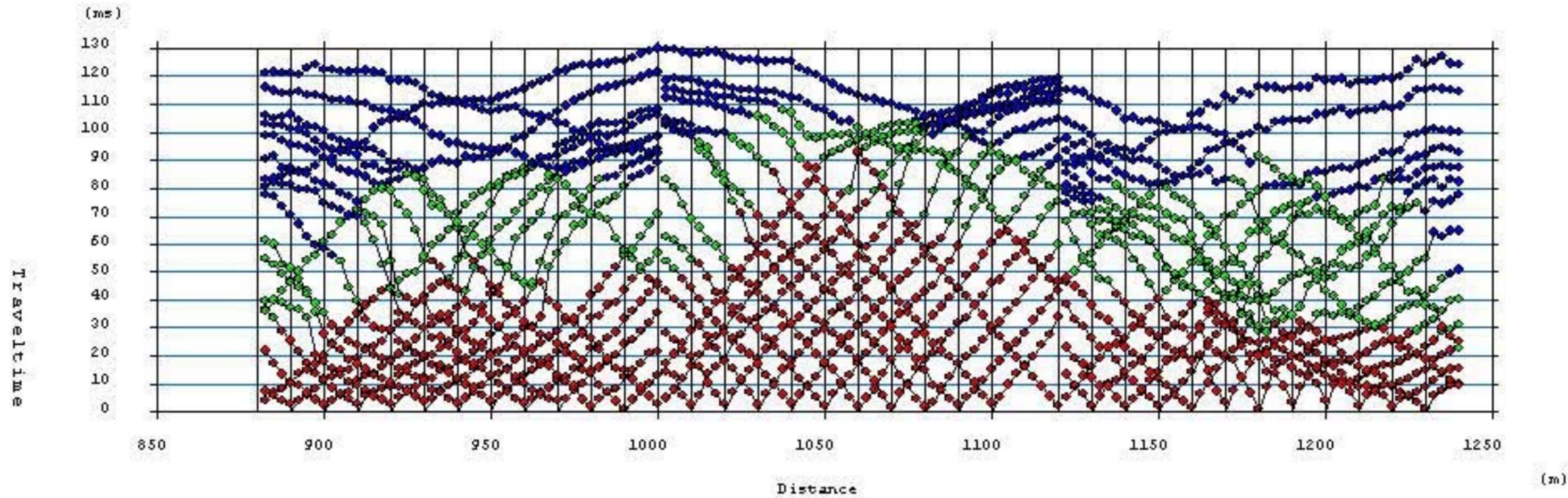
Project: Gladstone, TAS, Australia  
Project ID: AG-143  
Client: Van Dieman Mines Ltd  
Method: Refraction Seis  
Instrument: Seistronics RAS-24  
Acquired by: Kevin Wake-Dyster  
Survey date: 18/11/2006

Processed by: Kevin Wake-Dyster  
Processing date: 27/11/2006  
Positioning: dGPS  
Data gridding: Surfer v8.0  
Gridding method: Kriging  
Grid cell size: 5m x 5m  
Gridding radius: 10m

South

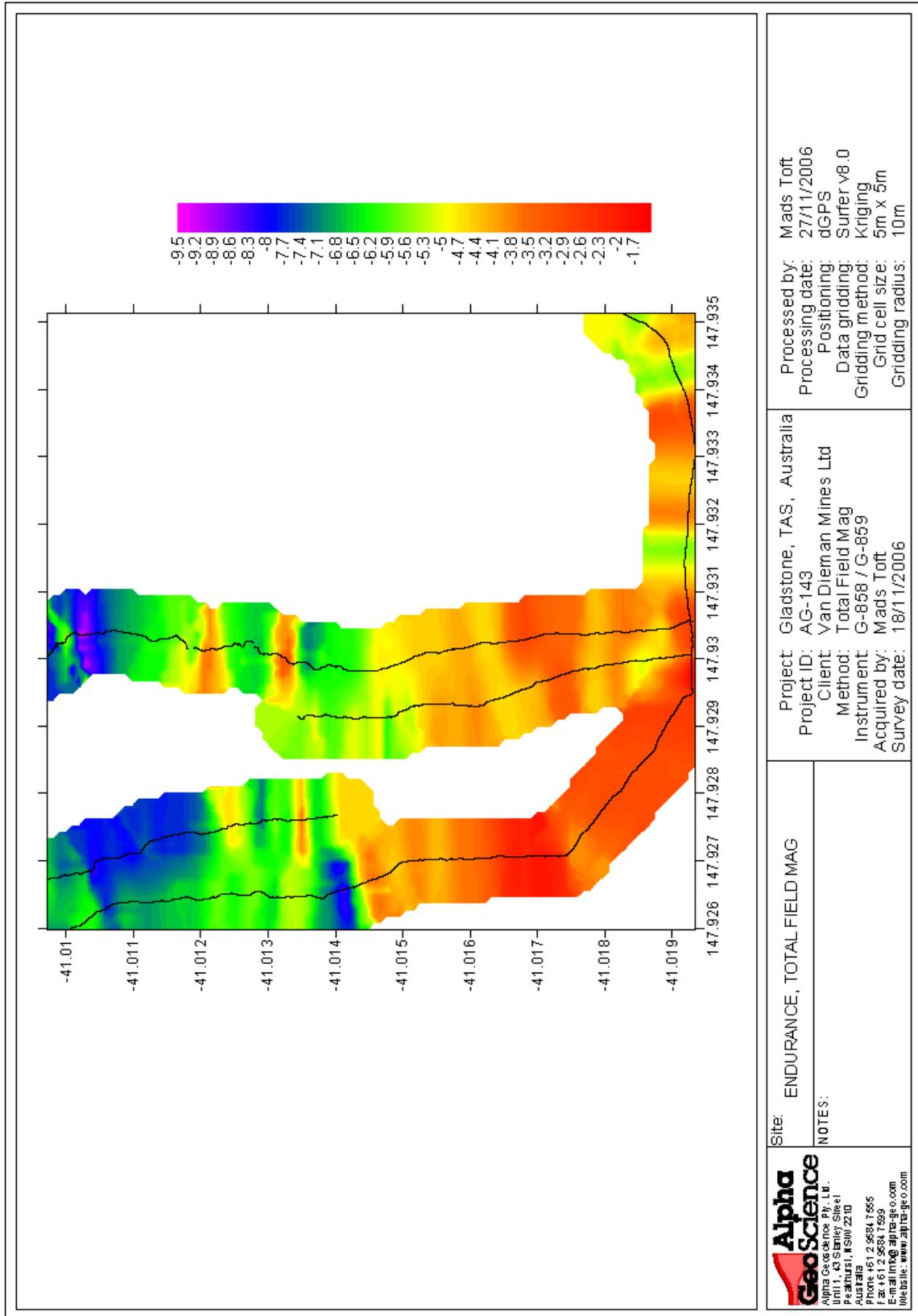
# Line 1 Scotia Seismic Test Line - First Arrival Travel Time Plot

North

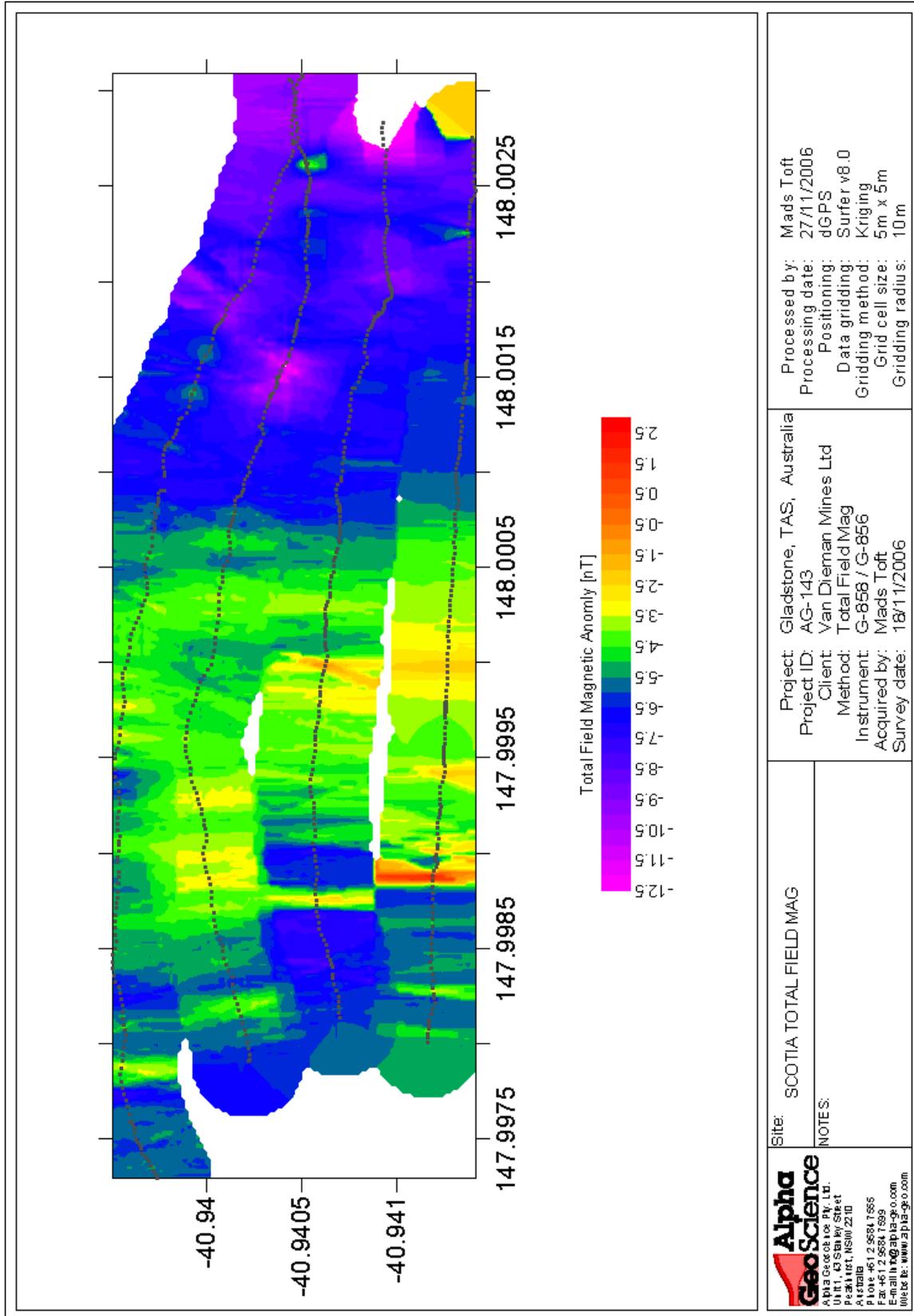


Scale = 1 / 2000

**14 APPENDIX 5 – ENDURANCE TOTAL FIELD MAGNETIC DATA PLOT**



**15 APPENDIX 6 – SCOTIA TOTAL FIELD MAGNETIC DATA PLOT**



## 16 APPENDIX 7 – ALPHA GEOSCIENCE - CURRICULUM VITAE

Alpha Geoscience was established in 1997 to offer high sensitivity geophysical tools and expertise as an alternative to intrusive investigations in the following areas:

- **Environmental Services** Including the mapping of buried structures, site assessments and the detection of chemical pollutants.
- **Ordnance Services** The location of buried unexploded ordnance (UXO), site assessments and sample surveys to determine extent of pollution. Alpha Geoscience is a member of the Defence UXO Panel.
- **Engineering Services** Assisting civil mining and construction engineers with sub surface investigations, especially where intrusive investigation is difficult and costly to undertake.
- **Forensic Geophysics** The location of buried gravesites and other buried objects for the police and other crime agencies.
- **Mining and Exploration** Assist mining and exploration companies with near surface investigations.
- **Training** Provides training courses in high-resolution magnetics, electro-magnetics, seismic refraction and ground-penetrating radar for clients who wish to undertake surveys themselves.
- **Project Management** Is an intricate part of all projects and Alpha Geoscience has expertise and experience in setting up, running and reporting on both major and minor projects worldwide.
- **Research and Development** Alpha Geoscience has been involved in running a number of research and development projects including the development of a multi-sensor geophysical instrumentation package for the horizon control of a coal-mining machine.

The types of techniques offered by Alpha Geoscience include high sensitivity magnetics, ground penetrating radar, time or frequency domain electro-magnetics, resistivity mapping and seismic refraction and reflection techniques. These services combined with the digital processing of the data to produce colour images of the site and the interpretation of the data gives high-resolution detail of the sub surface on the site. This data can be imported into Geographical Information Systems (GIS) for future reference and auditable documentation.

Alpha Geoscience also offers the services of processing and interpretation of data in Sydney with the data being downloaded from the field via the Internet.

Alpha Geoscience is based in Sydney Australia and is capable of mobilising to any part of the world with very short notice. We have experience in operations throughout Australia, North America, Europe and South East Asia.

Alpha Geoscience is offering its services and consultation so that the client obtains the best technology for the particular target being investigated. Whether it is an ordnance item or environmental pollution plumes, it has the technical expertise to provide the right solution.

## 17 APPENDIX 8 - REFERENCES:

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