GRANGE RESOURCES TASMANIA

SAVAGE RIVER LIDAR SURVEY 18.02.2015

VOLUME 24344A02NOK

Summary

Project

An airborne LiDAR survey carried out by AAM for Grange Resources Tasmania over the Savage River Mine and surrounds. The project area covers approximately 23km². LiDAR data was acquired from a fixed wing aircraft on the 18th of February 2015.

Data

This volume contains:

- Thinned Ground point cloud in DXF format
- Project Extent and Tile Index in ESRI SHP format

Data capture and post-processing has been controlled to achieve a vertical accuracy of 0.15m (RMS). All data is projected to GDA94 (MGA Zone 55).

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1. PROJECT REPORT

Safety: No safety Incidents were reported during the project

Acquisition: LiDAR data was acquired from a fixed wing aircraft on the 18th of February 2015. Delays in acquiring the data were due to low cloud over the project area.

Ground Support: GPS GPS base station support was provided by Omnistar Tasmania and SmartNet CORS networks. The ground check points acquired by the Grange Resources allowed an assessment of the accuracy of the LiDAR data.

Data Processing: Reduction of the ALS data proceeded without any significant problems. Laser strikes were classified into ground and non-ground points using a single algorithm across the project area. Manual checking and editing of the data classification further improved the quality of the terrain model.

Data Presentation: The data provided on this volume has been supplied in accordance with a specification agreed with the primary client. Subsequent users experiencing difficulties in handling the data should please contact AAM to arrange a more appropriate data presentation.

Further Issues: There are no further issues to report.

Project Contacts:

Client
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Company
Grange Resources

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2. DATA INSTALLATION

Data format	:	DXF, SHP, XML, PDF
Number & type of media	:	1 x 4.7 GB DVD
Information files on media	:	83, viz: 34 DXF files, 39 Metadata files, 4 Tile Index files, 4 Project Polygon files, 1 File List and Readme_24344A02NOK.pdf
Data formatted on	:	24.03.2015
Disk volume	:	124344A02NOK

README FILE

This document (README_24344A02NOK.PDF) is provided as an Acrobat file in this volume. To open the file, double click on the PDF file to activate Acrobat Reader Software.

Adobe Acrobat Reader may be downloaded from:
http://www.adobe.com/products/acrobat/readstep2.html

LOADING NOTES

Data may be copied using a file copy utility such as Windows Explorer or similar.

REVISION HISTORY

Volumes previously issued under this project include:

Volume	Date	Data Title	Contents
24344A01NOK	12.03.2015	SAVAGE RIVER LIDAR SURVEY 18.02.2015	Classified point cloud in LAS1.2 format

FILE SIZES AND NAMES

Data is provided in tiles 1km by 1km to the following filenaming convention:
eg. e347n5409.dxf

e347 -	coordinate easting (in thousands) of south west tile corner.
n5409 -	coordinate northing (in thousands) of south west tile corner
.dxf -	laser strikes classified to ASPRS V1.2 standards, model key point class.
.shp -	ESRI Shapefile format

A list of the files contained on this volume is provided in 24344A02NOK_File_List.txt

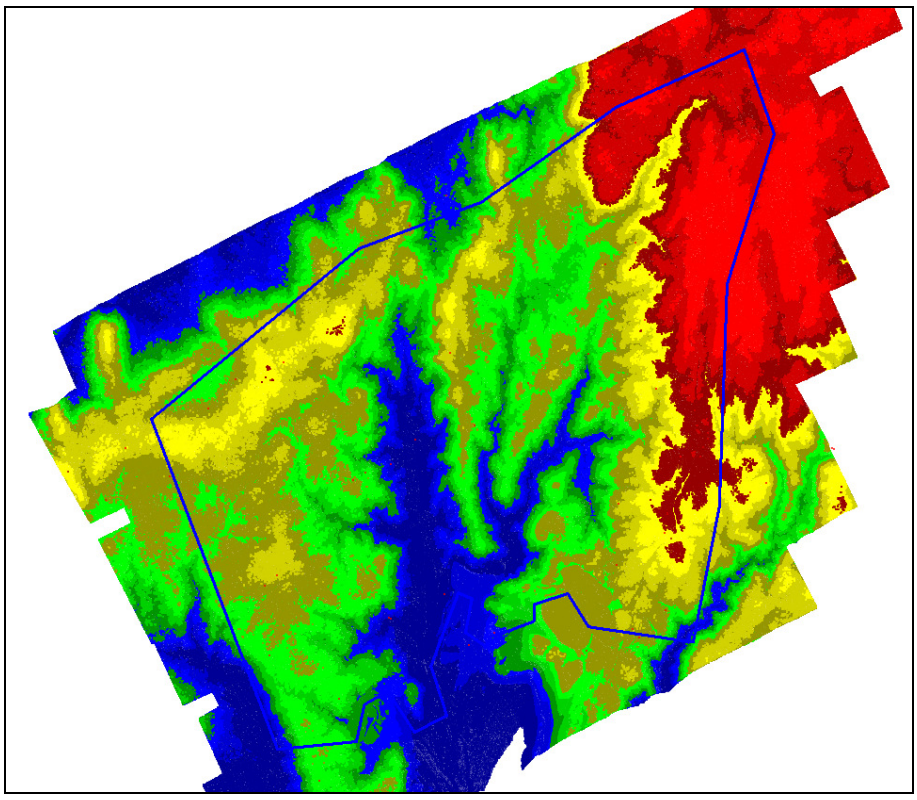
3. ADDITIONAL SERVICES AND EXTRA DATA

Product Generation

AAM can perform the following additional services on the data contained on this volume if required:

Change horizontal datum	:	to AMG other local grid
Alter geoid modeling	:	by transforming ALS data to fit orthometric survey heights
Improve data classification	:	by tailoring parameters to suit regional variations
Further classification	:	assist building identification by further classifying non-ground strikes
Data thinning	:	to remove superfluous points not adding to the terrain definition
Data subset	:	by dividing the data into different tiles or polygons
Data presentation	:	by creating contours, profiles, perspectives, fly-throughs, colour-coded height plots etc.
Ground truthing	:	by comparing the ALS terrain model with extra independent height data
Data gridding	:	to convert the measured spot heights into a regular grid
Extra data	:	extra data was collected beyond that supplied on this volume (see below)
Intensity Image	:	greyscale image created from laser's intensity returns
3d Perspectives		Image draping /slope models

Extra Data Captured



Laser Data shown in the above image outside the project boundary may be of a lower accuracy. It is not supplied within this volume and no manual classification editing has been undertaken.

4. METADATA

SOURCE DATA

Item	Source	Description	Ref No	Date
Laser System	AAM	Pegasus	24344A	18.02.15
Pulse Rate Frequency	AAM	150kHz	24344A	18.02.15
GPS Base Data	Omnistar	Static GPS	24344A	18.02.15
	SmartNet	Static GPS	24344A	18.02.15
Base Stn Coords	Omnistar	Published	24344A	18.02.15
	SmartNet	Published	24344A	18.02.15
Field Survey Data	Grange Resources	RTK GPS	24344A	19.02.15

LASER DATA CHARACTERISTICS

Characteristic	Description
Device Name	Pegasus
Half Scan Angle	30 degrees
Laser Pulse Rate	150kHz
Survey Speed (Kts)	140 Kts
Laser Pulse Mode	Multi Pulse
Laser return	1st, 2nd, 3rd and last
File Format	LAS 1.2, ESRI SHP
Horizontal Datum	GDA94
Vertical Datum	AHD using Ausgeoid09
Map Projection	MGA Zone 55
Vertical Accuracy Specification	±0.15m Standard Error (68% confidence level or 1 sigma)
Horizontal Accuracy Specification	±0.20m Standard Error (68% confidence level or 1 sigma)

REFERENCE SYSTEMS

	Horizontal	Vertical
Datum	GDA94	AHD
Projection	MGA Zone 55	N/A
Geoid Model	N/A	Ausgeoid09
Primary Reference Station	TSRV (TP Savage River)	TSRV
	350385.499 E 5405342.926 N	354.216 Ellipsoidal
Additional Survey Control	ABM7	ABM7
	350385.501 E 5405342.938 N	354.111 Ellipsoidal

GDA ***This data is GDA-compliant***

5. ACCURACY

PROJECT DESIGN ACCURACY

Project specifications and technical processes were designed to achieve data accuracies as follows:

	Measured Point	Derived Point	Basis of Estimation
Vertical data		0.15m	Project Design
Horizontal data	< 0.20m		System specifications ($^{1}/_{5500}$ flying height)
Test points	0.05m		Survey methodology used

Notes On Expected Accuracy

- Values shown represent standard error (68% confidence level or 1 sigma), in meters.
- "Derived points" are those interpolated from a terrain model.
- "Measured points" are those observed directly.
- Accuracy estimates for terrain modeling refer to the terrain definition on clear ground. Ground definition in vegetated terrain may contain localized areas with systematic errors or outliers which fall outside this accuracy estimate.
- Laser strikes have been classified into "ground" and "non-ground", based upon algorithms tailored for major terrain/vegetation combinations existing in the project area. The definition of the ground may be less accurate in isolated pockets of dissimilar terrain/vegetation combinations.

LIMITATIONS OF DATA

- The definition of the ground under trees may be less accurate.

DATA VALIDATION

- Ground data in this volume has been compared to 192 test points obtained by field survey and assumed to be error-free. The test points were distributed in 192 groups across the mapping area and located on open clear ground . Comparison of the filed test points with elevations interpolated from measured data resulted in:

Ref Point Site	No. of Points	Mean Difference (m)	Std Deviation (m)	RMS (m)
REF_001	94	-0.218	0.064	0.227
REF_002	98	-0.289	0.055	0.294

The mean difference has been removed from the data. Final accuracy estimates after removing the mean offset yielded:

Ref Point Site	No. of Points	Mean Difference (m)	Std Deviation (m)	RMS (m)
REF_001	94	0.032	0.064	0.071
REF_002	98	-0.039	0.055	0.067

- Data classification has been manually checked and edited against any available imagery.

USE OF DATA

- Intended use : Planning, Conceptual Design
- Intended use : Exploration
- Intended scale of use : 1:500

5. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **GRANGE RESOURCES TASMANIA**.

The data in this volume is provided by AAM Pty Limited (AAM) to **GRANGE RESOURCES TASMANIA** under **AAM Terms of Engagement (MQM020)**, which provide a license for **GRANGE RESOURCES TASMANIA** to access and use the data only for the project and explicit purpose for which it is provided. AAM retains ownership of all Intellectual Property Rights in relation to this data or modifications, enhancements or subsets of this data. The data must not be sold, lent or distributed to any other party; and used subject to the following conditions:

1. This file (README_24344A02NOK.PDF) is always stored with the unaltered data contained in this volume.

2. The data is not altered in any way without the approval of AAM. The data may be copied from this file to another.

3. The data is not used for purposes beyond that explicitly agreed in the description of the Services provided by AAM.

Any breach of these conditions will result in the immediate termination of the license issued by AAM, and **GRANGE RESOURCES TASMANIA** will indemnify AAM from all resulting liabilities.

Any problems associated with the information in the data files contained in this volume should be reported to AAM Pty Limited. A complete list of project related contacts is listed on page 2 under the Project Report heading.

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6. VALIDATION PLOT

Thinned Ground points coded by elevation