

# **CPSAN15 SEISMIC SURVEY**

## **2015 DELAWARE 3D**

**PEL 570  
AAL 231**

## **SOUTH AUSTRALIA**

# **ACQUISITION REPORT**

Compiled by: A. White  
Santos Ltd.  
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# 1 INTRODUCTION

## 1.1 GENERAL

In August - October 2015, Santos Ltd. carried out approximately 396.4928 square kilometres of 3D seismic imaging in South Australia's Petroleum Exploration Licence PEL 570. The survey also extended into SACB JV Petroleum Production Licences (PPL) PPL 33, 42, 43, 90, 99, 103, 104, 133, 134, 151 & 166. In addition, the survey extended into non-Santos acreage PRL's 110, 128 & 174. Access to the non Santos acreage was covered by Associated Activities Licence (AAL) 231 and an ingress agreement.

The survey was wholly located on the Innamincka pastoral lease / Innamincka Regional Reserve and was known as the CPSAN15 Delaware 3D Seismic Survey.

The following table details the key companies involved in the acquisition of the survey.

Activity	Contractor
Line Preparation	Terrex Contracting Pty. Ltd.
Surveying	Terrex Spatial Pty. Ltd.
Seismic Recording	Terrex Seismic Pty. Ltd.

Santos Ltd contracted Tom Pickett and John Searson to supervise field operations.

Processing of the seismic data was carried out by Global Geophysical in their centre in Denver, and will be the subject of a separate report.

This report describes the data acquisition of CPSAN15 Delaware 3D Seismic Survey, located approximately 75 kilometres north northeast of the Moomba Gas Facility, in the South Australian Cooper Basin.

## 1.2 TIMETABLE OF MAIN EVENTS

Activity	Description
09/06/2015	Notice of Entry sent to Pastoralists, Native Title claimants and other stakeholders.
05/06/2015	Notice of Intention sent to DSD.
26/08/2015	Line preparation commenced.
27/08/2015	Survey pegging commenced.
17/09/2015	Spread layout commenced
21/09/2015	Recording commenced.
21/09/2015	Line preparation completed
21/09/2015	Survey pegging completed.
27/10/2015	Recording completed.
1/11/2015	Spread pickup completed

## Santos

### Survey Location



## 2 SURVEY SCOPE AND OBJECTIVES

The existing seismic coverage of PEL 570 is a mix of 2D and 3D data of varying vintages. The acquisition of the Delaware 3D was designed to provide almost continuous coverage of 3D data over the southern PEL 570 block.

The PEL570 is primarily prospective for the Deep Coal condensate-rich gas play, but has secondary objectives within Permian tight sand reservoirs. Offset well data suggests that the southern part of the permit is likely to be mildly – moderately over pressured and as such a Basin Centred tight gas sand play may also be active at this location. Permian coals and carbonaceous shales have provided significant charge to the conventional traps in the area, with many nearby fields being economically productive for liquids-rich gas. The coal seams have been accessed via fracture stimulation in gas development wells in nearby fields and have been shown to produce liquids-rich gas at significant rates and flowed simultaneously and rate competitively with conventional sands.

The overall aim of the survey was to mature prospective areas and identify new opportunities in PEL 570 as well as meeting the work program commitment for the permit. The acquisition, data processing and interpretation of the Delaware 3D seismic survey will achieve the following:

- Eliminate mistie problems associated with 2D seismic data
- Reduce uncertainty of prospects identified on the edge of existing 3D seismic surveys
- Identify any additional prospects that lie in the gaps of the current 2D seismic grid
- Allow the generation of 3D seismic attribute maps, which may assist with the identification of 'sweet spots' for targeting gas bearing coal formations
- Facilitate specialised geophysics work (e.g. AVO) to support drill locations
- Allow optimisation of the locations of future exploration opportunities
- Allow optimisation of future appraisal and development wells

The surface acquisition consisted of the following 61 source and 89 receiver lines:

Receiver Line	Start	End	Length
CPSAN15-R1000	5208	5407	8.00
CPSAN15-R1008	5208	5407	8.00
CPSAN15-R1016	5208	5407	8.00
CPSAN15-R1024	5208	5479	10.88
CPSAN15-R1032	5208	5479	10.88
CPSAN15-R1040	5208	5479	10.88
CPSAN15-R1048	5208	5479	10.88
CPSAN15-R1056	5208	5479	10.88
CPSAN15-R1064	5208	5479	10.88
CPSAN15-R1072	5208	5479	10.88
CPSAN15-R1080	5208	5479	10.88
CPSAN15-R1088	5208	5479	10.88
CPSAN15-R1096	5208	5479	10.88
CPSAN15-R1104	5208	5479	10.88
CPSAN15-R1112	5208	5479	10.88
CPSAN15-R1120	5208	5479	10.88
CPSAN15-R1128	5208	5479	10.88
CPSAN15-R1136	5208	5479	10.88
CPSAN15-R1144	5208	5479	10.88
CPSAN15-R1152	5208	5479	10.88
CPSAN15-R1160	5208	5479	10.88
CPSAN15-R1168	5208	5479	10.88
CPSAN15-R1176	5208	5479	10.88
CPSAN15-R1184	5208	5479	10.88
CPSAN15-R1192	5208	5479	10.88
CPSAN15-R1200	5208	5479	10.88
CPSAN15-R1208	5208	5479	10.88
CPSAN15-R1216	5208	5479	10.88
CPSAN15-R1224	5208	5479	10.88
CPSAN15-R1232	5208	5479	10.88
CPSAN15-R1240	5208	5479	10.88
CPSAN15-R1248	5208	5479	10.88
CPSAN15-R1256	5208	5479	10.88
CPSAN15-R1264	5208	5479	10.88
CPSAN15-R1272	5208	5479	10.88
CPSAN15-R1280	5208	5479	10.88
CPSAN15-R1288	5208	5479	10.88
CPSAN15-R1296	5208	5479	10.88
CPSAN15-R1304	5000	5479	19.20
CPSAN15-R1312	5000	5479	19.20
CPSAN15-R1320	5000	5479	19.20
CPSAN15-R1328	5000	5479	19.20
CPSAN15-R1336	5000	5479	19.20
CPSAN15-R1344	5000	5479	19.20
CPSAN15-R1352	5000	5479	19.20

Receiver Line	Start	End	Length
CPSAN15-R1360	5000	5479	19.20
CPSAN15-R1368	5000	5479	19.20
CPSAN15-R1376	5000	5479	19.20
CPSAN15-R1384	5000	5479	19.20
CPSAN15-R1392	5000	5479	19.20
CPSAN15-R1400	5000	5479	19.20
CPSAN15-R1408	5000	5479	19.20
CPSAN15-R1416	5000	5479	19.20
CPSAN15-R1424	5000	5479	19.20
CPSAN15-R1432	5000	5479	19.20
CPSAN15-R1440	5000	5479	19.20
CPSAN15-R1448	5000	5479	19.20
CPSAN15-R1456	5000	5479	19.20
CPSAN15-R1464	5000	5479	19.20
CPSAN15-R1472	5000	5479	19.20
CPSAN15-R1480	5000	5479	19.20
CPSAN15-R1488	5000	5479	19.20
CPSAN15-R1496	5000	5479	19.20
CPSAN15-R1504	5000	5479	19.20
CPSAN15-R1512	5000	5479	19.20
CPSAN15-R1520	5000	5479	19.20
CPSAN15-R1528	5000	5479	19.20
CPSAN15-R1536	5000	5479	19.20
CPSAN15-R1544	5000	5479	19.20
CPSAN15-R1552	5000	5479	19.20
CPSAN15-R1560	5000	5479	19.20
CPSAN15-R1568	5000	5479	19.20
CPSAN15-R1576	5072	5479	16.32
CPSAN15-R1584	5072	5479	16.32
CPSAN15-R1592	5072	5479	16.32
CPSAN15-R1600	5072	5479	16.32
CPSAN15-R1608	5072	5479	16.32
CPSAN15-R1616	5072	5479	16.32
CPSAN15-R1624	5072	5479	16.32
CPSAN15-R1632	5072	5479	16.32
CPSAN15-R1640	5072	5479	16.32
CPSAN15-R1648	5080	5303	8.96
CPSAN15-R1656	5088	5295	8.32
CPSAN15-R1664	5096	5287	7.68
CPSAN15-R1672	5104	5279	7.04
CPSAN15-R1680	5112	5271	6.40
CPSAN15-R1688	5120	5263	5.76
CPSAN15-R1696	5128	5255	5.12
CPSAN15-R1704	5136	5247	4.48
<b>Total</b>			<b>1258.24</b>

Source Line	Start	End	Length
CPSAN15-S5000	1304	1567	10.56
CPSAN15-S5008	1304	1567	10.56
CPSAN15-S5016	1304	1567	10.56
CPSAN15-S5024	1304	1567	10.56
CPSAN15-S5032	1304	1567	10.56
CPSAN15-S5040	1304	1567	10.56
CPSAN15-S5048	1304	1567	10.56
CPSAN15-S5056	1304	1567	10.56
CPSAN15-S5064	1304	1567	10.56
CPSAN15-S5072	1304	1639	13.44
CPSAN15-S5080	1304	1647	13.76
CPSAN15-S5088	1304	1655	14.08
CPSAN15-S5096	1304	1663	14.40
CPSAN15-S5104	1304	1671	14.72
CPSAN15-S5112	1304	1679	15.04
CPSAN15-S5120	1304	1687	15.36
CPSAN15-S5128	1304	1695	15.68
CPSAN15-S5136	1304	1703	16.00
CPSAN15-S5144	1304	1703	16.00
CPSAN15-S5152	1304	1703	16.00
CPSAN15-S5160	1304	1703	16.00
CPSAN15-S5168	1304	1703	16.00
CPSAN15-S5176	1304	1703	16.00
CPSAN15-S5184	1304	1703	16.00
CPSAN15-S5192	1304	1703	16.00
CPSAN15-S5200	1304	1703	16.00
CPSAN15-S5208	1000	1703	28.16
CPSAN15-S5216	1000	1703	28.16
CPSAN15-S5224	1000	1703	28.16
CPSAN15-S5232	1000	1703	28.16
CPSAN15-S5240	1000	1703	28.16

Source Line	Start	End	Length
CPSAN15-S5248	1000	1703	28.16
CPSAN15-S5256	1000	1695	27.84
CPSAN15-S5264	1000	1687	27.52
CPSAN15-S5272	1000	1679	27.20
CPSAN15-S5280	1000	1671	26.88
CPSAN15-S5288	1000	1663	26.56
CPSAN15-S5296	1000	1655	26.24
CPSAN15-S5304	1000	1647	25.92
CPSAN15-S5312	1000	1639	25.60
CPSAN15-S5320	1000	1639	25.60
CPSAN15-S5328	1000	1639	25.60
CPSAN15-S5336	1000	1639	25.60
CPSAN15-S5344	1000	1639	25.60
CPSAN15-S5352	1000	1639	25.60
CPSAN15-S5360	1000	1639	25.60
CPSAN15-S5368	1000	1639	25.60
CPSAN15-S5376	1000	1639	25.60
CPSAN15-S5384	1000	1639	25.60
CPSAN15-S5392	1000	1639	25.60
CPSAN15-S5400	1000	1639	25.60
CPSAN15-S5408	1000	1639	25.60
CPSAN15-S5416	1024	1639	24.64
CPSAN15-S5424	1024	1639	24.64
CPSAN15-S5432	1024	1639	24.64
CPSAN15-S5440	1024	1639	24.64
CPSAN15-S5448	1024	1639	24.64
CPSAN15-S5456	1024	1639	24.64
CPSAN15-S5464	1024	1639	24.64
CPSAN15-S5472	1024	1639	24.64
CPSAN15-S5480	1024	1639	24.64

**Total 1267.20**

### 3 DATA ACQUISITION

#### 3.1 PERMITTING

##### 3.1.1 GENERAL

The programme was located on the Innamincka pastoral lease / Innamincka Regional Reserve. Property managers were advised of the proposed seismic operations by letter initially. Contact was then made with them by both the Santos Landholder Liaison officer and the Santos Seismic Field Representative to discuss and obtain approval for various aspects of operations before field operations commenced.

##### 3.1.1 OPERATIONAL

The survey was wholly located within the Innamincka pastoral lease and Innamincka Regional reserve. Infrastructure relating to Innamincka station included tracks, fences, yards and water supplies. Pre-existing gates were utilised throughout the survey.

Weed Management was a significant concern of both S. Kidman & Co (Innamincka) and DEWNR (National Parks). Mimosa Bush has previously been found along some of the watercourses adjacent the survey area. S. Kidman & Co (Innamincka) and DEWNR (National Parks) have undertaken a joint project aimed at eradicating Mimosa bush within the property boundary. No evidence of Mimosa Bush was identified during the survey.

#### 3.2 LOGISTICS AND COMMUNICATIONS

The Delaware 3D seismic survey is located approximately 75km to the north northeast of the Moomba gas facility in South Australia. Road Access from Moomba is East via the Della Road and then North via Dillons Highway to Innamincka (approx. 100 km). From Innamincka, follow the Cordillo road to the northwest and then turn into the Bookabourdie road to the centre of the survey (approx. 40km). Total driving distance to the centre of the survey is approximately 140km from Moomba.

The survey area also encompasses a number of existing flowlines and trunklines, along with various infrastructure and wells associated with the Bookabourdie field.

All Terrex contractors utilised the same camp site which was culturally cleared by the Yandruwandha/Yawarrawarrka people.

The camp site was located along the Cuttapirrie Road, and located in the centre of the prospect with the surrounding roads facilitating good access to all areas.

GDA94 Latitude	GDA94 Longitude	UTM Z54 MGA Easting	UTM Z54 MGA Northing
27°29'12.56"	140°31'08.63"	0452490	6959550





**Terrex Contracting & Seismic campsite**

Terrex camps were fully equipped with a kitchen, diner, ablution facilities, shower blocks, mechanics workshops, freezer rooms, single and dual occupancy accommodation vans, generators and back-up generators.

Potable water was sourced and transported from Cooper Parks, Moomba using Terrex's 10000 litre water trucks, with fortnightly food deliveries by KJM from PDF Food Services, Adelaide, South Australia.

Ablution and grey-water material were stored in a closed tank system and emptied as required by KJM, based in Cooper Parks. All other solid waste, including rubbish and recyclables, was taken to Moomba for processing.

Communications in the camps was via V-SAT systems, owned by Terrex Contracting and Terrex Seismic, which provided Internet access and VoIP telephone communications.

Fuel for all contractors was delivered to crew by IOR Energy Pty Ltd located in Eromanga, Queensland.

Crew change personnel were flown out via the Moomba and Ballera airport facilities and the Quilpie and Thargomindah airports as required.

### 3.3 SURVEYING

#### 3.3.1 GENERAL

Terrex Spatial (TSp), from the Terre x Group, completed all surveying on the project. Duties included line pointing, survey control, surveying source lines and pegging of receiver lines, data processing, managing the cultural heritage data, producing maps, and quality control of final survey data.

Terrex Spatial used the Real Time Kinematic method of survey. Using this method of positioning calculation, the NovAtel dual frequency real-time kinematic receivers can achieve accuracies of better than  $\pm 0.10\text{m}$  in position and elevation.

TSp also had two Trimble R10 GPS receivers on crew for survey control and backpacking hand carry sections on receiver lines.

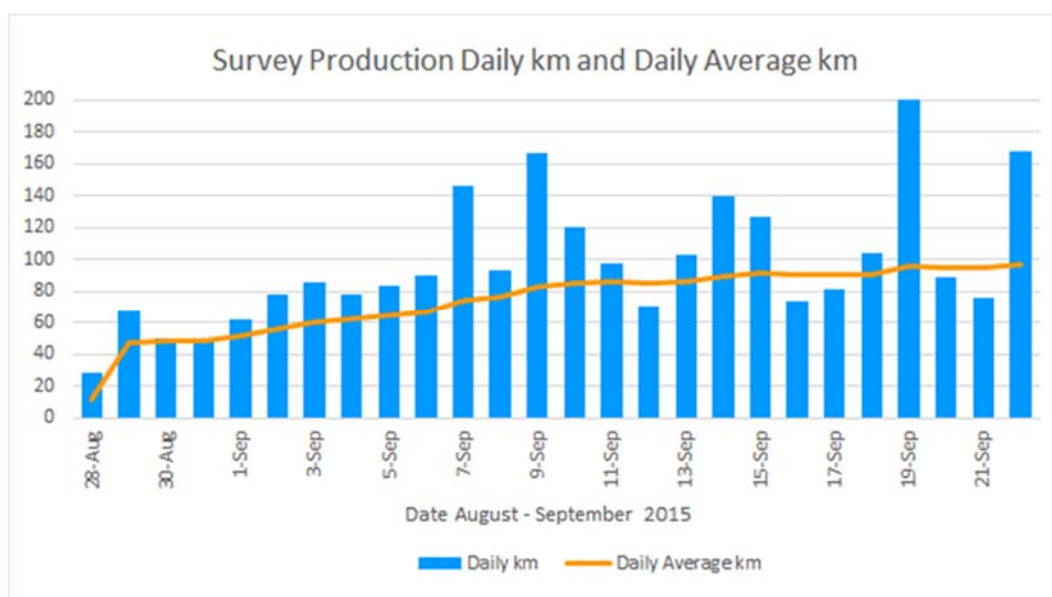
#### 3.3.2 OPERATIONS

A total of seven (7) survey personnel were utilised throughout the survey. Surveying commenced on the 26<sup>th</sup> August conducting control checks and establishing a GPS base. Line pegging commenced on the 27<sup>th</sup> August once the line preparation equipment had a sufficient lead.

A total of 2525.44 linear kilometres of seismic lines were surveyed (1267.20km Source & 1258.24km Receiver). The source lines were recorded in stake-less mode – no source pegs other than check stations were placed in the ground. Receiver lines were pegged as per normal methods with a numbered stake every 8th station and pin-flags for every other station. The wooden pegs and pin-flags were picked up by Terrex Seismic personnel whilst removing the recording ground equipment.

The vibrators had navigation units installed which guided operators to the surveyed source locations. The line crew had GPS navigation units in every vehicle which were loaded with detailed maps of the prospect.

There were many source offsets and detours for the Santos oil and gas pipelines, CH sites, dunes and waterholes (in the south). There were also twelve (12) vibrator skips due to these obstacles. Most of these were due to avoiding cutting dunes visible from the Cordillo Downs Road.



Graph showing Linear Kilometres Surveyed and Daily Average Kilometres



Survey fieldwork took 26 days to complete at an average of 97.13km per day (including hand-carry and field checks). There were 713 hand-carry points, due to infrastructure, CH sites and deviations. The survey project was completed on Monday 21st September 2015 and the surveyors demobbed from site on the 24th September 2015.



**Survey staff using the Trimble R10 GPS back pack to survey the hand carry sections on receiver lines**

Operations, personnel and equipment are fully detailed in Terrex Seismic Final Report, which is appended hereto (Appendix 1).

### 3.4 CULTURAL HERITAGE CLEARANCE

The Delaware 3D survey fell in the Yandruwandha / Yawarrwarrka native title area. Santos Limited has a long term agreement with Yandruwandha / Yawarrwarrka people where we abide by certain terms and conditions detailed in a jointly agreed Cultural Heritage Management Plan (CHMP). In particular, Santos Limited was to bear the cost of claimant representatives to inspect the proposed survey area in advance of any on ground activities commencing.

The pre-clearance teams consisted of a Santos Cultural Heritage supervisor, an archaeologist and two YW Cultural Heritage Officers. The Cultural Heritage clearance was completed in early August 2015.

Once Cultural Heritage approval was granted the GIS information and site sketches were sent to the survey crew for loading onto the line preparation GPS navigation units. The Cultural Heritage site data were loaded as “no go” areas which would activate audible and visual alarms if the machine entered into the area.

In general terms the Yandruwandha / Yawarrwarrka clearance team has cleared a corridor +/- 25m from the design lines (ie. a 50m wide corridor). Multiple sites were identified as having cultural heritage significance and were recorded and detoured as required.

All field personnel completed a Site-Specific Cultural Induction before commencing work on the project.

## 3.5 LINE PREPARATION

### 3.5.1 EQUIPMENT

Line preparation was carried out by Terrex Contracting who supplied a total of twenty four (24) personnel throughout the survey effort, including a paramedic and those for crew rotation. Personnel work on a 6 week on and 2 week off roster. Terrex Contracting supplied the following key equipment:

Equipment	Description	Quantity
Heavy Vehicles	Komatsu D65EX Dozer	4
	John Deere Grader	2
	Caterpillar D8 (hired)	1
	Kenworth Prime Mover	2
	Isuzu Service Truck	1
	Iveco - Pods	1
	Acco International - Pods	1
	Service Truck	1
Light Vehicles	Toyota Cab Chassis 4x4 support	2
	Toyota Landcruiser Wagon	3
Trailer	Water	1
	Fuel	1
	Ablution	1
	Generator	1
	Diner	1
	Kitchen	1
	Mechanics Workshop	1
	Fire Tender	1
	Float	2
	Accommodation Vans	7
	PM/HSE/Survey/Client Office	3

### 3.5.2 OPERATIONS

Santos site and Cultural Heritage inductions were conducted at the KJM Cooper Parks facility on the evening of 23<sup>rd</sup> August. The Terrex Contracting camp moved from Cooper Parks to Delaware 3D camp site on 24<sup>th</sup> August. The camp site was located on a large cleared site on the west side of the Cuttapirrie Road, north of the Bookabourdie satellite.

On 25<sup>th</sup> August Terrex Spatial personnel set up the navigation GPS units on the dozers. These units comprised either Algiz 10x or Motion tablets running TSp NavMini machine guidance software in combination with an external Garmin USB or serial GPS receiver. This equipment basically guided the dozer operator along a lines designed course without the need for any material aids. Also displayed, were previously recorded cultural heritage sites, cultural heritage exclusions, pipelines and their associated 'No Go' zones, wells and pastoral infrastructure.

Line preparation commenced on the 26<sup>th</sup> August with four dozers in the south of the prospect. The fifth dozer commenced work on 28<sup>th</sup> August in the south-east corner of the prospect. This area was very sensitive due to environmental (visibility from Cordillo Downs Road) and Cultural Heritage (large number of sites) issues. The Terrex Spatial

Senior Surveyor assisted the operator in preparing the seismic lines through this area to minimise line visibility and avoid CH sites.

Line preparation operations continued smoothly with high production in easy terrain, low dunes separated by swales that vary from a hundred to over a thousand metres in width.

Restoration activities are detailed in section 3.8.3 of this report.

### **3.5.3 PRODUCTION**

The line preparation operations took 27 days to complete at an average of 21.80km per day. Two graders continued tidying up the prepared lines for a further eight days. All line preparation activities were concluded on the 29<sup>th</sup> September 2015.

Line Preparation Statistics	
Total Km Prepared	2525.44
Dozer Work Hours	1188.30
Dozer Production Days	27
Dozer Km/Work Hr	2.12
Grader Work Hours	514.80
Production Days (Grading)	34

## 3.6 RECORDING

### 3.6.1 EQUIPMENT

Terrex Seismic provided a Sercel 428XL telemetric recording system, along with a field deployment of 14,100 of Sensor SM24 10hz geophones, cables(FDU Links) to match and 4 vibrators as source generation(plus 1 spare).

Terrex Seismic ran 5 cable trucks and 3 geophone trucks on line for moving the equipment.

Equipment	Quantity
Sercel LCI 428	1
Client Server HPZ400 Workstation & HPZ800 Workstation	2
Sercel VE-464-DPG	1
IBM LTO Tape Drive	1
NAS Star Hard Drives Model FX	2
Allied Telesyn Ethernet Gigabit Switch AT-GS900/8	2
Plotter V12	1
Eaton E Series DX UPS	1
Samsung 22" monitors	4
Gigabyte Technology Computer GA-790XT	1
Canon Printer	1
Prime GPS base antenna / tripod	1
Sercel TDMA Booster	1
Sercel TDMA Radio	1
Clarke Mast 8m	1
Yagi Antenna	1
GME UHF Radio TX4600	1
Motorola VHF Radio GM388	2
Westinghouse Series 1000 Satellite Phone	1
Kubota Generator	1
Isuzu Recorder Truck	1

Line Equipment	Quantity
Line Acquisition Unit, In-Line (LAUL)	360
Line Acquisition Unit, Cross-Line (LAUX)	30
Battery	420
Geophone x 6 phones per string	14100
Field Digitizer Unit (4 Link Cable x 4 channels)	3525
Transverse Cable	180

#### Automotive Equipment

A complete list of automotive equipment is included in Terrex Seismic Operations Report. A copy of this report is attached as Appendix 1.

### 3.6.2 RECORDING PARAMETERS

RECORDING	
Recording System	Sercel 428XL, 24-Bit Telemetric
# Channels	5408 (26 lines x 208 channels)
Recording Media	External Hard Disks and LTO 2
Recording Data Format	SEG-D Rev.1 8058 IEEE Demultiplexed, Noise edited correlated summed 4 sec record
Filters	Hi cut 200Hz, (0.8 Nyquist – Linear) Lo cut: Out
Sample Rate	2 ms
Correlated Record Length	4 seconds
Uncorrelated Record Length	16 seconds
RTC	Yes
Correlation Type	Zero Phase, After Sum
Stack	Diversity stack

SOURCE DATA	
Vibrators	Inova AHV-IV Articulated Buggie (67,000lb) 2 x 2 groups
Electronics	Sercel 464 DSD, DPG in recorder
Sweep Frequency	6 - 90 Hz
Sweep Length	12 seconds (plus 4 seconds listen)
Sweep Type	Linear Upsweep
# Sweeps / VP	1 standing sweep
VP Interval	40 metres
Vibrator Array	2 vibs in line, 12.5m pad to pad standing. No move-up. Centred on VP station
Drive Level	70% varied by amplitude control function
Start & End Tapers (Cosine)	0.250ms & 0.250ms
Phase Locking Type	Sercel Auto-adaptive servo mechanism
Amplitude Control	Peak to Peak
Sweep amplitude taper	100% (none)

RECEIVERS	
Receiver Group Interval	40 metres
# Live Traces	5408 (26 lines x 208 traces per line)
Geophones	Sensor SM-24, 10 Hz Land geophones w/spike
Array	6 geophones bunched, centred on station

SPREAD DESIGN	
Nominal Fold	169
Bin Size	20 x 20 metres
Roll	One line roll between swaths
Roll-on, Roll-off	Normal in both in-line and cross line directions
Receiver Line Spacing	320 metres
Source Line Spacing	320 metres
Max Inline Offset	4160 metres
Max XLine Offset	4160 metres
Max Diagonal Offset	5874 metres
Source-Receiver Line Geometry	Orthogonal

Recording parameters are detailed in the Terrex Seismic Operations Report. A copy of this report is attached as Appendix 1.

### 3.6.3 OPERATIONS

The recording phase was conducted by Terrex Seismic Crew A2 from 17<sup>th</sup> September to the 1<sup>st</sup> November 2015 (includes layout and pickup of 9 days).

An experimental line was laid out before the 3D receiver layout commenced. A total of 377 stations were laid out at 10m intervals. The purpose of the testing was to confirm the sweep parameters and analyse frequency content. The test data was processed on crew and reviewed by Santos to confirm sweep parameters. Data quality from the source tests was good. A single 12 second sweep, 6 – 90Hz sweep frequency, 0.250s start taper / 0.250s end taper and drive level of 70% was chosen.

A total of three days was required of receiver layout before the recording acquisition commenced on the 21<sup>st</sup> September 2015.

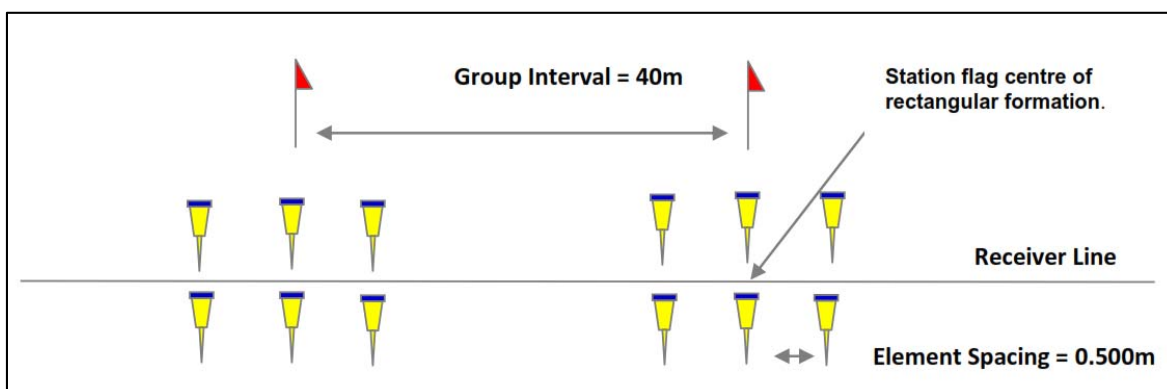


Diagram of 3D geophone array

Terrex Seismic supplied 5 x Inova AHV IV (67,000lb) vibrators for the recording acquisition. There were two groups of two vibrators on line with one spare, allowing for continuous recording. The vibrators were equipped with Sercel 464 digital servo drive (DSD) controllers. This system allows for different configurations, improved reliability of operation and also permits fast and accurate quality control of the vibrator.

Sand tyres were used by all vibrators for the whole project. The wide tyres enable the machines to easily traverse sand dunes.

The vibrator groups were supported by two scout vehicles which scouted ahead of the group locating the detours around the fence lines, flow lines, and cultural heritage sites as required.

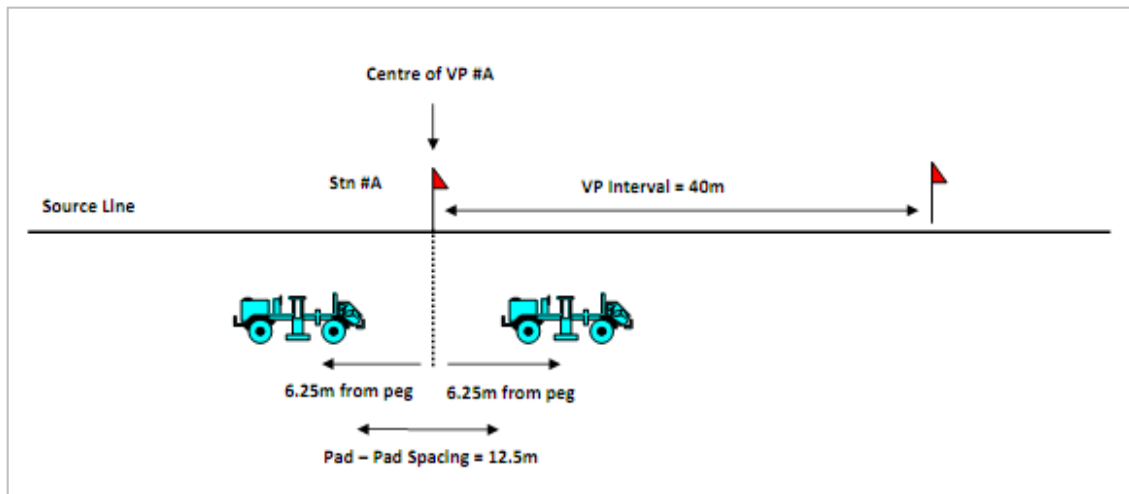


Diagram of Vibrator x 2 in-line array

Occasional moderate winds continued throughout the survey. A noise value of 20microvolts for monitoring the wind noise was in place where that if more than 80% of traces exceeded the noise value the recording acquisition was to be stopped. These limits were reached on a couple of occasions but first breaks and reflectors were still evident on the far traces, so recording continued.

There was heavy traffic noise throughout the recording phase due to a drill rig setup on the Washington wellsite, followed by a fracking crew. The survey experienced some delays during fracturing operations on the Washington well as 3D recording was suspended approximately half an hour prior to the commencement of pumping through to approximately half an hour after the pumping was completed. The seismic acquisition was also stopped briefly before perf shots were taken and a couple of minutes after the perf shot before recommencing the seismic acquisition.

The Innamincka Station infrastructure included three dams located within the survey for the grazing cattle however there was minimal spread damage. Once the recording crew cleared R1240 there was no spread damage logged from the other two dams located in the northern part of the project.

Data quality was generally good throughout the 3D survey. Strong seismic reflectors were evident at 0.8 - 1.0 seconds, 1.5 seconds and 1.8 - 2.2 seconds. Wind noise was evident on some days but had little or no effect on the robust data.

A total of 37 days of recording was required to complete the project. The daily average production rate was 856 VPs per day at the conclusion of the recording acquisition. A total of 31,680 source points were to be recorded and 31,456 receiver points to be laid out within the 3D program. A total of 19 source points were skipped due to Cultural Heritage Exclusion Zones, pipelines, terrain and corrupt files.



Start Date	21 <sup>st</sup> September 2015
End date	27 <sup>th</sup> October 2015
Total Recorded Square Kilometres	396.4928 km <sup>2</sup>
Total Recorded Linear Kilometres	1267.2000km
Receiver Interval	40m
Source Interval	40m
Source Line Interval	320m
Receiver Line Interval	320m
Number Of Live traces	5408 (26 lines x 208 channels )
Nominal Fold	169
Total Recording Hours	344.6
Total Operational Hours	541.4 hours
Average VPs / Day	856
Average Recording Cycle Time (VPs / Hour)	92
Average Square Kilometres / Day	10.70 km <sup>2</sup>
Average Linear Kilometre / Day	34.20 km
Total Recording Days	37 days
Total VPs	31680 (19 skips)

### 3.6.4 HEALTH & SAFETY

The climate in the Cooper Basin is generally characterised by hot dry summers and mild dry winters. This program started in the winter month of August 2015 and finished in spring, October 2015. The month of August saw daily highs of 20-21° C, September 21-34°C and October 30-40°C.

Throughout the seismic project, winds were light with variable direction on most days but occasional moderate to fresh winds were recorded.

There were no Lost Time Incidents (LTIs) recorded during the survey.

All rubbish and waste material, including tyres, scrap metal and batteries, was segregated on site and disposed of at the Moomba waste depot. The disposal of effluent water from the two campsites, kitchens and toilets was managed by Veolia Environmental Services.

Daily Toolbox and weekly Safety meetings were held by all contractors involved with this survey. Minutes of Toolbox and the weekly Safety meetings were forwarded to Santos Limited.

## 3.7 WEATHERING SURVEY

### 3.7.1 GENERAL

There was no uphole survey undertaken.

## **3.8 ENVIRONMENT**

### **3.8.1 GENERAL**

As operator, Santos Ltd is committed to planning and conducting seismic operations in such a way that environmental disturbance is avoided or minimised, and affected areas can rehabilitate naturally in a reasonable time frame. These objectives have most recently been set out and discussed in the publications “Santos Operations Geophysics SEO Arid Areas July 2012”, and “South Australia Cooper Basin & Arid Regions Environmental Impact Report: Geophysical Operations” Santos Ltd, July 2012.

### **3.8.2 OPERATIONAL OBSERVATIONS**

The Delaware 3D seismic survey is located around 75km north northeast of Moomba. Road Access from Moomba is East via the Della Road and then North via Dillons Highway to Innamincka (approx. 100km). From Innamincka you follow the Cordillo road to the northwest and then turn into the Bookabourdie road to the centre of the survey (approx. 40km). Total driving distance to the centre of the survey is approximately 140km from Moomba.

The survey area falls within the Innamincka Regional Reserve and the Innamincka Pastoral Station. As such, the area is extensively grazed by cattle, but is also considered to be an important area for nature conservation, particularly in relation to the Cooper Creek wetlands. The survey area has also been subject to extensive previous oil and gas exploration, with seismic surveys dating back to the 1970s.

The survey area also encompasses a number of existing gas wells, including those of the Bookabourdie and Pondrinie fields and their associated flow lines.

Three distinct landforms dominate the area covered by the survey. The predominant landform is dune field which is characterised by a series of NNW – SSE trending, sub-parallel dunes up to 10 m in height separated by swales that vary from a hundred to over a thousand metres in width.

The eastern side of the survey is covered by an area of undulating downs consisting of rolling gibber plains with minor watercourses throughout. Separating the dissected residuals from the dune fields is a belt of the Cooper Creek floodplain. A number of temporary waterholes and creeks lie throughout the survey area including the Bookabourdie, Derawantana and Catchiekamoo waterholes.

The dunes are sparsely vegetated with a diversity of shrubs and grasses. The vegetation consists mainly of Sandhill canegrass grassland on the dune crests and Marpoo open shrubland on the dune flanks. Needlewoods and occasional Prickly wattle occur as emergent low trees or shrubs in the swales. The inter-dune sand plains support a low open shrubland of bindyi and Mulga grass. In places the sand plain also supports Needlewood and Marpu.

Most of the floodplain in the survey area supports relatively sparse shrubland. The main exceptions are the waterholes that support dense Coolibah woodland and some sections of floodplain that support moderately dense Old man saltbush.

The floodplain consists of a network of shallow drainage lines supporting mainly Old man saltbush, Queensland bluebush and Lignum shrubland, and ephemeral herbfield. The occasional deeper channels and waterholes support Coolibah / River coolba woodland and Lignum shrubland. Occasional Queensland bean trees occur around the larger waterholes. The undulating downs in the south eastern corner of the survey area support mainly Barley Mitchell grass and ephemeral herbfield.

The line preparation crew adhered to Santos' Code of Practice for Line Preparation/Survey Crew.

- Restrict lines to one blade width.
- Move as little earth and vegetation as possible.
- Walk across clay pans and consolidated flat open ground.
- Avoid steep cuts and fills, which may cause erosion or landslide problems.
- Cut sand dunes to the minimum depth required for safe access and operation.
- Push sand to side of cut, not to bottom of dune.
- Avoid or reduce to a minimum the formation of windrows.
- Avoid destruction of isolated trees or stands of vegetation.
- Avoid unnecessary blockage of creeks and channels.
- Include erosion control features such as spur drains on sloping terrain.
- Conceal lines from public roads or tracks by stopping 50 metres short on either side or placing a dog-leg to reduce line of sight in vegetated areas.
- Offset crossings at drainage channels to avoid the removal of trees and vegetation.
- Avoid sites of natural, historical, heritage, aboriginal and archaeological significance, known or discovered.
- All work is to be carried out with due regard to safety and consideration/protection of the environment (including Cultural Heritage sites).

### **3.8.3 RESTORATION**

Terrex Contracting completed all line preparation using a combination of Komatsu D65EX Dozers and John Deere 672 & 772 graders. The line preparation was conducted in such a manner as to minimise the need for any restoration at the end of the job.

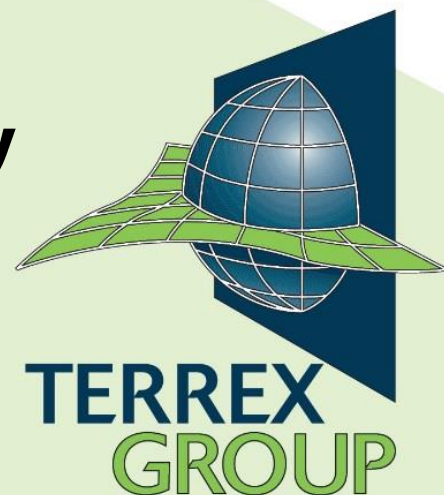
The Innamincka-Cordillo Downs road (public road), bisected the survey and all lines abutting the road had the road verge re-shaped, to disguise the lines to the public traffic. The Santos field roads to Bookabourdie and Cuttapiirie were also restored where necessary. Lines abutting the road were lightly scarified and the road verge was re-shaped, to disguise the lines to the public traffic.

The restoration was carried out after line preparation activities had been completed on the CPSAN15C Beanbush 3D survey from the 20<sup>th</sup> October and was concluded on the 22<sup>nd</sup> October 2015.

## **APPENDIX 1 – OPERATIONS REPORT**

# Delaware 3D Seismic Survey

## Field Operations Report



Prepared for Santos Limited

**Advance Crew:** 22<sup>nd</sup> August to 29<sup>th</sup> September 2015  
**Recording Crew:** 15<sup>th</sup> September to 30<sup>th</sup> October 2015

Job No. J00303

Crew A2



# Field Operations Report

For

## **Delaware 3D Seismic Survey**

PEL 570

Written by

Hagay Haviv– Infield Geophysicist

Crew A2

This report is confidential and was prepared exclusively for Santos Limited.

Terrex Seismic is certified to OHSAS 18001, ISO 14001 and AS 4801.

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**PERTH OFFICE**

Level 4 76 Kings Park Rd  
West Perth WA 6005

T +61 8 9235 4600

F +61 8 9324 3640

E [info@terrexseismic.com](mailto:info@terrexseismic.com)

**BRISBANE OFFICE**

22 Crockford Street  
Banyo QLD 4014

T +61 7 3621 0300

F +61 7 3266 7345

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## TERREX GLOSSARY OF TERMS

Term	Description
Acquisition	All days onsite doing seismic related activities i.e. from the first station laid to the last station picked up, any experimental or spread testing time
Recording	Covers all the days data was recorded i.e. from the first VP to the last VP
Survey	All activities the client paid for including mobilisation/demobilisation



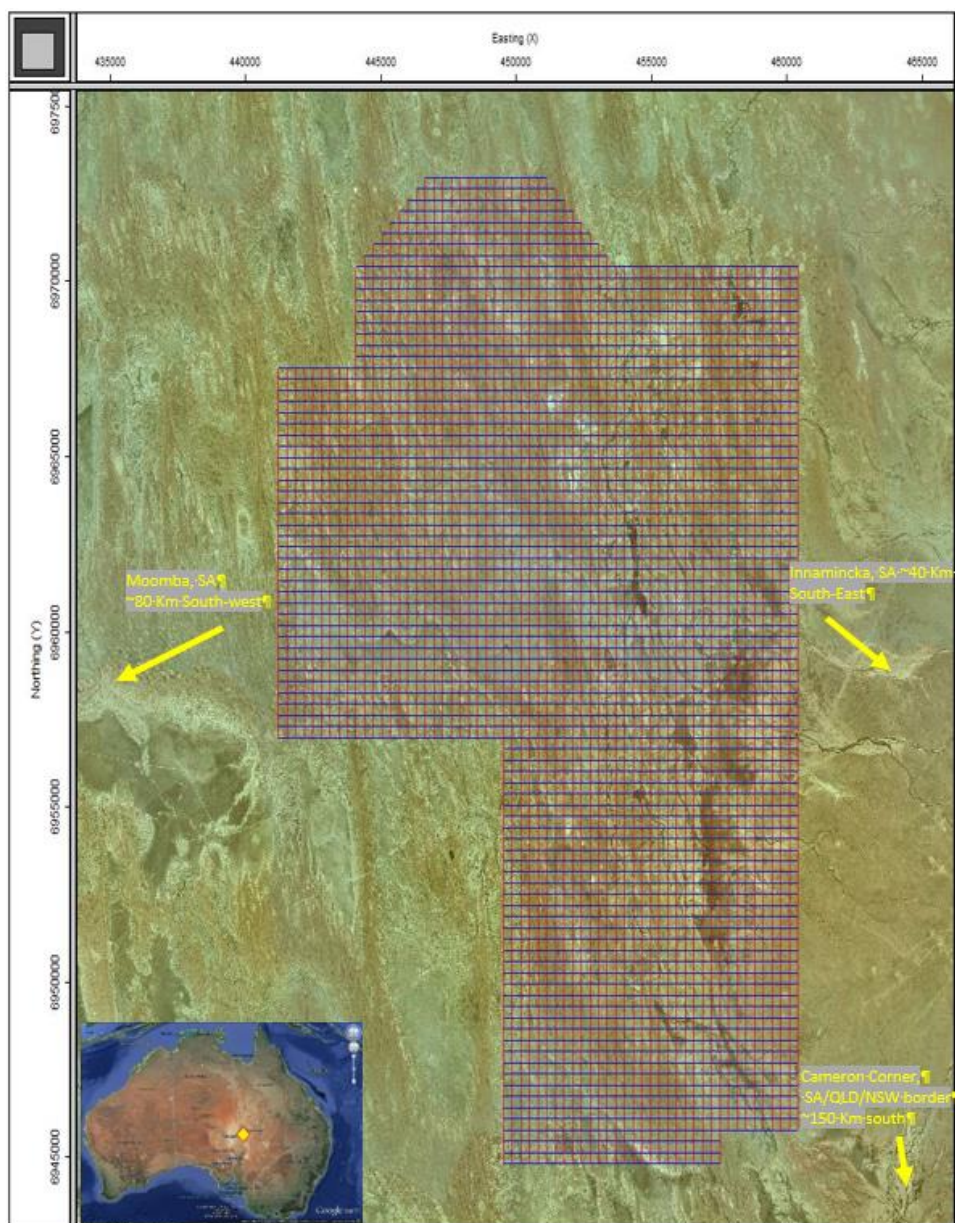


Figure 2 Map of prospect overlain on LandSat imagery.

## 1.2 Health, Security, Safety and Environmental

The Delaware 3D Seismic Survey was conducted from 22<sup>nd</sup> August 2015 to 30<sup>th</sup> October 2015.

During acquisition by Crew A2 there were a total of 55,728 man hours and 6,336 subcontractor hours accrued with no serious injuries resulting in MTI or LTI and no reportable/recordable incidents. A total of 577 hours of training was recorded with 697 hours of toolboxes and 8 audits were conducted during the course of acquisition.

Refer to Appendix G - HSE – Delaware 3D End of Contract Report for additional information.

## 1.3 Climatic Conditions

Average Minimum Temperature:	11 degrees
Average Maximum Temperature:	26 degrees
Days lost due to wet weather:	None
Rainfall:	0 mm



## 1.4 Logistics

### 1.4.1 Advance Crew

The advance crew arrived in Cooper Park on August 22<sup>nd</sup> and arrived at the project site in Bookabourdie on August the 24<sup>th</sup>. Line preparation commenced on August 26<sup>th</sup>.

On September the 29<sup>th</sup> crew performed vehicle maintenance and prepared the camp for shut down.

### 1.4.2 Recording Crew

On September the 15<sup>th</sup> the crew departed the Brisbane office on bus, stayed overnight in Charleville where they met the QC van and 2 QC personnel. The crew arrived at the camp on September the 16<sup>th</sup>.

On September the 17<sup>th</sup> crew started layout. An experimental 2D test line was acquired and processed on September 19<sup>th</sup> and 20<sup>th</sup>.

Production commenced on September the 21<sup>st</sup>.

Acquisition was completed on October the 27<sup>th</sup>. On completion the crew started to lay spread on the next project (Beanbush 3D), while the vibes and recorder travelled to next project. The crew remained at the camp used for Delaware, while recording the Beanbush 3D, due to the close proximity of the two projects.

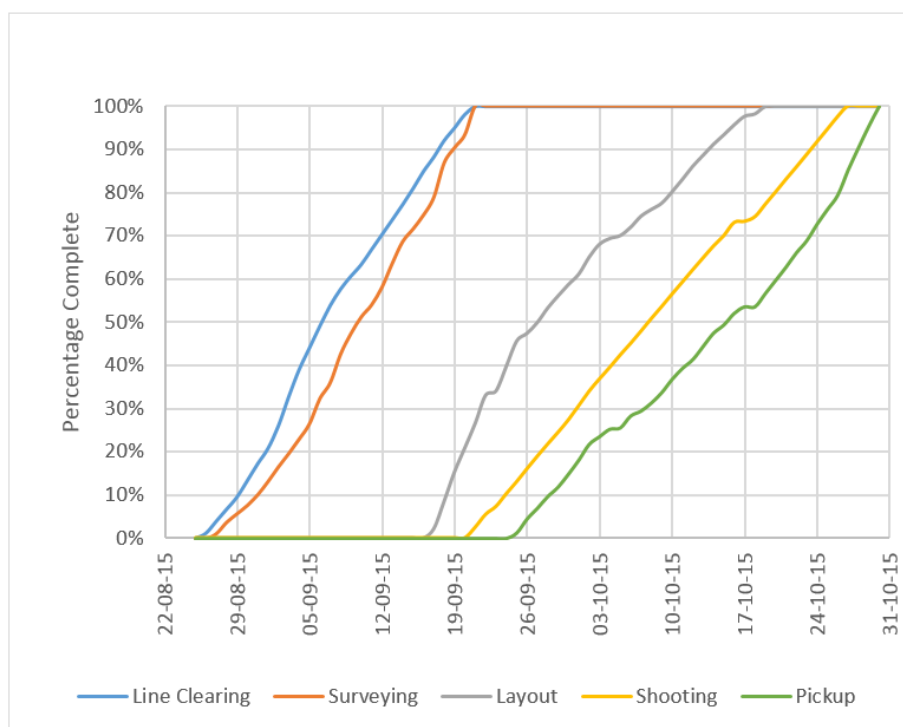


Figure 3 Cumulative daily production chart, for advance and recording crews.

## 2. SURVEYING

The crew initially stayed at Cooper Park while the camp was readied for moving to the prospect.

### 2.1 Line Pointing/Chaining/Surveying

Line pointing & survey services were provided by Terrex Spatial.

A listing of the personnel involved can be found in Appendix I.

*Refer to Appendix F - Terrex Spatial – 2015 CPSAN15 Delaware 3D Seismic Survey Final Report for additional information.*

### 2.2 Line Clearing

Line clearing services were provided by Terrex Contracting. The clearing was conducted between 26<sup>th</sup> August and 21<sup>st</sup> September, 5 dozers and 2 graders were used.

A listing of the personnel involved can be found in Appendix H.

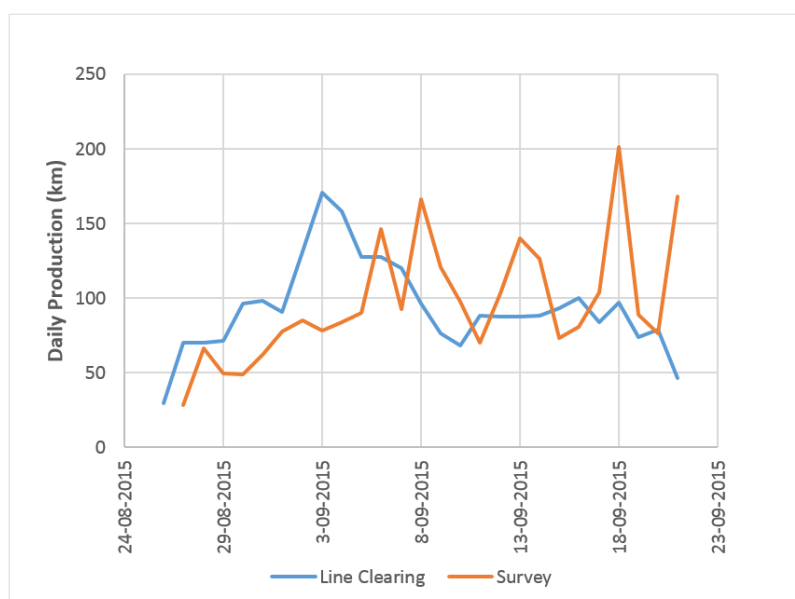
### 2.3 Production figures

Line preparation operations continued smoothly with high production in easy terrain (low dunes and large flats) allowing the line preparation lead over survey to reach 450km on 7th September.

The adoption of the stake-less source method for recording also enabled the survey crew to achieve very high production rates on source lines with the crew achieving over 200km production on 18th September

**Table 1 Line Clearing and Surveying production statistics**

	Terrex Spatial	Terrex Contracting
Average Production	97.1 km/day	93.6 km/day
Minimum Production:	28.4 km/day	29.6 km/day
Maximum Production	201.2 km/day	170.9 km/day
Lost/Standby Time	0	0
Total Days Onsite:	26 days	27 days
Total Production	2,525 km	2,525 km



**Figure 4** Line Clearing and Surveying production graph.

### 3. SERVICES

The following services were supplied by third party contractors for this project:

#### 3.1 Permitting

No Permitting relating contract was involved in the project

#### 3.2 Fencing

No Fencing relating contract was involved in the project

#### 3.3 Paramedic

Corporate Protection Australia Group provided on-site paramedic services for the survey. Paramedics were provided to reduce response times due to the camp being in such a location that an injured person is unable to be conveyed to the nearest medical establishment within one hour.

#### 3.4 Traffic Control

No traffic control was involved in this project

#### 3.5 Client Representative

The Client Representatives for this survey were: Tom Picket and John Searson.

The following people also visited the project site:

- Greg Dunlop Terrex CEO
- Michael Giles Santos Geophysical Manager
- Andrew White Santos Senior Surveyor
- Sergey Vlasov Santos Senior Geophysicist
- Michael Dello-Iacovo Graduate Geologist

## 4. RECORDING/PROCESSING

The Delaware 3D acquisition commenced on September the 21<sup>st</sup>.

On the 23<sup>rd</sup> of September, windy conditions with gusts of up to 55km/h were experienced. To reduce the noise on the record data, the geophones on the active spread were re-kicked, resulting in low layout production for the day as the line crew were re-kicking.

During the period from 15th-19th October, production rates were reduced due to 3D data recording being suspended during the reservoir stimulation operations on the Washington #1 well.

Throughout the latter part of the project there was a lot of troubleshooting to repair spread damaged by cattle dragging the cables overnight.

**Table 2** Acquisition production statistics

	Layout	Shooting	Pickup
Average Production	953 channels/day	856 VPs/day	897 channels/day
Minimum Production:	176 channels/day	80 VPs/day	91 channels/day
Maximum Production	2,130 channels/day	1,056 VPs/day	1,817 channels/day
Lost/Standby Time	21.5 hours, due to Washington 1 fracture stimulation		
Total Days Onsite:	33 days		35 days
Total Production	31,456 RPs	31,680 VPs Including 18 skips	31,456 RPs

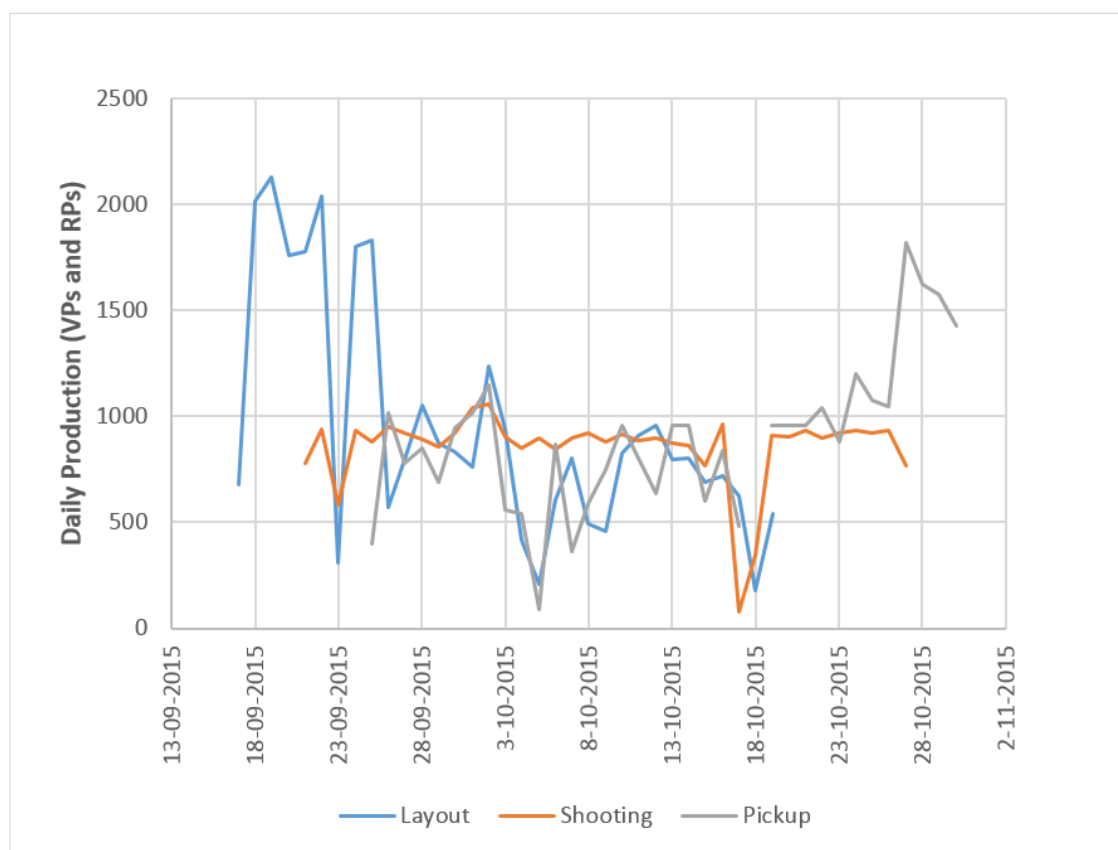


Figure 5 Acquisition daily production rate chart.



## 4.1 General Survey Details

Survey:	Delaware 3D
Survey Location:	Copper Basin, South Australia
Total Area:	396.5 km <sup>2</sup>

## 4.2 Recording Parameters

The tables below describe the parameters used in the production data acquisition.

**Table 3 Production Recording parameters**

Parameter	Description
Instruments:	Sercel 428
No. Channels:	5408 live channels (14,100 channels were available)
Tape Drives:	LTO
Tape Format:	SEGD version 2.1, recorded to LTO tape. SEG normal polarity
Filters:	Low cut filter 3Hz Hi cut filter Out Anti-alias filter 200 Hz (80% of Nyquist)
Sample Interval:	2 ms Sweep sampled at 500 us
Record Length:	4 seconds
Correlation Type:	Correlated with the pilot
Stack:	Single sweep, no stacking
Data recorded to tape	Uncorrelated and Correlated.
Auxiliary Channels	Channel 1 Time break Channel 2 100 Hz timing reference from VE464 Channel 3 True Reference (digital pilot) Channel 4 DPG Reference Channel 5 Autocorrelation

**Table 4 Production Source Parameters**

Parameter	Description
Vibrators:	4x AHV-IV Source Driven, Shooting as 2 groups of 2.
Electronics:	Sercel VE464
Sweep Frequency:	6 – 90 Hz linear upswing
Sweep Length:	12.0 seconds sweep time (+4s listen)
Number of. Sweeps:	1 Sweep per VP
VP Interval:	40 m
Vibrator Array:	2 vibrators inline with a 12.5m pad-pad spacing.
Sweep Amplitude Taper:	Blackman
Drive Level:	70%
End Tapers (cosine) (s):	250ms start, 250ms end tapers
Phase Locking Type:	Ground Force using M51 HP accelerometers.
Amplitude Control:	Peak to Peak

**Table 5 Production Receiver parameters**

Parameter	Description
Receiver sensors	SM24 10 Hz Equivalent Geophones
Receiver Group Interval:	40 m
Spread:	Nominal spread: Symmetrical split-spread, 26 lines, 208 channels with roll on/off
Array:	6 geophones, Bunched on peg
Connection:	2 parallel strings of 3 phones in series.

**Table 6 Production Recording Geometry**

Parameter	Description
Receiver Line Interval:	320 m orthogonal to the source lines
Number of Receiver Lines	89
Number of Receivers per Line	Between 272 to 480 for the bulk of the survey with some shorter lines as the survey tapers at the Northern and Southern ends.
Source Line Interval	320 m orthogonal to the receiver lines
Nominal Offset	Inline and Crossline +/- 4,160m Absolute 5,883m
In Line Fold	13
Cross Line Fold	13
Nominal Multiplicity:	169 in 20m x 20m bins

**Table 7 Variations to production parameters**

Parameter	Variation	Comments
Sweep Start/End Tapers	Changed from 300ms to 250 ms	Was decided after testing's by Santos representative, prior to any production

### 4.3 3D Recording

The project was acquired as a single panel from the South to the North.

In general the project rolled with no particular issues, generally around 1-2 swaths were shot every day. With one exemption that on October 17<sup>th</sup> production slowed down to 80 VPs due to the fracking of Washington #1.

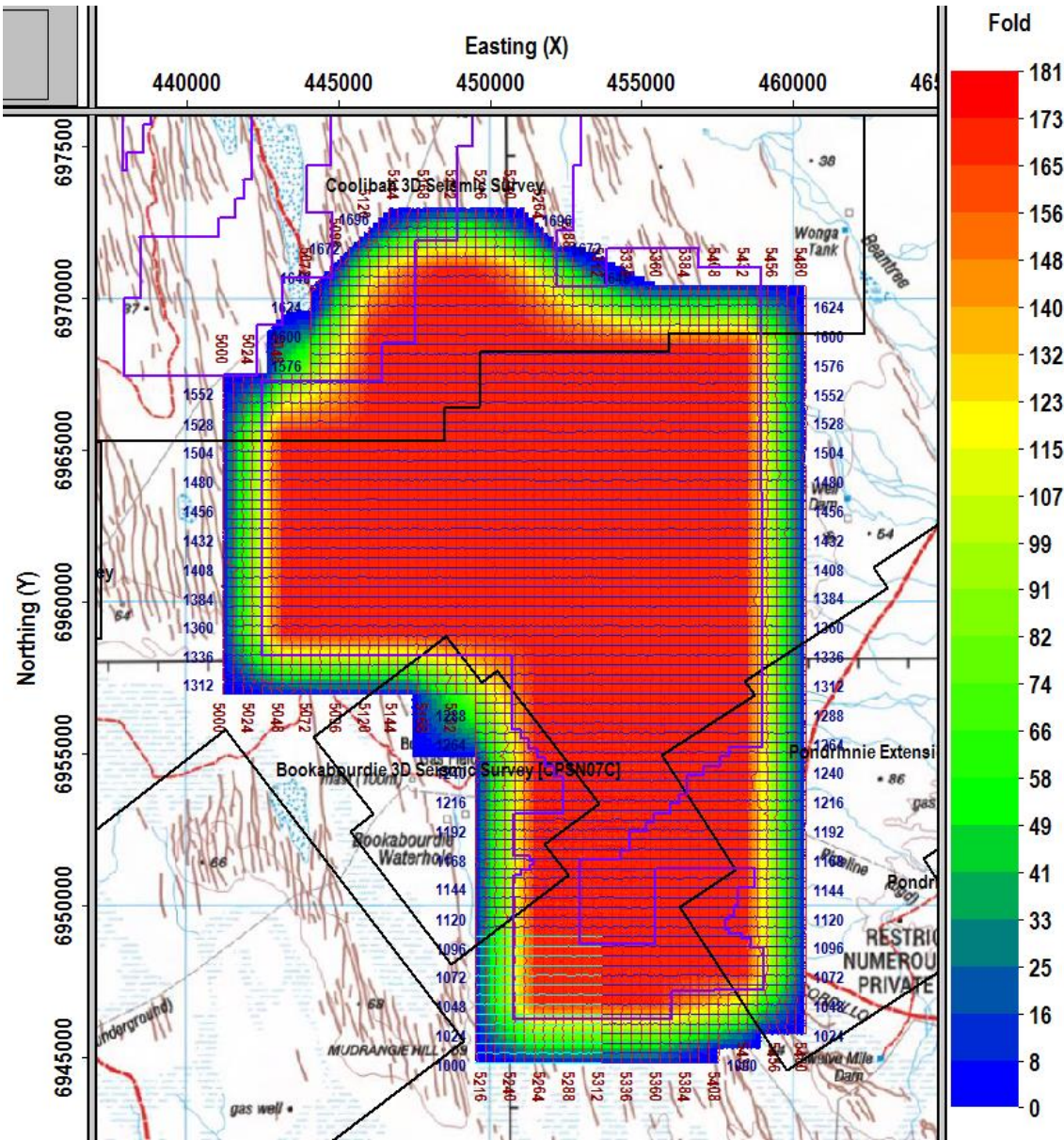


Figure 6 Post Acquisition fold of coverage map.

## 5. QUALITY CONTROL

### 5.1 Infield QC

The In-Field QC unit worked as an integral part of the crew and coordinated data flow between the different units on the crew during the seismic operation. The unit performed the quality control of data and seismic processing on a daily basis.

The unit was responsible for checking the seismic data and associated coordinates files for data verification, geometry, noise and overall seismic quality. A field stack was also generated and updated as the acquisition continued.

In addition to data checking, the unit was responsible for the shipments of data to a client's nominated address.

#### 5.1.1 Geophysical Objectives

Santos overall aim of this survey is to mature prospective areas and identify new opportunities in PEL 570 as well as meeting the work program commitment for the permit. The acquisition, data processing and interpretation of the Delaware 3D seismic survey will achieve the following:

Objective 1:	Eliminate mis-tie problems associated with 2D seismic data
Objective 2:	Reduce uncertainty of prospects identified on the edge of existing 3D seismic surveys
Objective 3:	Identify any additional prospects that lie in the gaps of the current 2D seismic grid
Objective 4	Allow the generation of 3D seismic attribute maps, which may assist with the identification of 'sweet spots' for targeting gas bearing coal formations
Objective 5	Facilitate specialized geophysics work (e.g. AVO) to support drill locations
Objective 6	Allow optimization of the locations of future exploration opportunities
Objective 7	Allow optimization of future appraisal and development wells

#### 5.1.2 Personnel

The In-Field QC unit was staffed by two In-Field Geophysicists at start-up and handover. And one In-Field Geophysicists at all times with a small overlap to allow for handover during staff rotation. The In-Field Geophysicists were supported by Senior Geophysicists based in Terrex Seismic Brisbane office. The staff involved in the quality control and processing of data in this project are listed in Table 8.

**Table 8** QC Personnel involved in the Project

Name	Duration Dates
Andrew Grace	15 <sup>th</sup> September to 24 <sup>th</sup> September, 2015
Hagay Haviv	15 <sup>th</sup> September to 30 <sup>th</sup> September & 23 <sup>rd</sup> October to 27 <sup>th</sup> October, 2015
Ian James	28 <sup>th</sup> September to 26 <sup>th</sup> October, 2015
Richard Barnwell	Support from Brisbane

#### 5.1.3 Equipment

The QC unit operated out of a dedicated data processing trailer located on crew. The hardware is secured with shock mounts and straps to facilitate easy mobilisation; the main components are detailed in Table 2.

**Table 9 QC Unit hardware listing**

Number	Item Description
1	High specification processing/mapping workstations equipped with 1GbE networking: Hewlett Packard z800 dual-CPU (16 cores) workstation, Red Hat Enterprise Linux v6.5, 24 GB RAM
2	Core i7 4770k (12 cores) workstation, Windows 7 Professional, 16 GB RAM
2	12TB high speed enterprise-grade storage, RAID6
2	LTO3 tape drive
6	21" flat screen monitors
1	Hewlett Packard DesignJet T770 A0 (24") colour plotter
1	Brother J6910DW A3 colour inkjet multifunction printer
1	Gigabit (1GbE) network switch
1	Wireless Router Access Point
1	2.5 kVA UPS

#### 5.1.4 Software

The main geophysical, technical and spatial software components are listed in Table 10.

**Table 10 Processing Software**

Software	Version	Purpose
Claritas	v6.2.1.11983	Data processing and seismic QC
OMNI	v13.000	Survey design and planning
Global Mapper	v12.02	Manipulating spatial data
Copy+	V3.1.0 RHEL	Recording and verifying data to tapes
Testif-i	v2.05	Processing Vibrator and Instrument tests

Claritas is the processing software used to import, analyse raw seismic data, and geometry using imported SPS files. It is also used to generate field stacks and export geometry applied data in SEG Y format.

OMNI is used to analyse pre-plot (pre-surveyed positioning) spatial data, import surveyed data, edit or move stations, add infill stations, generate recording scripts (set of computer instructions for the recording system on spread geometry for each shot point).

Testif-i is a third-party software used to analyse instrument and vibrators' performance, flagging up any errors or early signs of failure. This is to independently verify the results alongside the built-in QC software in the Sercel recording system.

Global Mapper is a mapping package that is used to import a variety of spatial data set types, to generate maps and to process and reformat spatial data to be used in other packages such as OMNI.

Copy+ is used to read, write and verify data to and from tapes.

### 5.1.5 In-Field QC Processes

The schematic in Figure 7 outlines the interaction and data flows between the QC department and the other crew operations.

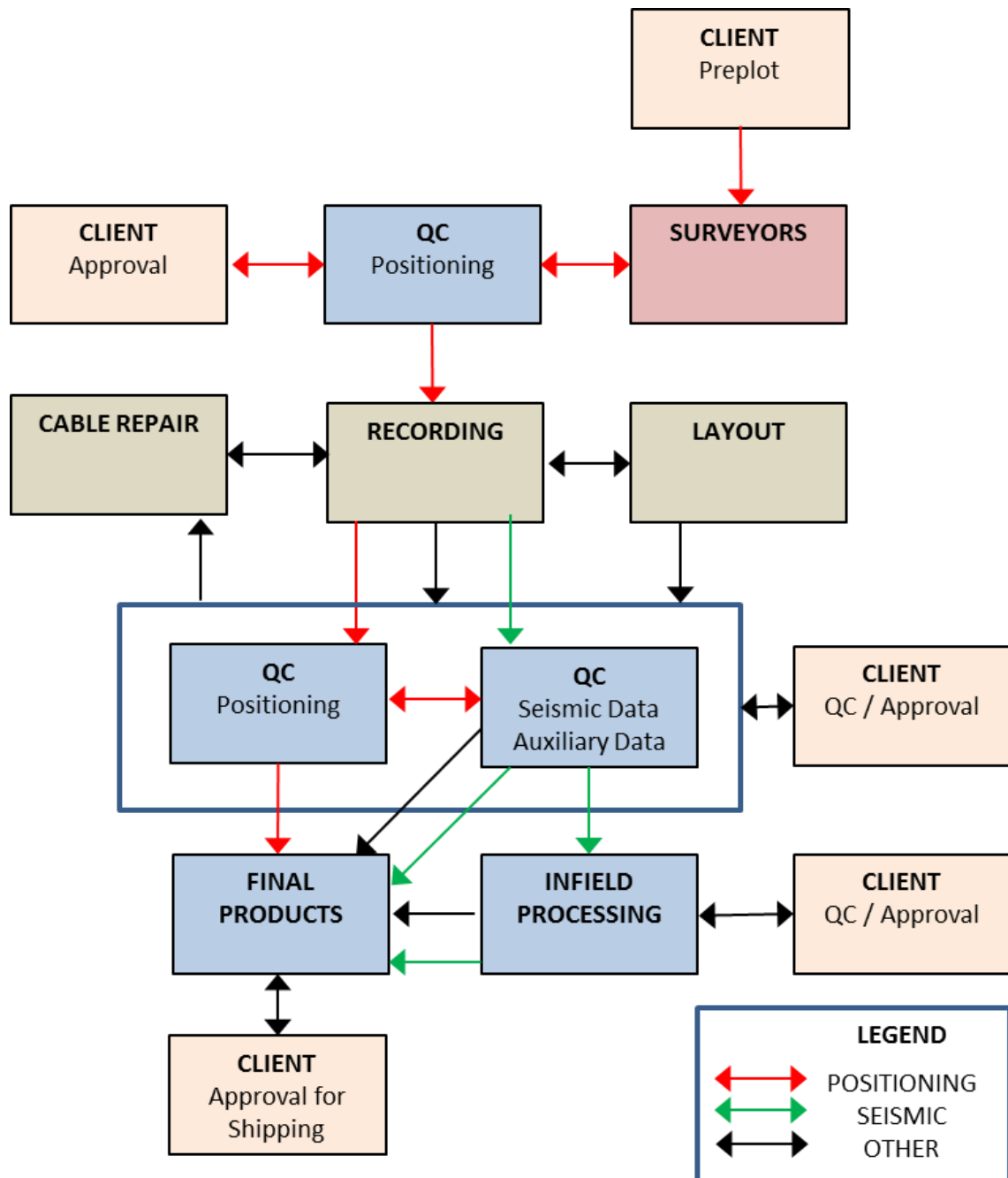


Figure 7 In-Field QC process diagram

The main responsibilities of the in-field QC unit are as follows:

- Maintaining the contracted geophysical specifications from the client.**  
 This included regular field visits to the line crews, vibrator fleets and the recorder, liaison with the client representatives on matters concerning the project's design, fold coverage, daily progress, data quality and compliance of the acquired seismic data with the contractual specifications.



- **Generation of recording scripts**  
A set of instructions with coordinates and spread geometry for the recording system and vibrator control and positioning.
- **Quality control of the seismic, navigation and support data**  
Including the analysis and processing of the co-ordinate data to generate a final corrected data set, and the analysis of the seismic data to identify and correct any issues.
- **Processing data to Field Stacks**  
Using the final co-ordinates the data was processed to generate a field stack. Along with a first look at the processed data, these stacks provide additional quality control along with additional information such as first pass velocities for the processing centre.
- **Generation and shipment of final data products**  
To the processing centre for the final processing, the client for data archival along with the provision of test data and field stacks for further client assessment
- **HSE Compliance**  
The In-Field QC unit are heavily involved in the HSE programme of the crew with personnel attending the daily HSE toolbox meetings, operational meetings, weekly Safety Sunday sessions, reporting hazards, near-misses and Take 5s using Terrex Seismic's reporting system.



*Photograph 1 QC processing and backup systems including tape drives*

## 5.2 Project Start-Up

### 5.2.1 Acquisition Parameter Tests

Prior to main acquisition, a testing regime was undertaken to investigate vibe distortion and wave field propagation. Pre-tests of the vibes in camp consisted of the following:

- Hardwire on two locations, Floodplain (camp) and Sand dune (behind camp).
- Distortion level test in relation to the force level using Testif-i. Refer Figure 13 for Vibrator hardwire, performance test.
- Vibe similarity test: radio channel and wireline analysing force and distortion at the two locations.
- Vibe GPS checks, each vibe checked Vs Omnistar using a vibe scout.

Following the pre-tests an experimental line was laid on part of source line number 5328, and the following parameters were used:

- Linear sweep 16 seconds, 4-84Hz, Tapering 500ms for the low end, 250ms for the high end.
- Geophones bunched around the peg.
- Testing the use of fleets of one and five vibrators
- Recording both uncorrelated and correlated records.
- VP Range 1035-1341 on test line as part of source line 5328
- Receiver Range 1001-1376 used for the test production but with a 10 m receiver spacing

Later, on the experimental line two vibrator runs were made with the force levels specified below. The following arrays were tested:

- One Vibrator located on source point, 10m shot spacing, 60% drive level.
- Five vibrators, spaced 20m apart with array centred on source point (middle vibe located on source point). Shoot every 5th peg, i.e. 50m shot spacing, 50% Drive level.

Correlated and uncorrelated data of the experimental tests were recorded in field, distortion and frequency content were analysed, following these tests the acquisition parameters were revised and per contractual agreement modified to 12 Sec Sweep, 6-90 Hz 70% Force level, 250ms Start/End tapers.

In Addition to the tests described above, the following tests were also performed prior to the production acquisition:

- Vibes GPS verification tests checked that the vibe locations were accurate by comparing that to OmniStar readings at the same locations.
- Instrument and geophone tests were conducted to ensure all were within specification.

Test results were dispatched to Santos. An example of the result is shown in Figure 8 and Figure 9.



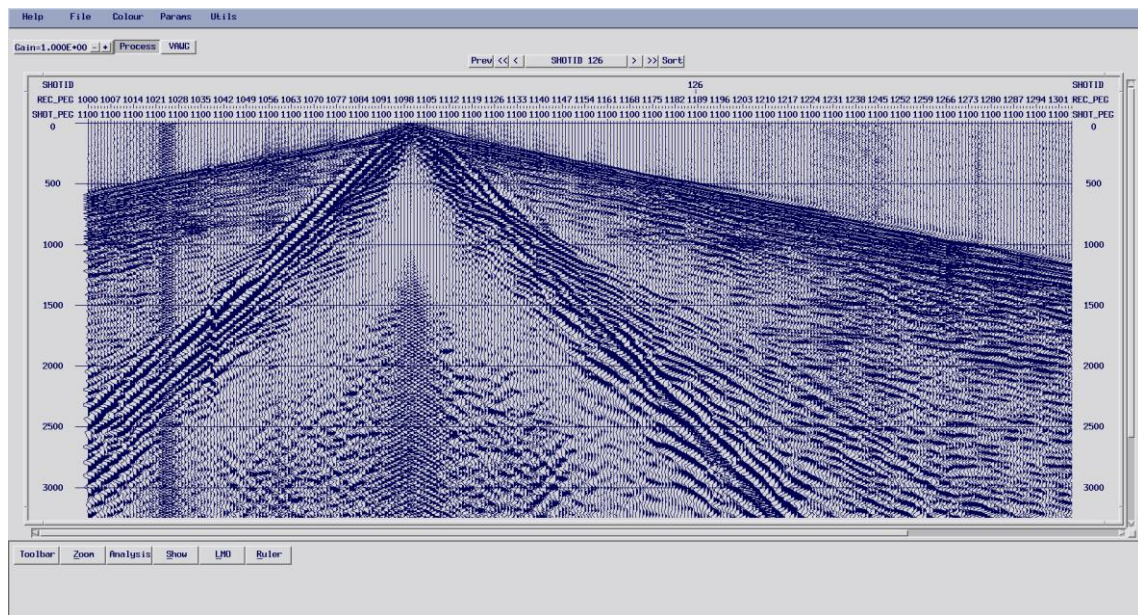


Figure 8 Experimental line: Shot Record: One vibe 10m receiver/source interval

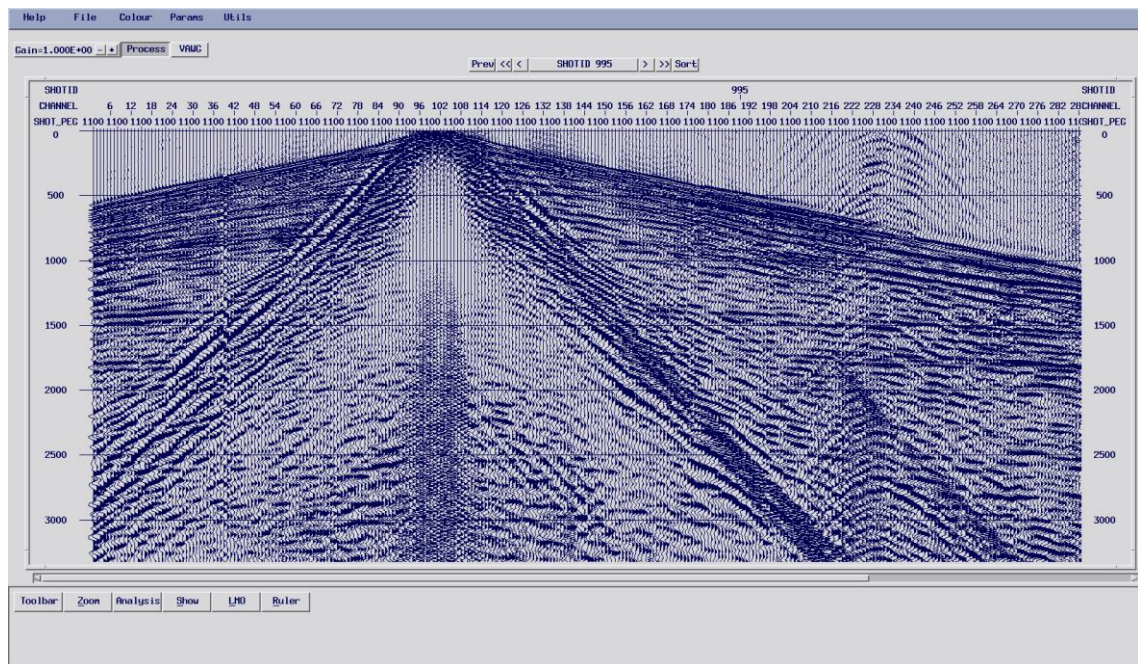


Figure 9 Experimental line: Shot Record: Five vibes 50m source interval 10m receiver interval

The recording parameters as agreed with the client representative on crew and used for production can be found in section 4.2.

## 5.2.2 Navigation Data

The survey was acquired using a survey projection of MGA zone 54 and the GDA94 datum. The SPS files were in standard 2.1 format, as described in Table 14 and Table 15.

The same recording parameters were used for the whole project, the point codes listed in Table 11 were recorded in the SPS files.

**Table 11 Point codes for the source and receiver types**

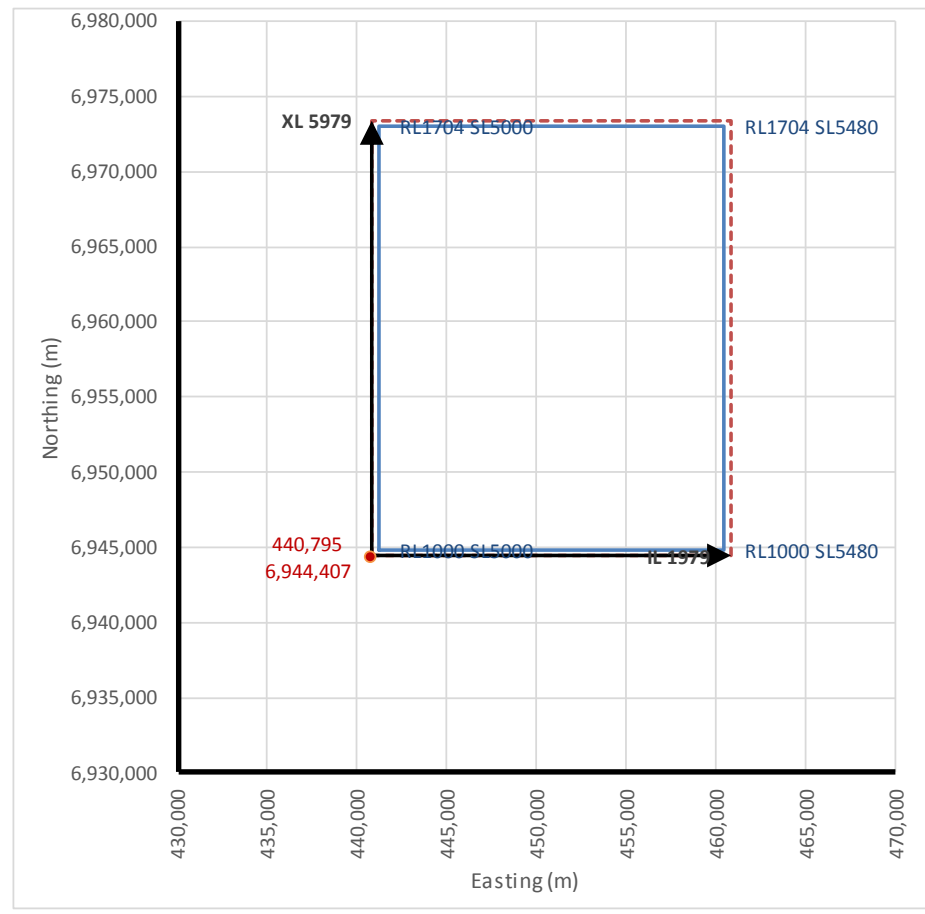
Point Code	Description	Usage
<b>Receiver Arrays</b>		
G1	6 geophones bunched, centred on station, 40m interval	Whole project
<b>Source Arrays and types</b>		
V1	1, 6 – 90 Hz linear, 250 ms tapers 12 second sweep	Whole project

### 5.2.3 Acquisition Grid

Details on the acquisition and processing grids can be found in Figure 10.

ACQUISITION GRID Defined at Source and Receiver Line intersections.							
	RL	SL	Easting	Northing	IL	XL	CDP
1	1000	5000	441205	6944817	1999	5999	19995999
2	1000	5480	460405	6944817	1999	6959	19996959
3	1704	5000	441205	6972977	3407	5999	34075999
4	1704	5480	460405	6972977	3407	6959	34076959
Azimuth	90	0	Degrees				
Spacing	40	40	m Per Unit				

PROCESSING GRID Defined at cell centres.							
	RL	SL	Easting	Northing	IL	XL	CDP
1	990	4990	440795	6944407	1979	5979	19795979
2	990	5490	460795	6944407	1979	6979	19796979
3	1714	4990	440795	6973367	3427	5979	34275979
4	1714	5490	460795	6973367	3427	6979	34276979
Azimuth					90	0	Degrees
Spacing					20	20	m per cell





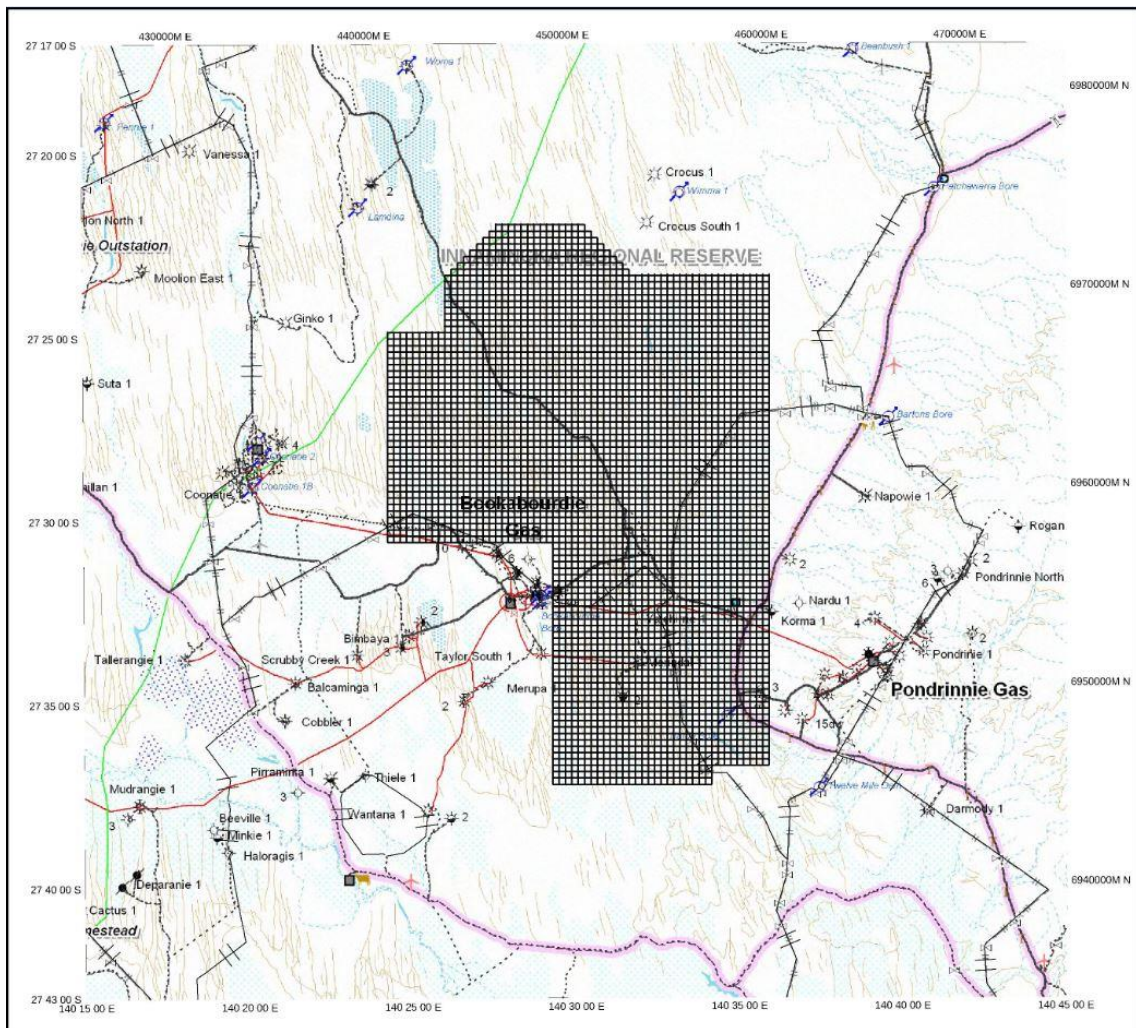


Figure 10 Map showing location of survey.

#### 5.2.4 Processing Parameters Testing

The in-field seismic processing was performed utilising the Claritas seismic processing system running on an enterprise-grade Linux processing workstation. At the start of the project, the processing flows were carefully selected from a standard set of Terrex Geophysical proven flows. These flows were tested and processing parameters were optimised to accommodate the unique requirements of this project. Such as geometry, source type, recording parameters, geology and objectives. The processing parameters selected can be found in Table 12.

#### 5.2.5 Processing Sequence

The processing sequence applied is detailed in Table 12. The processing commences with the seismic data once the daily SPS files have been validated, corrected (if required) and combined. A schematic flowchart of the data processing is included in Figure 11.

**Table 12 Standard field stack processing parameters**

Process	Parameters	Comments
<b>PRE-PROCESSING</b>		
Reformat SEG2 to Claritas format		Excluding void files Remove “non-live” traces
Apply geometry	From validated SPS files	Add CDPs to headers
<b>Write to SEG2</b>		For shipping to the processing center
Discard Auxiliary traces		
<b>SIGNAL PROCESSING AND DATA CONDITIONING</b>		
Correction to floating datum	Elevation statics applied to a smoothed datum. Replacement velocity 2100 m/s	
Resample	4 ms	
Spherical divergence	Velocity Power: 1.0 TWT Power: 1.0 Scale Factor: 1.5 X (offset) Power: 0.5	Velocities from smoothed NMO file
Trace Amplitude Balance	1000 – 4000 ms	
Airwave Mute	330 m/s, 50ms mute, 100ms taper	
Elevation Statics	Correct to floating datum Replacement velocity 2100 m/s	
FK filter	+ve dip cut off of 16 ms / trace Taper 0.35 of KNyquist	Inside 110% NMO wrapper
Surface consistent deconvolution	Gap: 16 ms Operator Length: 176 ms White noise: 0.1% Manually picked offset dependant design gates	
Sort to CDP order		
<b>VELOCITY AND STATICS MODELLING</b>		
Velocity Analysis	Every 100 CDP Every 100 <sup>th</sup> Inline	Interactive picks NMO supplied in shipment as Claritas text format
Normal move-out correction	70% stretch mute	
AGC gain	500 ms window	
Surface consistent residual statics	Window: 1250 2500 ms Max shift: 8 ms Iterations: 8	
<b>GENERATION OF FIELD STACKS</b>		
Stack	Stack with unity	
FX deconvolution	Filter length: 19 traces Window: 50 traces	
Correction from floating to final fixed datum.	Datum elevation 100 m Replacement velocity 2100 m/s	
Update stack headers	Shot point number at CDP Co-ordinates and elevations at CDP location	

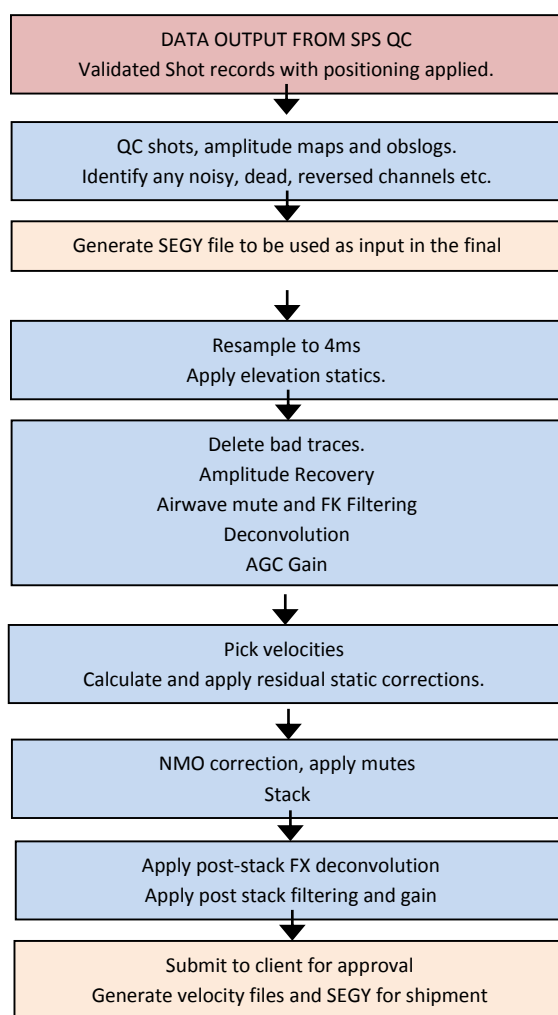


Figure 11 Data Processing Flowchart

## 5.3 Data Quality Control

### 5.3.1 Instruments Testing

As part of the internal QC conducted by observers in the field, a set of standard instrument tests are run prior to each day's recording to confirm that all the instruments are in working order, as listed in Table 13. The test data is then processed and analysed by the QC unit using Testif-i, to provide an independent confirmation of the test results. All values are well within manufacturer tolerances. An example display is included in Figure 12.

Table 13 Daily instrument tests

	TEST	THRESHOLDS
1	Gain tests	Max error 1.0% gain, 20us phase
2	RMS noise tests	Max 0.25 uV
3	Common mode rejection tests	Min 100 dB
4	Cross-feed tests	Min rejection 110 dB
5	Total Harmonic Distortion tests	Max -103 dB
6	Impulse tests	N/A
7	Impedance tests	

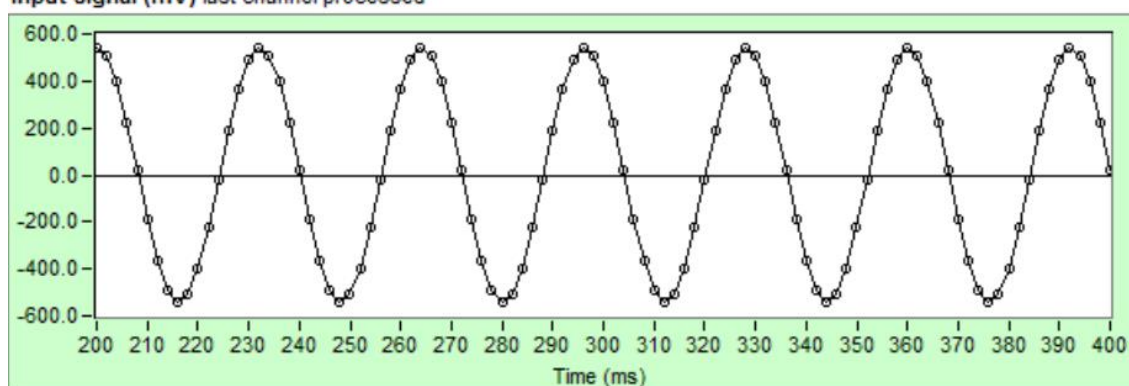
## Distortion Analysis

Title for Tests  
Printed on All Results Pages

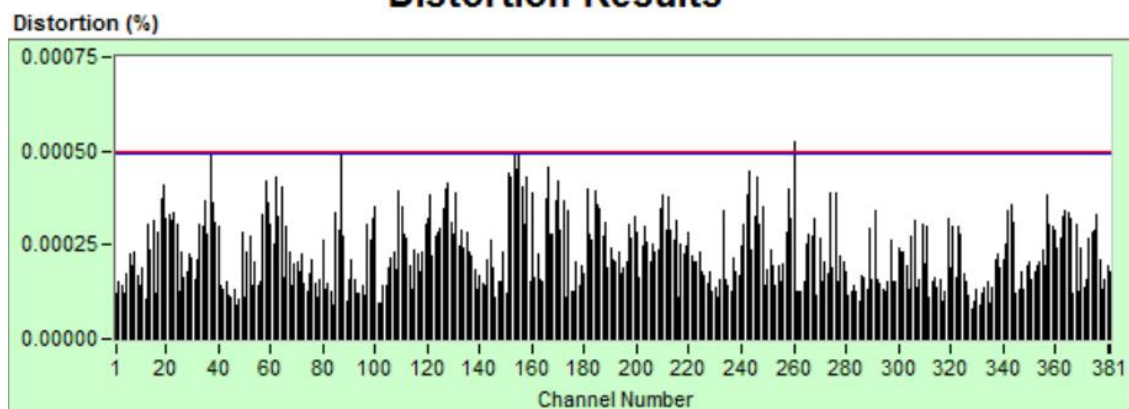
Recorded on 19th September '15 at 1:20:53 pm  
Processed on 19th September 2015 at 7:56:09 pm

1st Record <input type="text" value="90012"/>	No. Records <input type="text" value="2"/>	First Channel <input type="text" value="0"/>	Start Time <input type="text" value="200"/>
Record Found <input type="text" value="90012"/>	Specification (%) <input type="text" value="0.00050"/> %	No. Channels <input type="text" value="0"/>	End Time <input type="text" value="0"/>
Channel Read <input type="text" value="381"/>	Full Scale (mV RMS) <input type="text" value="1408.00"/>	No. Harmonics <input type="text" value="0"/>	Sample Interval (ms) <input type="text" value="2.00"/>

Input Signal (mV) last channel processed



## Distortion Results



Average Distortion (%) <input type="text" value="0.00021"/>	Median Signal (dB) <input type="text" value="-11.2626"/>	Maximum Distortion (%) <input type="text" value="0.00052"/>	Median Frequency (Hz) <input type="text" value="31.2500"/>
Standard Deviation <input type="text" value="0.000094"/>	Median Signal (mV RMS) <input type="text" value="385.010"/>	Minimum Distortion (%) <input type="text" value="0.00008"/>	Number of Failures <input type="text" value="1"/>

Testif-i Version 2.07a, licence 818319114 next update 3. © Verif-i Ltd.

Figure 12 Example distortion test from Testif-i

### 5.3.2 Vibrator Hardwire Similarities

At the start of the job, the observers carried out hardwire tests on all vibrators in production and processed in Testif-i. Regular testing was conducted thereafter to ensure performance remained within specifications.

The In-Field QC unit analyses the Testif-i results to ensure the vibrators are performing within specifications and to advise the relevant personnel of any possible deterioration in performance.

It must be said that hardwire tests are very dependent on sweep parameters and ground conditions. Harsh sweep parameters that fall outside the manufacturer specifications for the Vibroseis and hard, uneven ground surface will adversely affect the results. Where ground parameters were believed to be having an excessive detrimental effect on the hardwire results a second test was run on more suitable ground, if practical. An example hardwire test can be found in Figure 13.



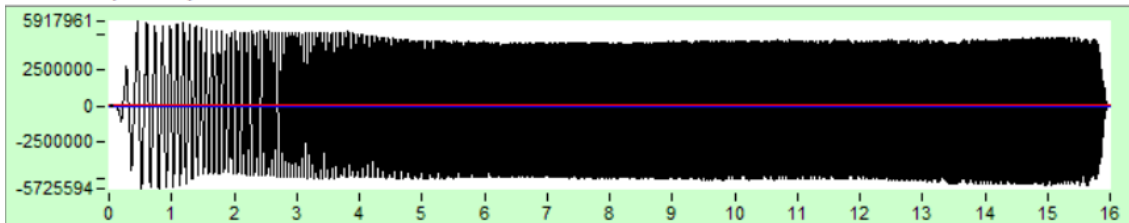
## Vibrator Analysis

Title for Tests  
Printed on All Results Pages

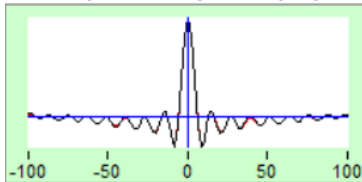
Recorded on 19th September '15 at 9:35:47 am  
Processed on 19th September 2015 at 9:38:26 am

Record to Process 47	Reference Chan. 5	Minimum Frequency 5 Hz @ -20 dB	Force Channel 6
Record Found 47	Start Time Ref. 4	Maximum Frequency 84 Hz @ -20 dB	Baseplate Channel 0
No. Harmonics 0	Sweep Start (s) 0.000	Sweep Length (s) 16.000	Mass Channel 0
			Vibrator Id. vibe7-70%

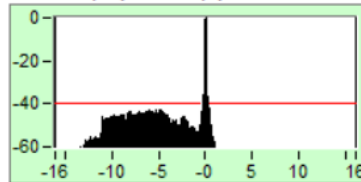
Data Trace (Pounds)



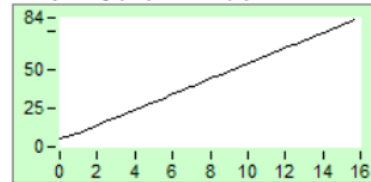
Wavelet (Normalised) v Time (ms)



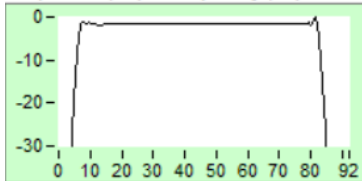
Wavelet (dB) v Time (s)



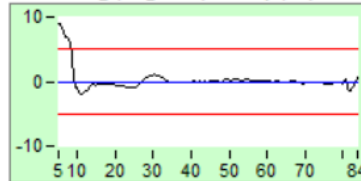
Frequency (Hz) v Time (s)



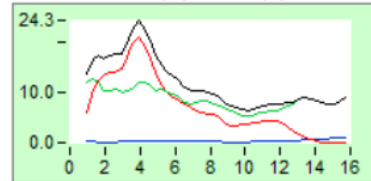
Amplitude (dB) v Frequency (Hz)



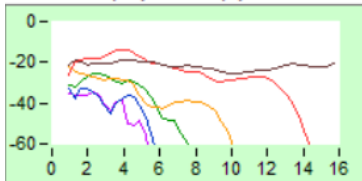
Phase Lag (Degrees) v Freq. (Hz)



Total Distortion (%) v Time (s)



Harmonics (dB) v Time (s)



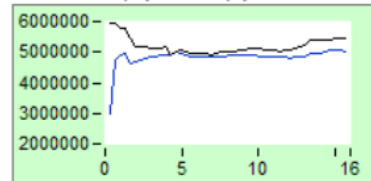
2nd  
3rd  
4th  
5th  
6th  
7th

Start Time  
Error (us)  
0

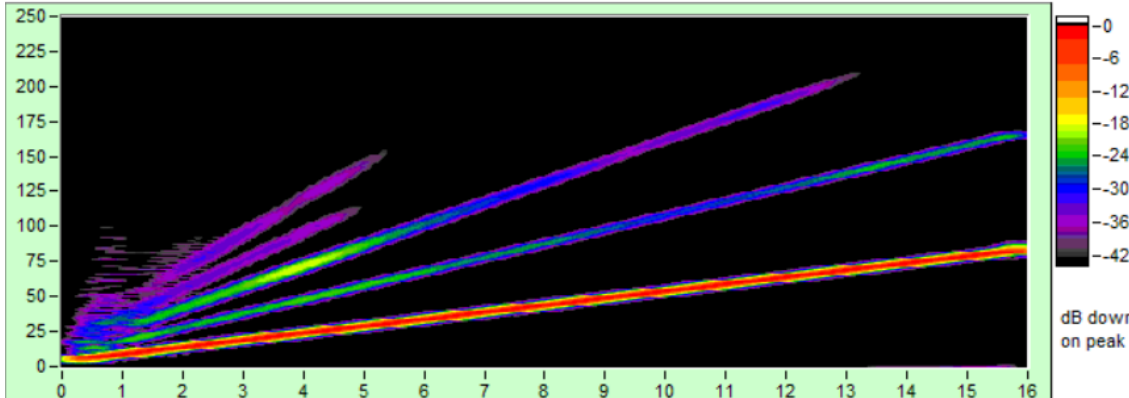
Cursors at  
+/- 20%

Total  
Even  
Odd  
Sub  
Raw  
Fund

Peak Force (lb) v Time (s)



Amplitude (dB) v Frequency (Hz) v Time (s)



Testif-i Version 2.07a, licence 818319114 next update 3. © Verif-i Ltd.

Figure 13 Vibrator hardwire, performance test



### 5.3.3 Geometry Validation

Where the vibrators were offset more than 5m from the surveyed location, the final source co-ordinates were derived from the vibrator GPS, at the Centre of Gravity (CoG) of the pad locations of each vibrator in the fleet, with the elevations interpolated from the raw survey data.

Particular attention was given to this part of the operation as coordinating shots and receivers are critical to the integrity of the acquired seismic data. A well-developed Terrex Geophysical system utilised dedicated seismic positioning software called OMNI, and automated scripts and templates to generate an accurate final SPS dataset containing only valid records. A schematic of the process flow from receipt of data from the recorder, through verification to generation of final corrected SPS files is shown in Figure 14.

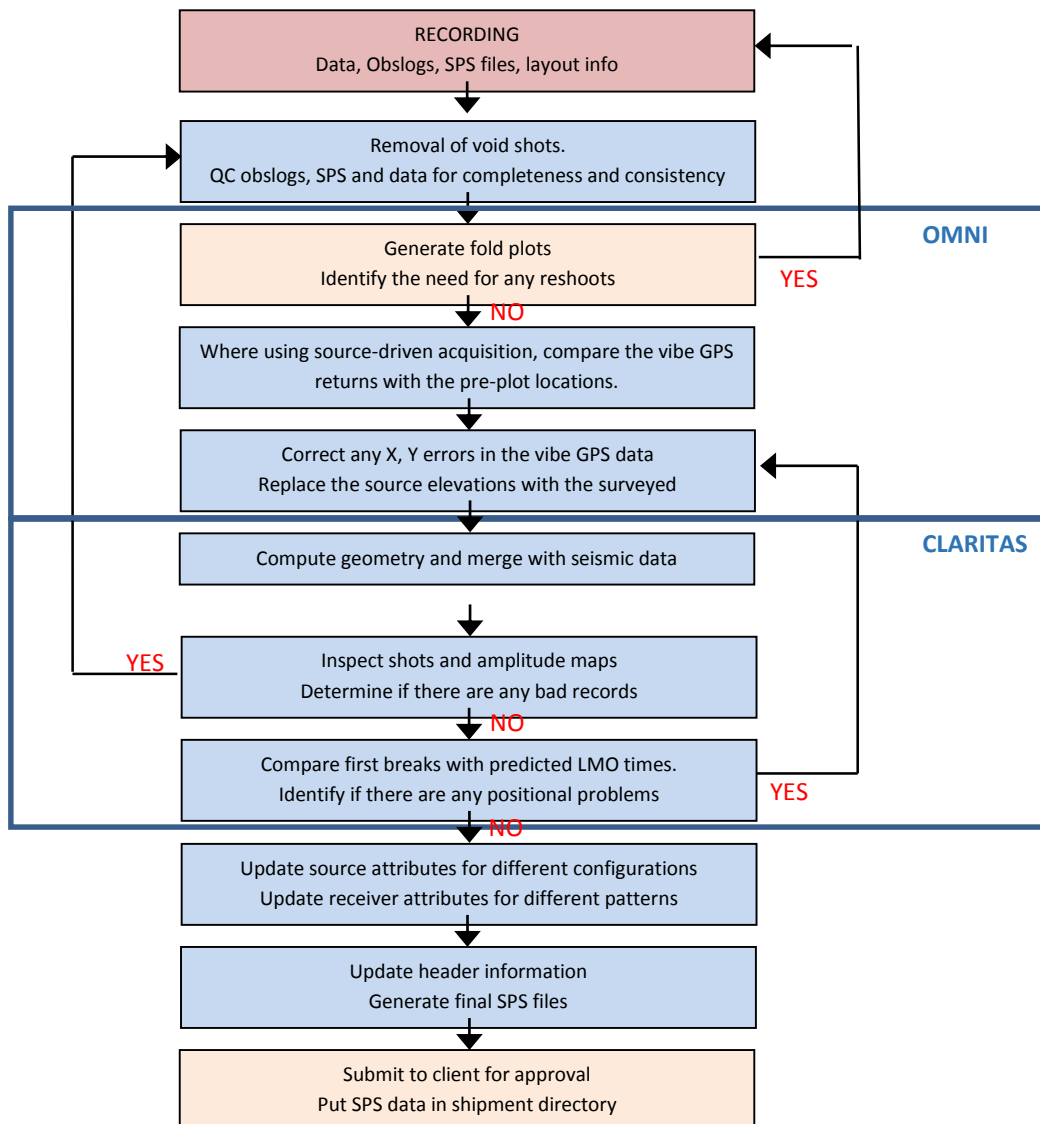


Figure 14 Flowchart of the navigational QC process

The vibrator GPS was compared to the surveyed location, both statistically and graphically, as shown in Figure 15.

Large offsets (>5m) were analysed in conjunction with comments in the observer logs or with the observers themselves. Where the offsets were legitimate, they are included, otherwise when known the co-ordinates are corrected, otherwise the VP is either reshoot or voided as a skip.

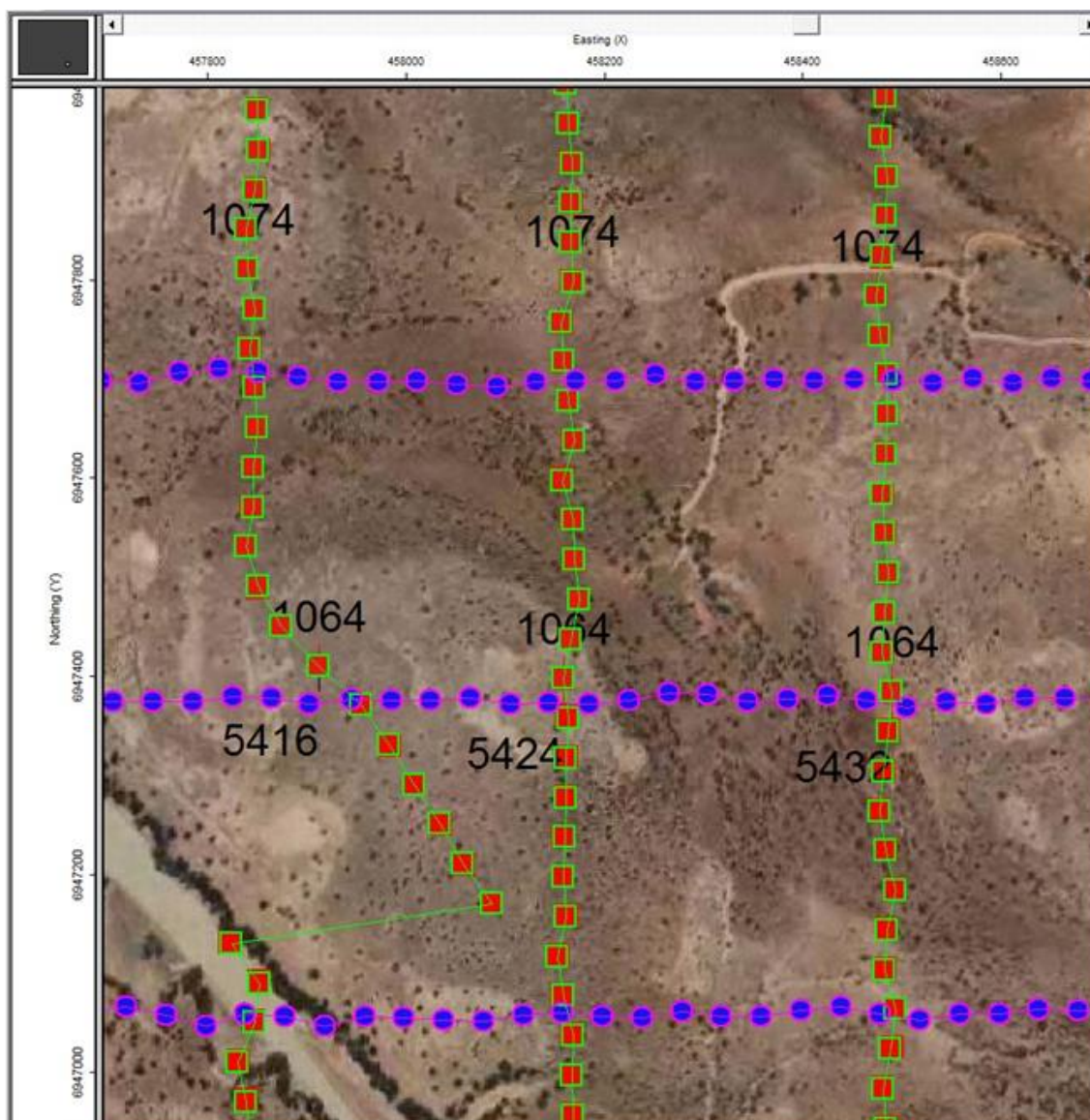


Figure 15 Checking vibrator array CoG against survey positions

The Field seismic data was verified using the Claritas processing software. Raw shots were analysed and seismic data integrity checks were performed promptly after receiving the data. In case of anomalies such as geometry errors, missing shots or below-specification shots, the In-Field QC unit reported the issues to the observers, vibrator technicians and any other relevant personnel before the spread was picked up in order to rectify errors.

The first stage of the data processing includes a QC of the navigational data. The valid seismic data was merged with the navigation data. Each shot is reviewed to identify any noise or data issues, first arrival times are predicted using a constant velocity linear move-out based on the observed moveout of the first breaks and overlaid on the gathers (as shown in Figure 16 & Figure 17) to identify any mis-positioning issues. Common source and common receiver stacks of the LMO corrected data are also generated as shown in the examples in Figure 19.

Any mis-positioned sources & receivers or spread errors are identified as timing errors in the LMO displays and the cause is investigated and corrections made to the SPS files and updated in the data prior to the SEG Y generation and further processing. This ensures the SPS files are correct and accurately represent the seismic data.

All supplied positioning data were delivered in SPS v2.1 format with a full set of descriptive headers which include projection and datum used for the coordinates and elevation data.

It should be noted that the original SEG-D seismic trace headers contain elevation data from the Surveyors GPS system and these should be updated using the supplied SPS files in the data shipment. The SEG-Y files already contain the updated correct elevation from survey and any XY corrections as the supplied SPS files were used to update the trace headers prior to exporting the SEG-Y files.

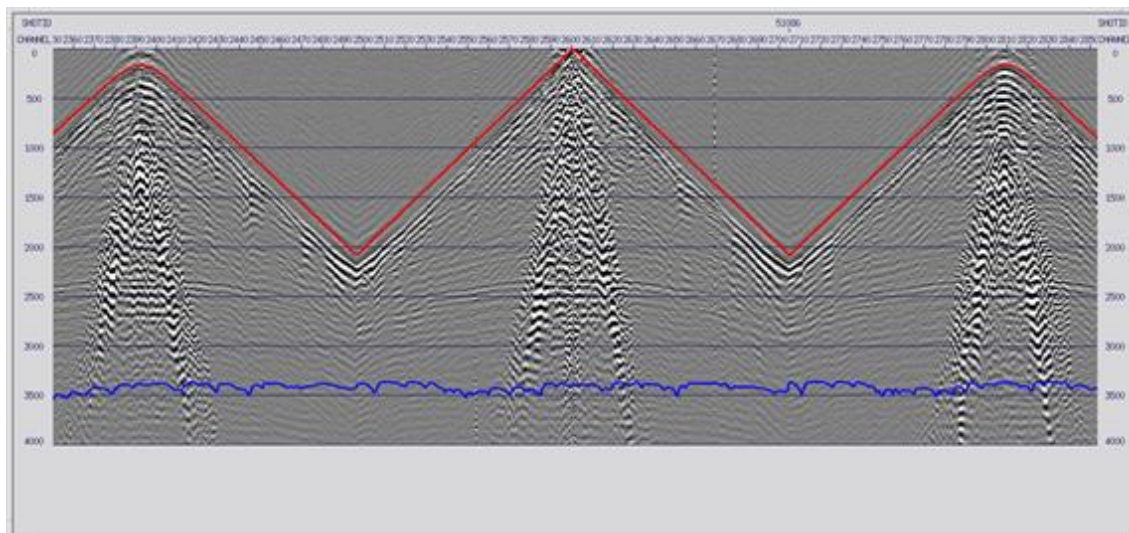


Figure 16 Near offset geometry check (FFID50844)

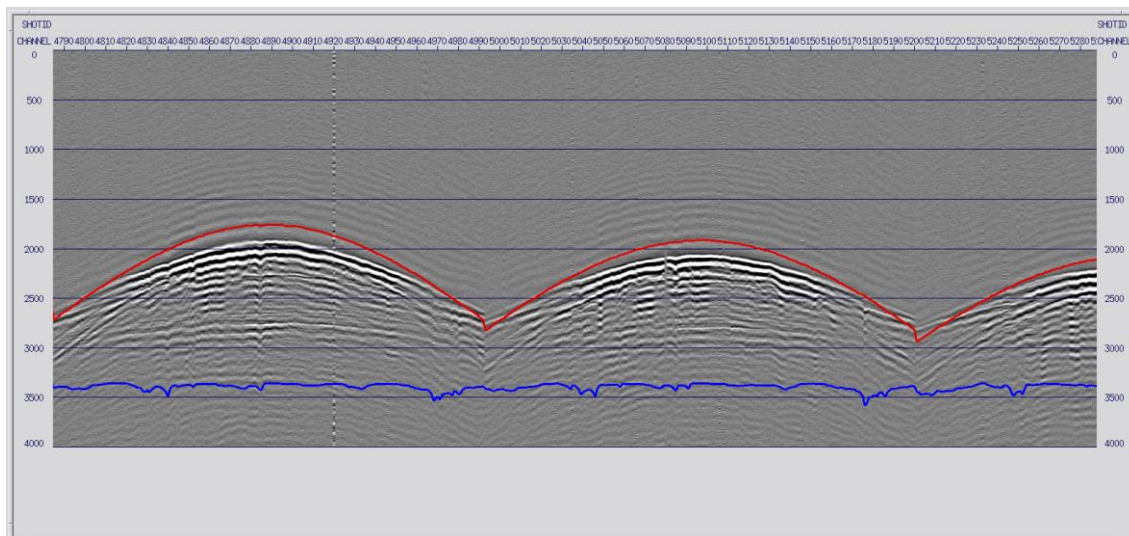


Figure 17 Far offset geometry check (FFID50844)

The geometry check image in Figure 16 & Figure 17 illustrates both near (top panel) and far (bottom panel) offset data. The red line is a velocity profile for a given offset using an average arbitrary velocity setting of  $2000 \text{ ms}^{-1}$ . The blue line is a plot of receiver elevation, which shows a number of elevation static issues present in the data. The ground roll at near offsets is spatially aliased due to the large receiver spacing and strong reflections are visible throughout the dataset.

A linear move out scan (LMO) was run to select an optimum velocity and offset range for first breaks analysis, as shown in Figure 18, this was checked daily to ensure the optimum velocity and offset range is used in the LMO stacks.



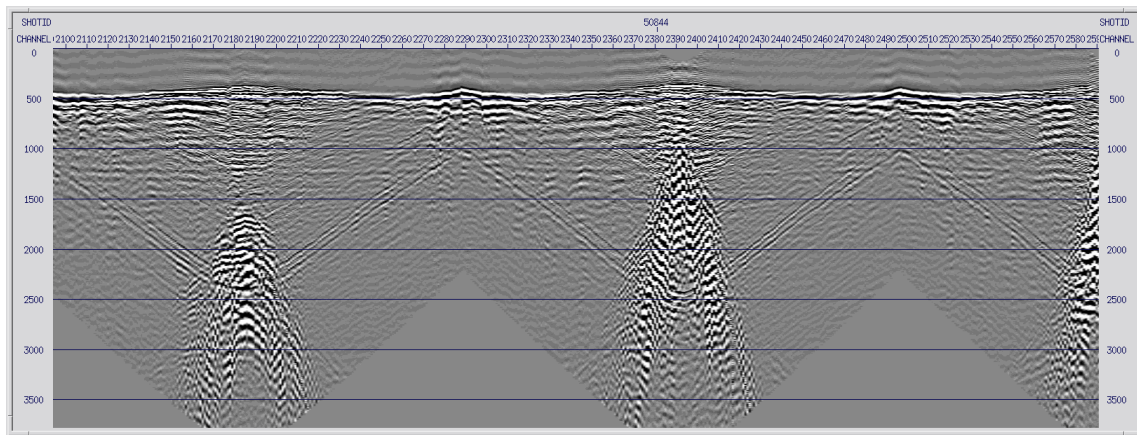


Figure 18 *LMO Flattening Check*

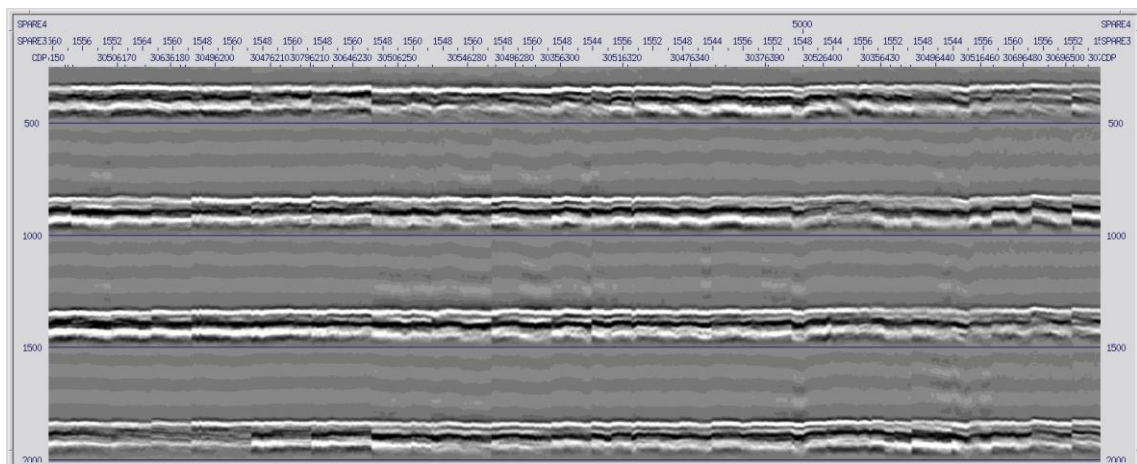


Figure 19 *Example common shot LMO stack*

#### 5.3.4 RMS Noise Analysis

Once the geometry is applied to the traces, the CDP fold is calculated and plotted (as shown in Figure 6) this is used to confirm that the data is complete and meets the client's specifications. Then an RMS map is generated to analyse the source(s) of any noise. A dedicated flow was used to filter out the first breaks and a spherical divergence filter applied to balance the amplitudes, and windowed for 500 to 3000ms. The RMS amplitudes were then plotted in separate maps for source and receivers, see Figure 19 and Figure 22. The noise patterns mirror the surface elevation, and represent more environmental noise at exposed locations. The two significant sources of noise are related to the seismic camp (centre) and Washington 1 well (north). Note these maps were generated prior to the last day of acquisition.

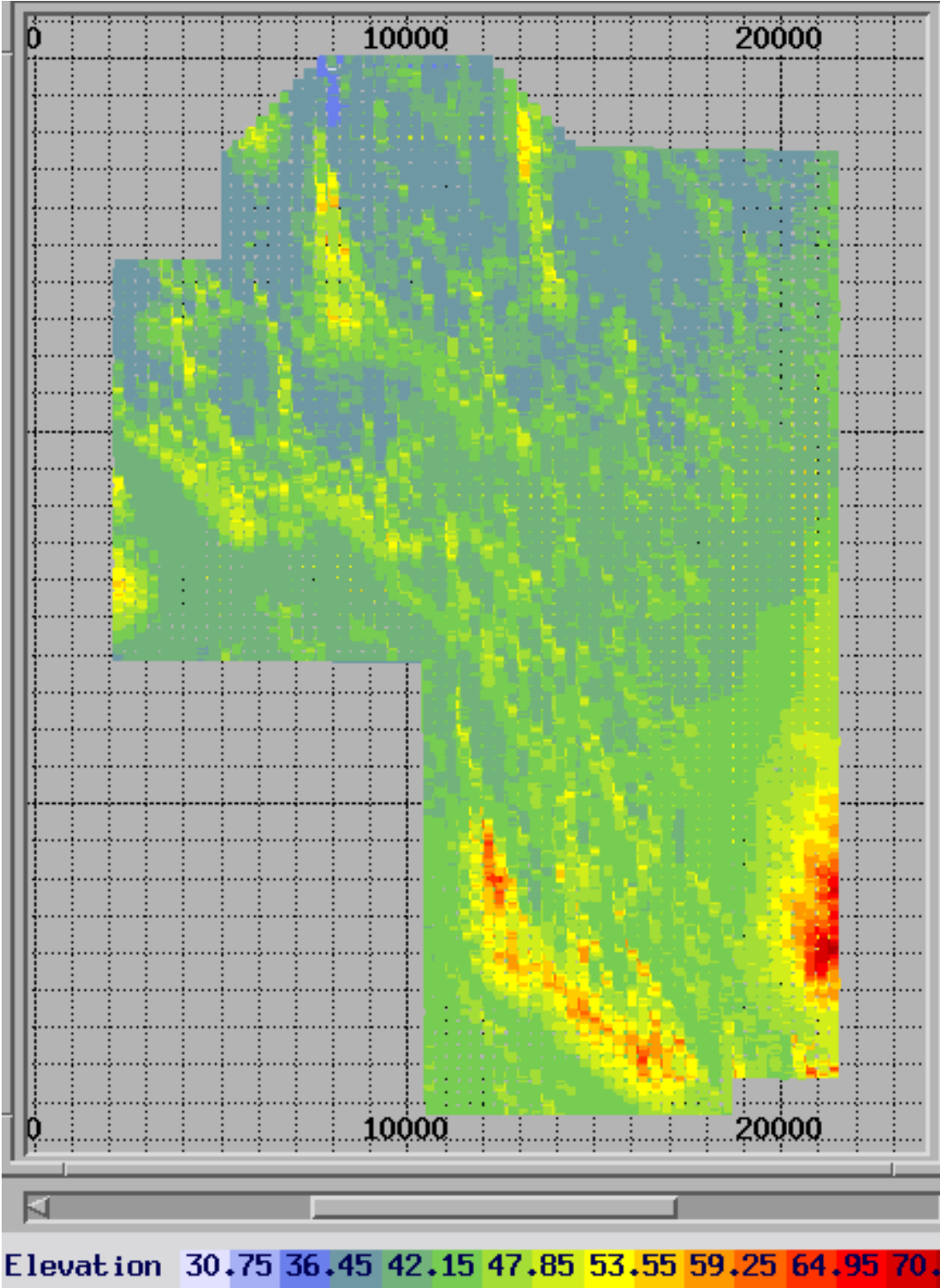


Figure 20 Map of source and receiver elevations.

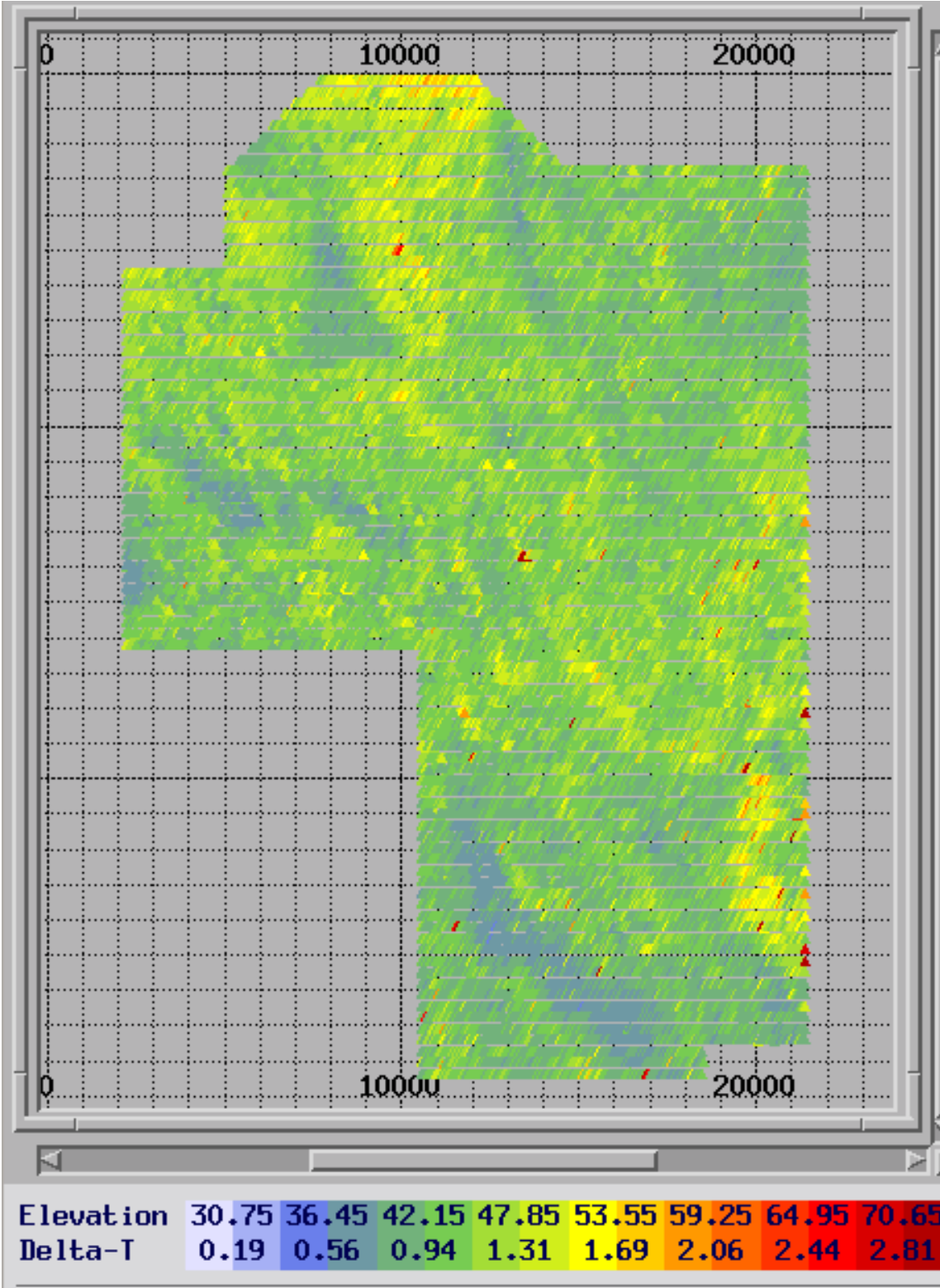


Figure 21 Receiver RMS Amplitude map

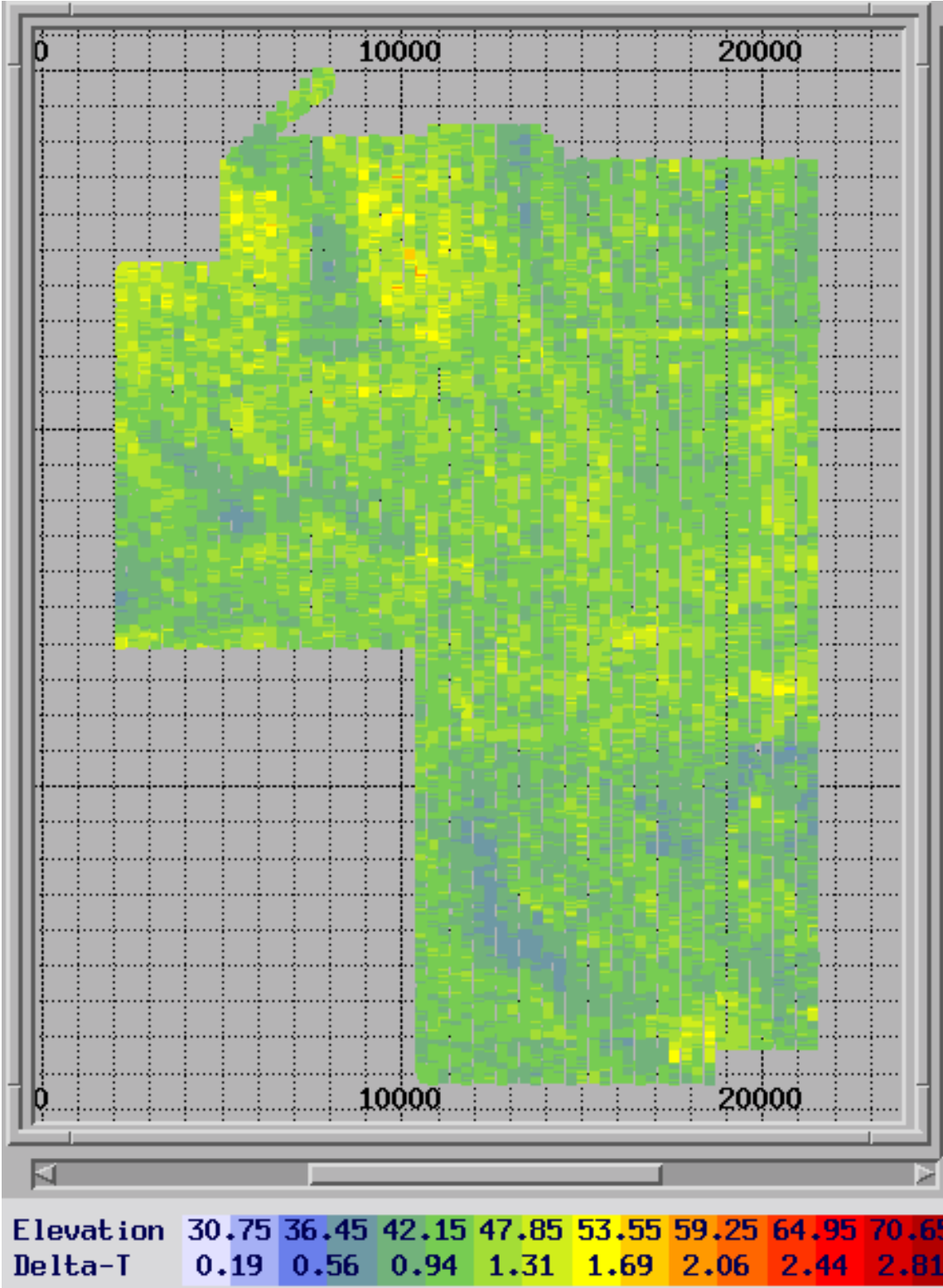


Figure 22 Shot RMS amplitude map

5.3.5 Signal Processing

Once the data has been QC'ed and any issues addressed, the signal processing steps detailed in Table 12 were applied, to balance the data and attenuate unwanted noise and events other than reflections prior to the imaging.



### 5.3.6 Interactive Velocity Analysis

As velocity analysis was carried out at regular intervals (see Table 12) on the data after the application of the signal processing. The velocities of the reflection events across the prospect were picked, in order to apply a normal move-out correction to account for the differing travel-times to the various offsets recording reflections from the same sub-surface point.

Velocities are picked interactively, by examining a range of analyses, as shown in the examples in Figure 23 and Figure 24.

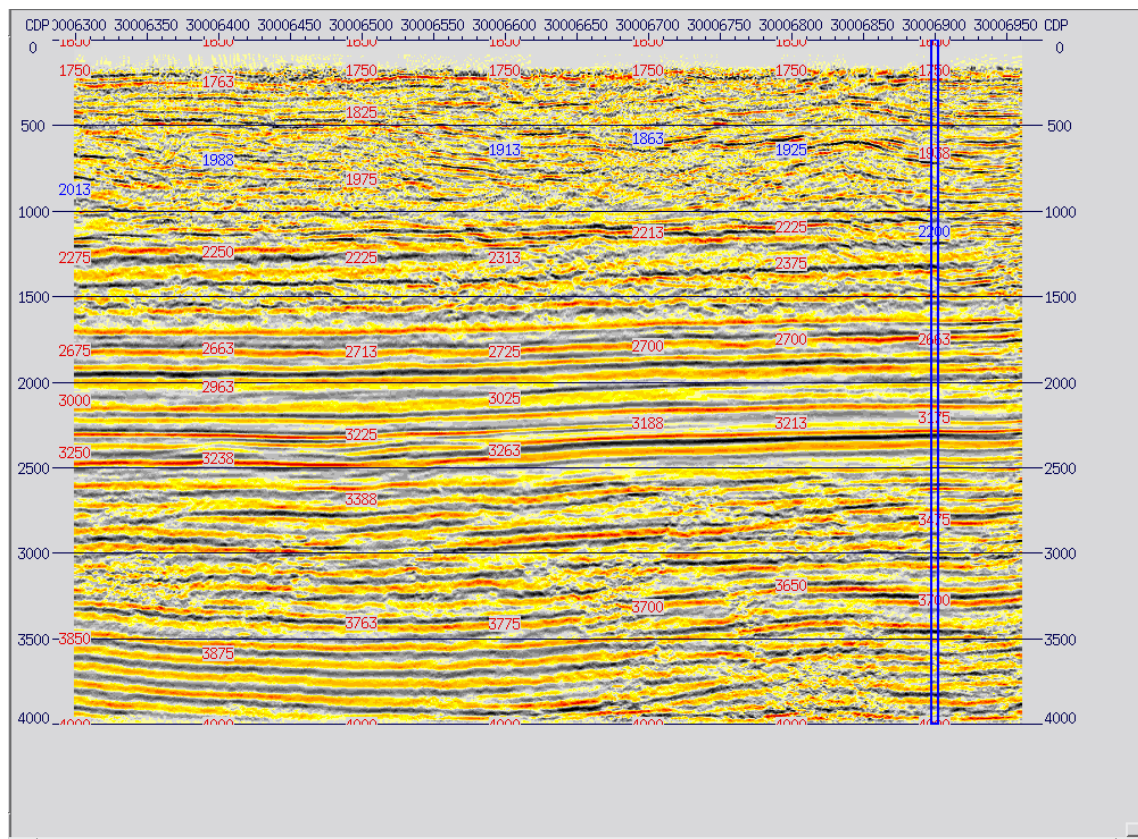


Figure 23 Stack window showing CDP picking

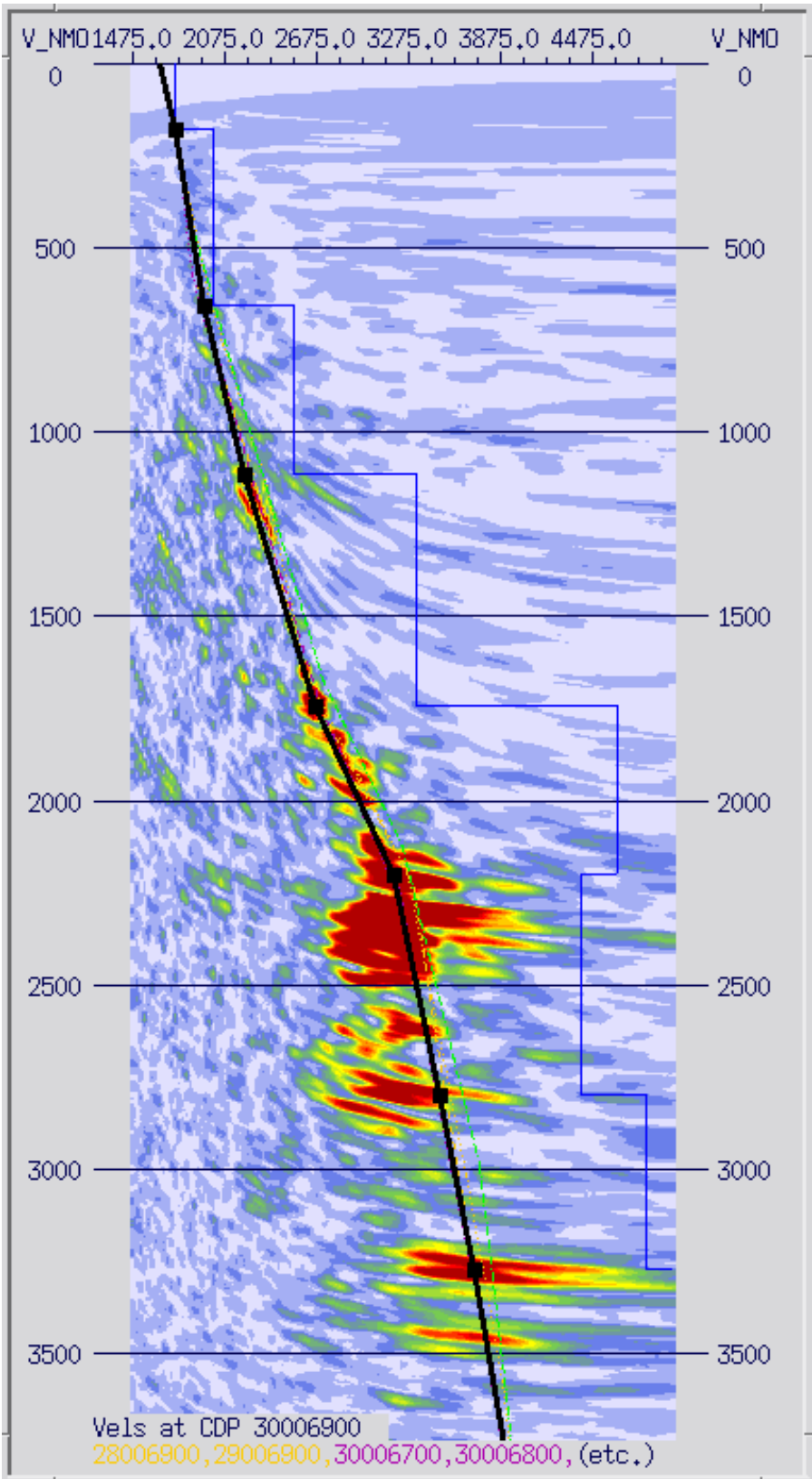


Figure 24      Semblance window

5.3.7 Residual Statics Correction

Time shifts between traces with the same reflection point were measured by cross-correlating the NMO corrected data over a window demonstrating the strongest reflections. This process is run iteratively to generate a surface consistent model of time shifts for each source and receiver that minimises the error with the measured time shifts. This process compensates for time shifts in the data caused mainly by velocity variations in the shallow weathering layer. The shifts are then applied to the data prior to stack. Maps of the calculated static shifts, can be found in Figure 25 and Figure 26. The static shifts generally follow the elevations of the dunes, indicating that they are correcting for the constant velocity assumption for the elevation replacement statics, both the source and receivers exhibit similar trends with minimal edge effects adding confidence to the veracity of the statics solution.

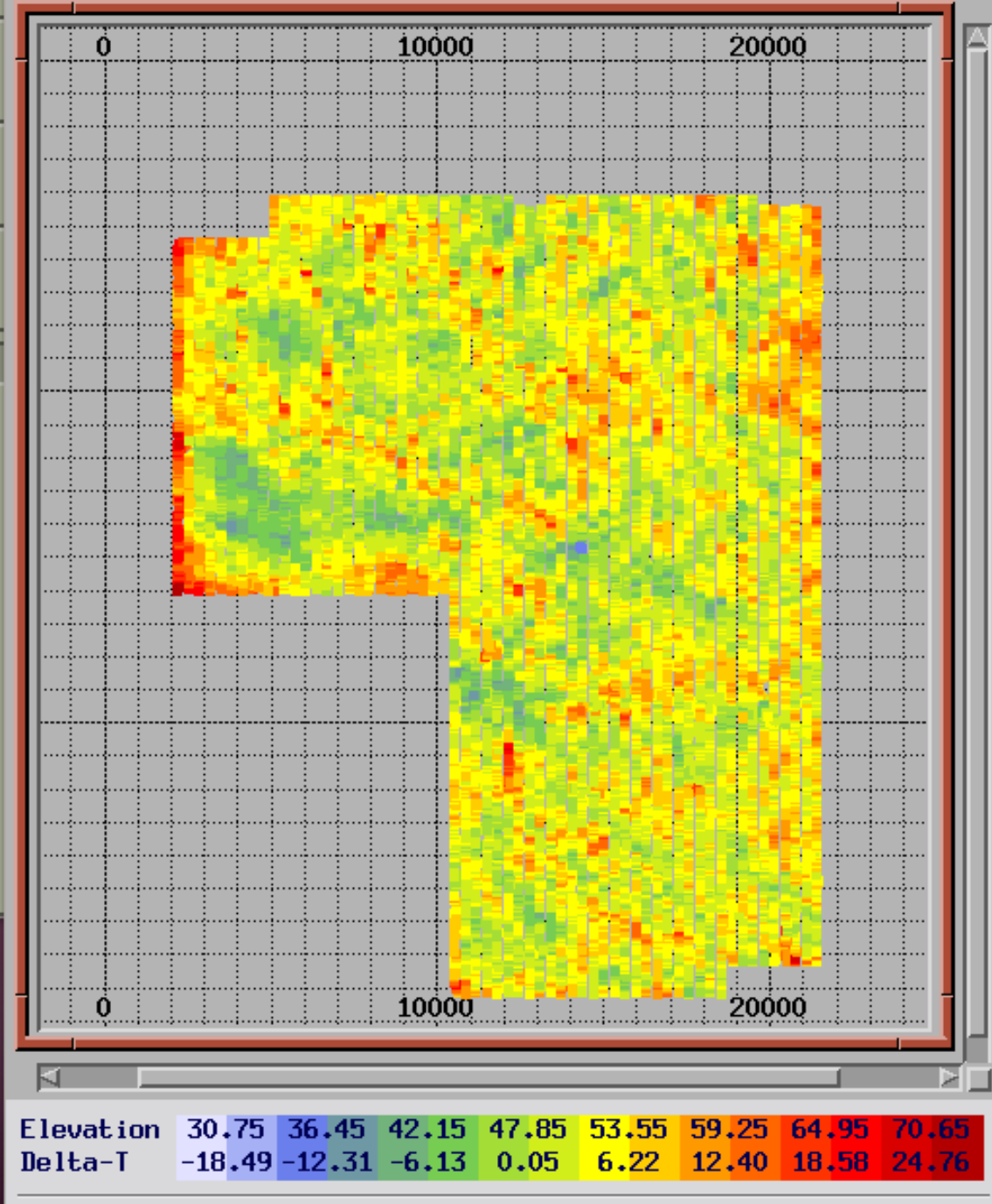


Figure 25 Source residual static map.

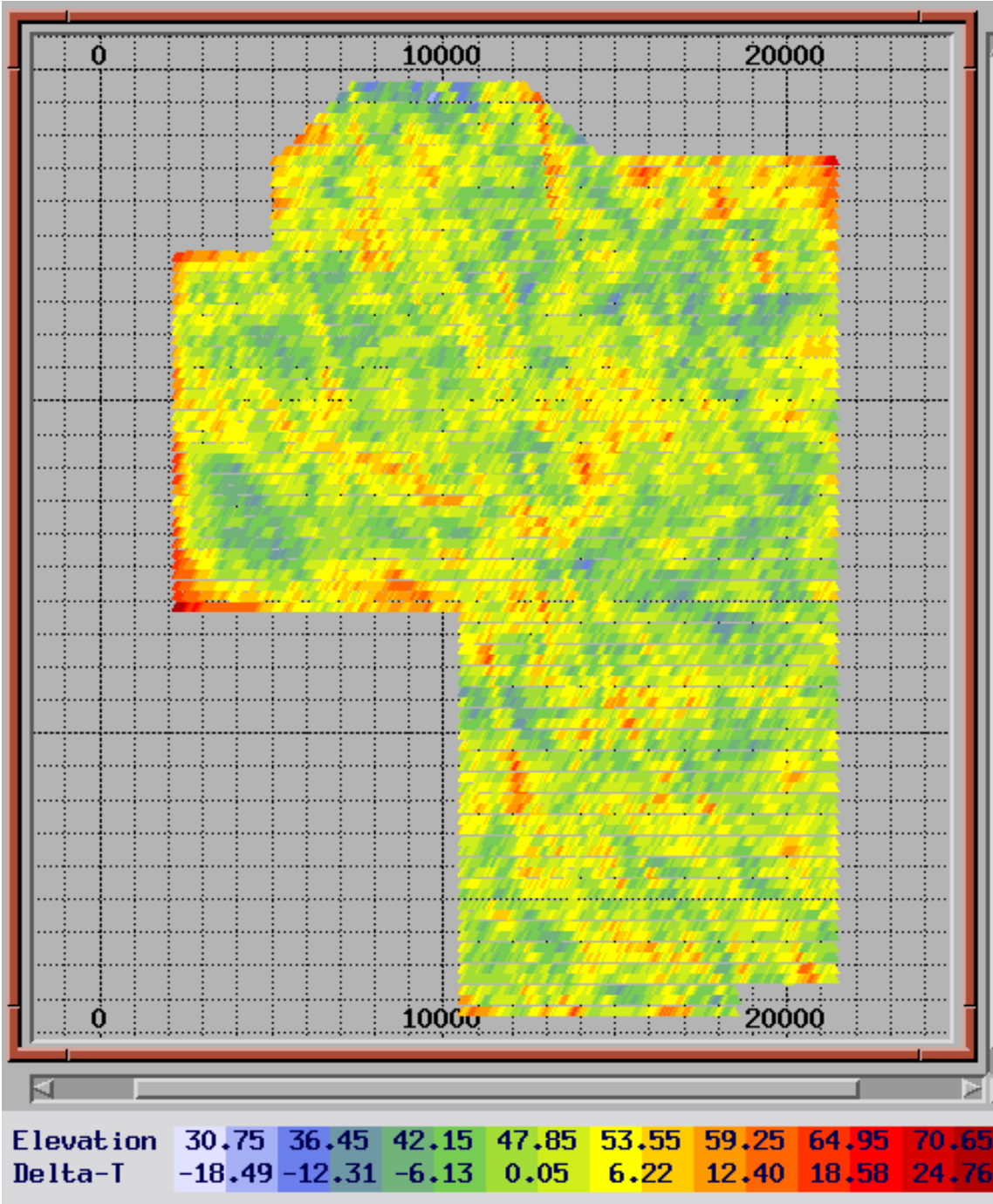


Figure 26 Receiver residual statics map.

5.3.8 Field Stack Generation

After the application of the picked velocity field and residual statics solution data with common midpoints are summed to generate the field stacks.

5.3.9 Generation of Final Products

The SPS co=ordinate files were written with a survey projection of MGA Zone 54 and the GDA94 datum, using the standard 2.1 format, as described in Table 14 and Table 15. The different source and receiver arrays utilised are recorded as point codes listed in Table 11.



**Table 14 SPS source and receiver format description**

Definition	Columns	Format
Record Identification	1	'R' or 'S'
Line name	2 – 11	F10.2
Point Number	12 – 21	F10.2
Point Index	24	I1
Point Code	25 – 26	A2
Easting (m)	47 – 55	F9.1
Northing (m)	56 – 65	F10.1
Elevation (m)	66 – 71	F6.1
Julian Day	72 – 74	I3
Time (hhmmss)	75 – 80	3A2

**Table 15 SPS relational file format description**

Definition	Columns	Format
Record Identification	1	'X'
Tape number	2 – 7	3A2
Record number	8 – 15	I8
Record increment	16	I1
Instrument code	17	A1
Source line number	18 – 27	F10.2
Source point number	28 – 37	F10.2
Source Index	38	I1
First channel in group	39 – 43	I5
Last Channel in group	44 – 48	I5
Channel increment	49	I1
Receiver line number	50 – 59	F10.2
First receiver point in group	60 – 69	F10.2
Last receiver point in group	70 – 79	F10.2
Receiver point index	80	I1

The validated raw seismic data updated with the geometry, and the field stacks were recorded in standard SEGY format, the header locations used are shown in Table 16. An example SEGY EBCDIC header is included in Figure 27.

Once generated the SEGY data is independently verified on another system with a stand-alone SEGY viewer, is then ready for shipment to the client and/or nominated processing centre. The raw dataset has no processing or trace deletion applied, and only the headers updated with the validated geometry information

**Table 16** SEGY header locations

INFORMATION	CLARITAS NAME	BYTE LOCATIONS	FORMAT	COMMENTS
File Number	RECORDNUM	9 - 12	4b-int	
CMP Number	CDP	21 - 24	4b-int	
Offset	OFFSET	37 - 40	4b-int	Decimetres – Signed
Rvcr elev	REC_HT	41 - 44	4b-int	Decimetres
Source elev	SOURCE_HT	45 - 48	4b-int	Decimetres
Source X	SOURCE_X	73 - 76	4b-int	Decimetres
Source Y	SOURCE_Y	77 - 80	4b-int	Decimetres
Rcvr X	REC_X	81 - 84	4b-int	Decimetres
Rcvr Y	REC_Y	85 - 88	4b-int	Decimetres
Year	YEAR	157 - 158	2b-int	
Julian Day	DAY	159 - 160	2b-int	
Hour	HOUR	161 - 162	2b-int	
Minute	MINUTE	163 - 164	2b-int	
Second	SECOND	165 - 166	2b-int	
Channel Num	CHANNEL	185 - 188	4b-int	
SP number	SHOT_PEG	189 - 192	4b-int	
Rcvr number	REC_PEG	193 - 196	4b-int	
CMP X	CDP_X	197 - 200	4b-int	Decimetres
CMP Y	CDP_Y	201 - 204	4b-int	Decimetres
Azimuth	AZIMUTH	219 - 220	2b-int	In tenths of degrees
Line Number	SPARE1	225 - 228	4b-int	

```

Contents of 3200-byte header
Interpreting input file header as EBCDIC
NULL (0) characters are printed as underscores (_)

Line 1 : C01 CLIENT SANTOS LTD      COMPANY TERREX SEISMIC      CREW NO A2
Line 2 : C02 DELAWARE3D
Line 3 : C03 LAND 3D, RECORDED LENGTH 4000MS, SAMPLE INT 2MS
Line 4 : C04 DATA: FIELD BRUTE STACKS
Line 5 : C05 2 VIBE 40M VP 40M RP 70% DRIVE
Line 6 : C06 FORMAT SEG Y, SAMPLE FORMAT IBM 32BIT FP
Line 7 : C07 ACQUIRED BY TERREX CREW A2, DATE 20150920
Line 8 : C08
Line 9 : C09 RECORDING PARAMETERS
Line 10 : C10 SERCEL 428
Line 11 : C11 VIBROSEIS, SWEEP LINEAR, TYPE BLACKMANN, 6-90HZ, 12SEC, 250/250MS TAPER
Line 12 : C12 CORRELATION AFTER STACK, ALIAS FILTER 0.8 NYQUIST, NOTCH OUT
Line 13 : C13 LINEAR RECEIVER ARRAY 40M INTERVAL, GEOPHONES SM24 EQUIV, FREQ 10HZ
Line 14 : C14
Line 15 : C15
Line 16 : C16 GEODETIC PARAMETERS
Line 17 : C17 LOCAL GDA94, MGA54
Line 18 : C18
Line 19 : C19
Line 20 : C20 PROCESSING SEQUENCE
Line 21 : C21 RAW DATA
Line 22 : C22 GEOMETRY UPDATE WITH FINAL SPS
Line 23 : C23 SPHDIV, BALANCE
Line 24 : C24 AIRWAVE ATTENUATION
Line 25 : C25 DATUM FLT 12MS/TRACE DIP FILTER
Line 26 : C26 AGC(500ms) NMO, STACK
Line 27 : C27 SHIFT TO DATUM S/D
Line 28 : C28 BYTE LOCATIONS FOR TRACE HEADER
Line 29 : C29 CDP ELEVATION (dm):41-44(INT)
Line 30 : C30 CDP X COORD (dm):73-76(INT), CDP Y COORD (dm):77-80(INT)
Line 31 : C31 PEG NUMBER AT CDP LOCATION :17-20(INT)
Line 32 : C32 OFFSET (dm):37-40(SINT)
Line 33 : C33 STACK FOLD :33-34(INT)
Line 34 : C34 CDP NUMBER :21-24(INT)
Line 35 : C35
Line 36 : C36
Line 37 : C37
Line 38 : C38
Line 39 : C39
Line 40 : C40 WRITE SEG Y, PROCESSED BY QC DEPARTMENT, END EBCDIC

```

*Figure 27* Example SEG Y EBCDIC test header

### 5.3.10 Example data

A typical raw shot record (Zoomed in for improved visibility) is shown in Figure 28. And It contains a limited amount of noise, is free of dead traces and clear reflectors can be observed on the shot record

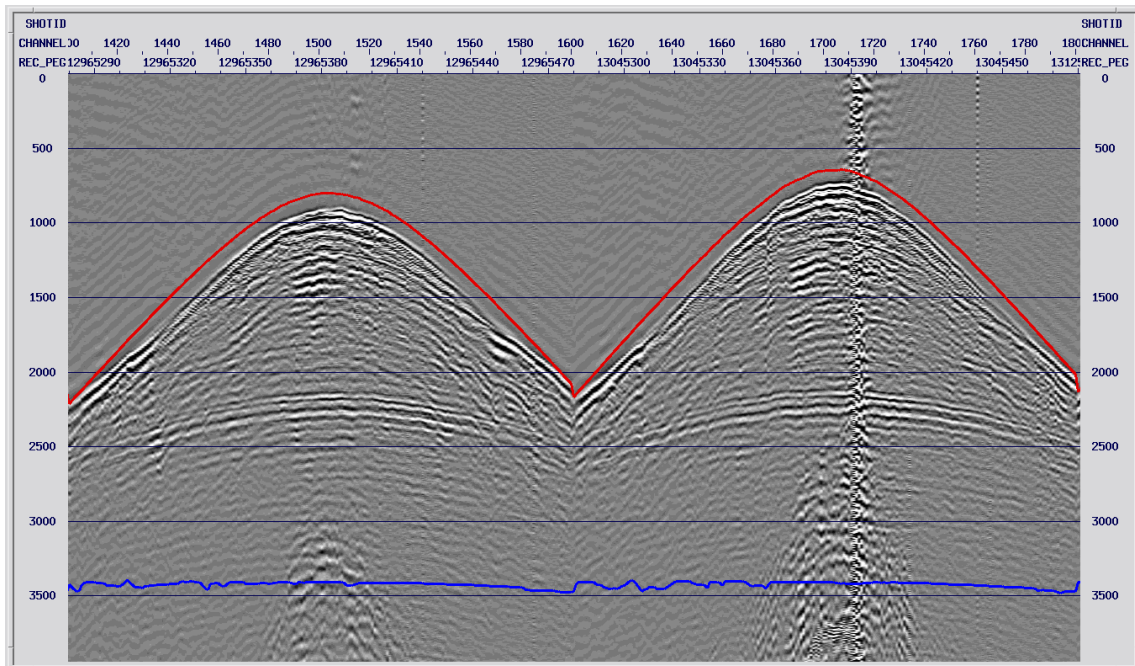


Figure 28 Typical raw shot display

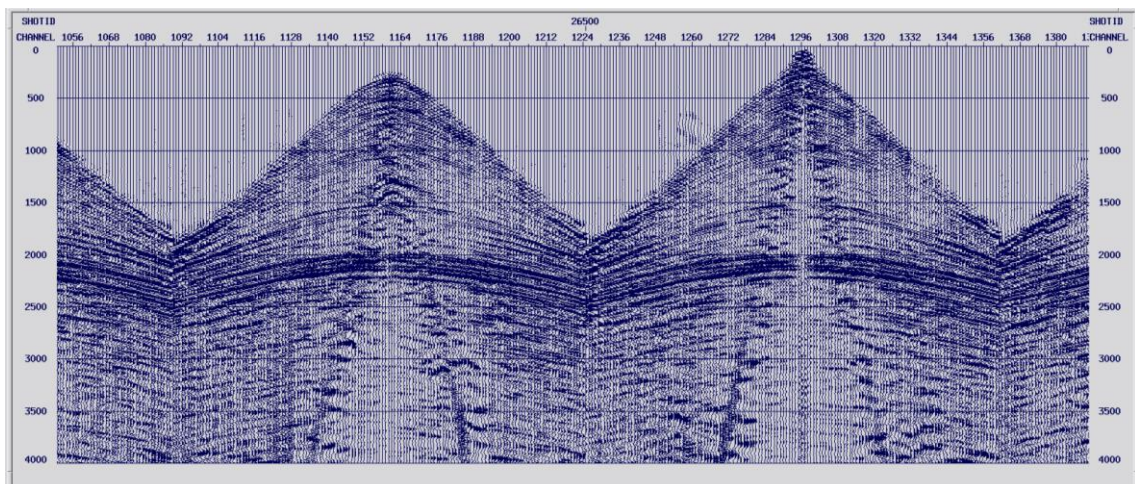


Figure 29 Typical pre-processed raw shot display

Strong reflectors can be seen in the processed display in Figure 29, clearly showing reflectors in the near, mid and far offsets, especially the strong high amplitude response at ~2500 ms.

The field stacks generated for this project show strong reflectors at various depths, clearly delineating features and other geological structures. The velocity files for these stacks are provided in the shipment.

Example stack displays can be found in Figure 30 and Figure 31 below. It should be noted that the processing applied in these field stacks is designed for efficiency with regards to the resources and time available on crew, to provide a quality control product in the stack domain and an early indication of the data and structures. Significant improvements would be expected after the data has been fully processed.



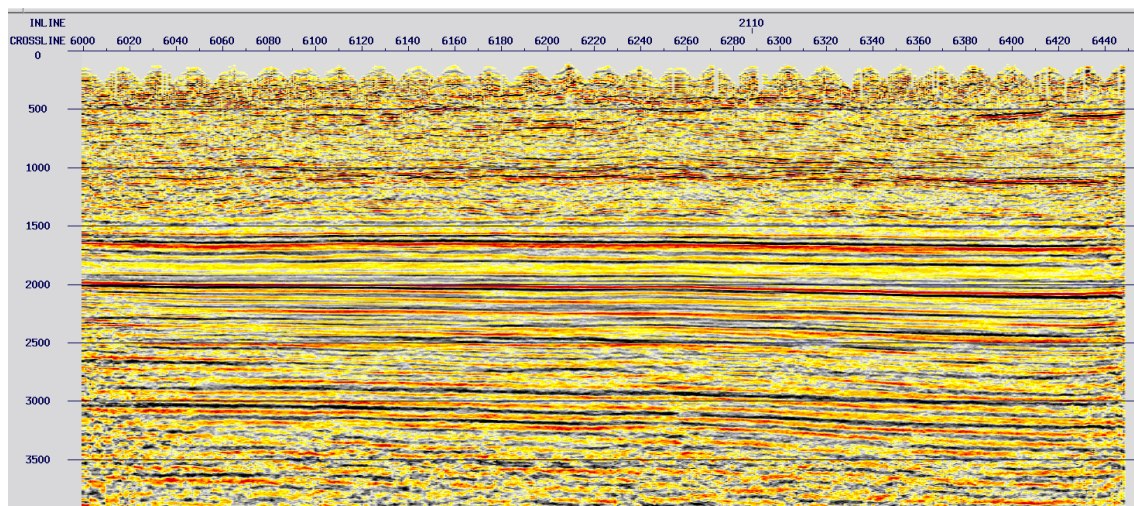


Figure 30 *Field brute stack, inline 2110*

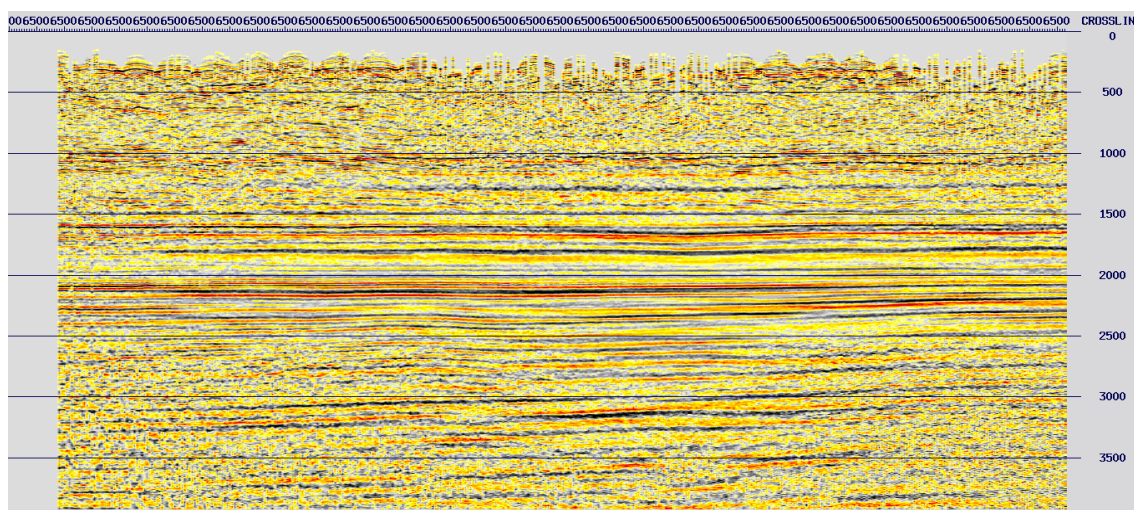


Figure 31 *Field brute stack, crossline 6500*

The stacks depict very obvious continuous reflectors throughout the entire line between 1500ms and 2500 ms two-way time (TWT). The overall structure shown is of west-east dipping beds. Deeper reflectors can be observed (at 3500 – 4000 ms) which may assist in the evolutionary history of the structures.

The near surface layers show some complex structures with greater changes in velocities than perhaps the deeper areas.

A cube was generated and a series of timeslices were displayed. Screenshots are shown in Figure 32 and Figure 33 below showing the structural changes with increasing depths.

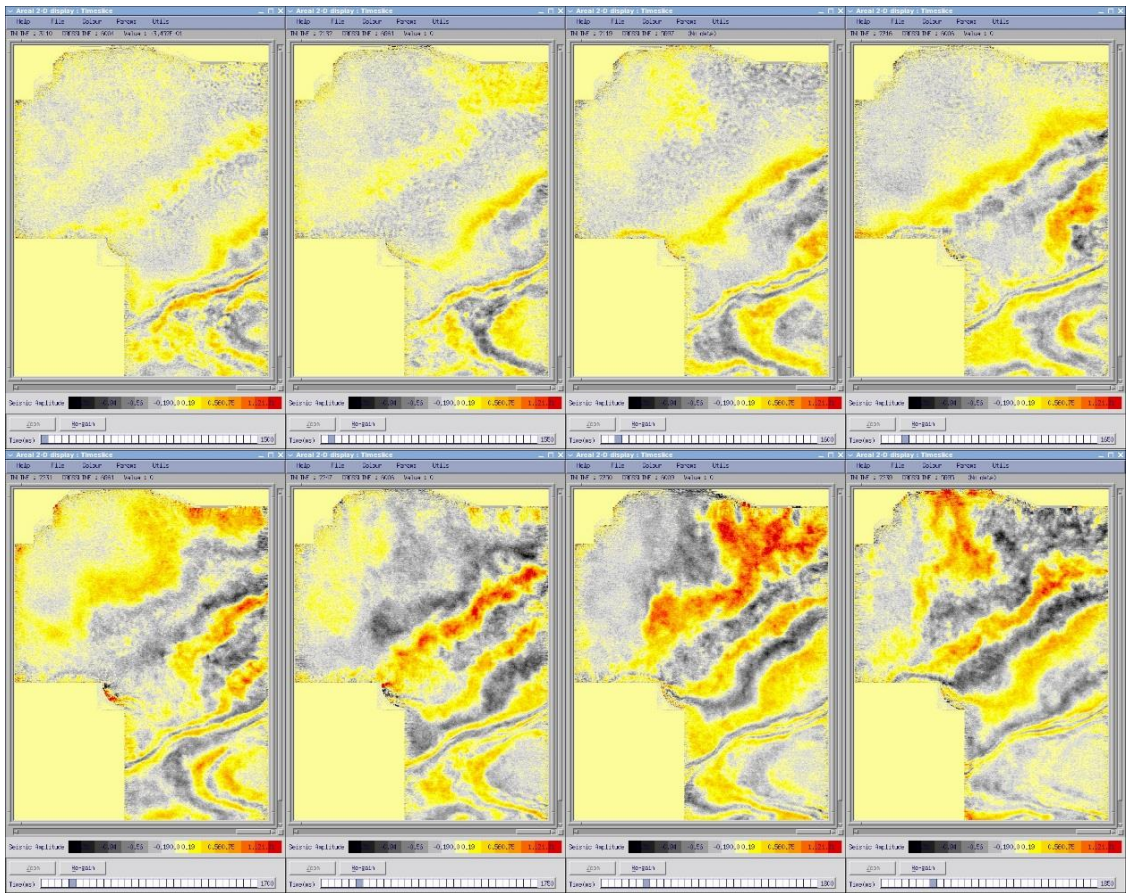


Figure 32 Timeslices (top left to bottom right, slices from 1600 - 1850 ms – every 50 ms)



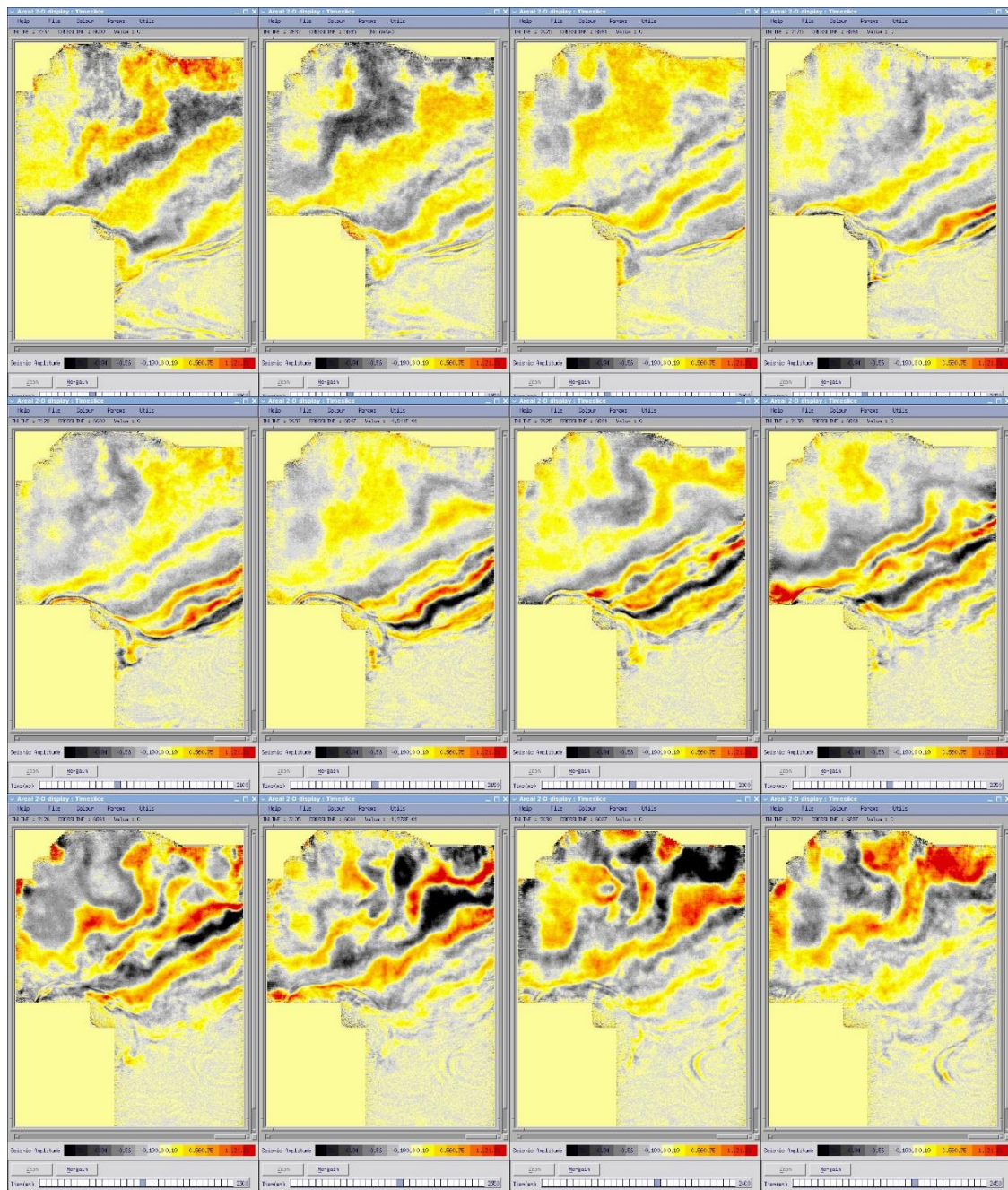


Figure 33 Timeslices (top left to bottom right, slices from 1900 to 2450 ms in 50ms intervals)

### 5.3.11 Summary

Throughout the project the data quality was of high resolution. Where the target reflectors were successfully imaged in the field stacks.

## 5.4 Data Shipments

The In-Field unit was responsible for the seismic data shipment to the client, processing centre and infield representatives, details on the data and destinations can be found in Table 18.

Offsite shipments are detailed in Table 19 and the shipping details and addresses are in Table 17.

The support data was supplied on DVD alongside the field data tapes and included the following data:

- SPS files, version 2.1 (Source, Receivers, and Relational files).  
- See Table 14 and Table 15 for formats
- Final, edited and combined observer logs relevant to the shipment
- QG log (Notes about the data in the shipment including a list of void files)
- Shipment report (Notes about the data in the shipment)
- Raw daily files (unedited SPS files, unedited observer logs and ancillary files)

The field data tapes were recorded as SEG D revision 2.1 on LTO 2 cartridges. Tapes were read back to verify the data integrity before shipment.

The raw validated seismic data updated with the geometry was supplied in standard SEG Y format, the header descriptions can be found in Table 16 and an example of the EBCDIC headers in Figure 27.

**Table 17 Shipping Details**

Client Office ("A1 & A2" copy)		Client Office ("B" copy)	
Shipping Agent	A1. Hand carried by Andrew White A2. StarTrack/Australian Air Express	Shipping Agent	StarTrack/Australian Air Express
Company	Santos Ltd.	Company	Santos Ltd.
Contact	Nick Papanicolaou	Contact	Nick Papanicolaou
Phone	+61 (0)8 8116 7833	Phone	+61 (0)8 8116 7833
Address	60 Flinders Street, Adelaide S.A. 5000	Address	60 Flinders Street, Adelaide S.A. 5000

**Table 18 Summary of deliverables**

DAILY			
What Data	Comments	To Where	Medium
Raw Data	Screenshots of raw shot gathers	Client Rep	Email
Brute Stack	Screenshots of field stacks	Client Rep	Email
RMS noise map	Noise map of shot and receivers	Client Rep	Email
ON CLIENT REQUEST			
Field stack	SEG Y stack	Client	FTP
AT PROJECT END			
What Data	Comments	To Where	Medium
Original Seismic Data	SEG D Correlated	Client office, "A" Copy	LTO2 tape cartridges
Geometry Applied Data	SEG Y Geometry Applied		Hard Drive
Original Seismic Data	SEG D Correlated and Uncorrelated		
Support Data	SPS, obslogs, recorder and QC files etc.		

AT PROJECT END			
What Data	Comments	To Where	Medium
Original Seismic Data	SEGD Correlated	Client office, “B” Copy	LTO2 tape cartridges
Geometry Applied Data	SEG Y Geometry Applied		Hard Drive
Original Seismic Data	SEGD Correlated and Uncorrelated		
Support Data	SPS, obslogs, recorder and QC files etc.		
AT PROJECT END			
What Data	Comments	To Where	Medium
QC Final Report			FTP/Email

**Table 19** Details on shipments

Shipment	Date	Data	Comments
1	20/10/2015	Tapes 1-10 on LTO2 Uncorrelated and correlated records of tapes 1 – 7 on HDD SEG Y and support data on USB	Copy "A1" to client
2	30/10/2015	Tapes 11-15 on LTO2 Uncorrelated and correlated records of tapes 7 – 15 on HDD SEG Y and support data on USB	Copy "A2" to client
3	7/11/2015	Tapes 1-15 on LTO2 Uncorrelated and correlated records of tapes 1 – 15 on HDD SEG Y and support data on USB	Copy "B" to client

## 5.5 Conclusions and Recommendations

The final data product delivered to the client is of an excellent standard. The field stacks show that client's objectives were imaged effectively, highlighting features around their areas of interest. It is expected that final processing will yield excellent and usable datasets.

In-Field Quality Control has been useful in this project, identifying and repairing files with bad geometry, incorrect coordinates or removing poor records with questionable or missing attributes. This process help to improve data quality of the final product, and reduce time spent at the processing centre in trying to remedy the problems. Some issues flagged by the In-Field Unit were rectified immediately in the field when the equipment and staff is present. Otherwise, potentially useful data will have to be removed.

## Appendix A Cable Field Equipment Specifications

### Recording Equipment

Data Acquisition System:	SERCEL 428 - 24 Bit 3D Seismic
Similarity System:	Sercel VE464
Computing:	Sun Blade Computer with 4x 19inch Flat Screens
Plotter:	Veritas V12 Plotter, UPS, LIM, APM
Tape Drives:	2 x LTO High Density
Comms:	1 x 10 meter 6 DB Boost High Gain Antenna

### Source Equipment

Vibrators:	4 x AHV-IV (PLS-364) Online. Shooting as 2 fleets of 2.
Peak force:	61,800 lbs per Vibrator
Hold-Down Weight:	62,000 lbs per Vibrator
Vibrator Control Electronics:	Sercel 464 DSD, DPG in recorder
Sweep Generator :	Sercel 464

*Electronics are capable of Trade Marked Varisweep.*

### Line Equipment

Seismic Cables:	3,525 (4 FDU's per cable) 14,100 channels
Takeouts:	55m separation between takeout
LAUL Units:	400
LAUX Units:	50
Transverse Cables:	120
Batteries:	400
Battery Chargers:	4 Sercel
Geophones:	Sensor SM24 10Hz geophones or equivalent
Geophone Strings:	14,100 (6 ph/group)
Geophone Tester:	1 x Sensor SMT200

*Note: Terrex Seismic warrants that 90% of equipment will be used in field and up to 10% may be undergoing repair and maintenance.*



## Appendix B Equipment Specification Sheets

### Source Products



#### AHV-IV™ COMMANDER (PLS-364)

##### FEATURES

- Accurate weighted-sum ground force estimate
- Stiffer baseplate designed for improved coupling
- Increased force output
- Lower distortion
- INOVA's Patented Pre-Loaded Stilt Structure prolongs the life of parts
- Certified Roll-Over Protection
- Articulated, Oscillated Steering



##### TECHNICAL SPECIFICATIONS - PLS-364 ACTUATOR

Shaker Model:	P-Wave Vibrator; PLS-364	Filtration:	3-micron absolute servo filter; 3.5-micron absolute, high and low pressure, triple element
Peak Force:	275 kN (61,800 lb)	Accumulators:	2 x 19 L (5 gal); bladder-type
Piston Area:	132.9 sq cm (20.6 sq in)	Heat Exchanger:	Steel core; multi-wing fan; hydraulically-driven
Mass Weight:	4,998 kg (11,020 lb)	Reservoir:	170 L (45 gal)
Driven Weight:	2,027 kg (4,469 lb)	Baseplate Type:	Reinforced rectangular
Useable Stroke:	9.83 cm (3.87 in)	Baseplate Area:	2.5 m <sup>2</sup> (3,864 in <sup>2</sup> )
Frequency Limit:	1 Hz to 250 Hz*	Baseplate Clearance:	46 cm (18 in) - Tires
Mass Accumulators (2):	3.8 L (1.0 gal.) Servo Manifold	Winch Capacity:	13,608 kg (30,000 lb)
Lift Stroke:	97 cm (38 in)		
Balance Method:	Airbags		
Isolation Method:	Airbags		
Hydraulic System:	Closed-loop		
Hydraulic System Pumps:	2 x 119 cc (7.25 in <sup>3</sup> ); Denison P-7		
Servo Valve:	Atlas 240H (with DR modification)		
Pilot Valve:	MOOG		

\* Max peak force from 5.18 Hz

\*\* Desired weight achieved with removable slide-on frame weight

#### AHV-IV Commander

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\*\* Desired weight achieved with removable slide-on frame weight

## AHV-IV Commander

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Corporate Headquarters  
12200 Parc Crest Drive  
Stafford, TX 77477  
+1.281.568.2000  
+1.281.568.2001  
www.inovageo.com



## AHV-IV™ COMMANDER (PLS-364)

### TECHNICAL SPECIFICATIONS - CHASSIS

Engine:	Detroit Diesel – Series 60, 14 L (425 BHP @ 1,900 RPM) Optional Engine: 500 BHP @ 1900 RPM
Air Cleaner:	Dry-type, 3-stage with pre-cleaner
Cooling:	Water-cooled radiator to +50° C (+122 °F) for hot climate and -50 °C (-58 °F) for cold climate
Air Compressor:	13 CFM
System Warning Device:	Engine shutdown system for low oil pressure, high engine water temperature, and low coolant level
Fuel Capacity:	757 .08 L (200 gal)
Drive Pumps:	100 cc (6.1 in <sup>3</sup> ) with electric displacement control
Drive Motors:	250 cc (15.25 in <sup>3</sup> ) variable volume with electronic control for 6 forward and 2 reverse speeds
Frame:	Solid-steel frame for maximum strength and reliability; 35 articulated; hydraulic power steering; 16.5 oscillation center joint
Axles:	Inboard planetary axle with enclosed wet disc brakes and differential lock
Gearboxes:	Single speed
Cab:	Fabricated-steel construction; high visibility with adjustable driver and passenger seat; two, 3-point shoulder belts; air-conditioning; heater; defroster; wiper; dome light; and side-mounted mirrors
Electrical:	+24 V start; +12 V run with 110-amp alternator and two, heavy-duty +12 V, 8D batteries; battery-disconnect switch

### PHYSICAL SPECIFICATIONS

Buggy Length:	10.01 m (400 in)
Buggy Width:	3.4 m (134 in) for 66 x 44 in tires 2.44 m (96 in) for 23.5 x 25 tires
Height (maximum):	3.50 m (138 in) for tires
Wheelbase:	4.77 m (188 in)
Turning radius – inside:	6.93 m (273 in)
Speed:	26 km/hr (16 mph)
Gradeability:	Tires: 60%; (31 degrees)
Gross Vehicle Weight:	Minimum 25,968 kg (57,250 lb) Maximum** 29,937 kg (66,000 lb)
Hold-down Weight:	Minimum 22,383 kg (50,350 lb) Maximum** 29,030 kg (64,000 lb)
Front axle Weight:	Minimum 13,789 kg (30,400 lb) Maximum** 15,853 kg (34,950 lb)
Rear axle Weight:	Minimum 12,179 kg (26,850 lb) Maximum** 14,084 kg (31,050 lb)

\* Max peak force from 5.18 Hz

\*\* Desired weight achieved with removable slide-on frame weight

## AHV-IV Commander

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Information subject to change without notice. Commander-DS-EN-1018-040026E-0514

## SM-24 Geophone Element

Where Quality Data Starts



### Features

- Tight specification, low-distortion geophone
- Extended spurious over 240 Hz, allowing full bandwidth at 2-ms sampling
- Backwards compatible with SM-4, SM-4 Superphone™ range, and SM-24ST
- Horizontal element available for shear-wave and 3-C recording.
- 3-year non-prorated warranty
- Lowest lifecycle cost of ownership in the industry
- Installed base of over 8 million worldwide (est.)

The SM-24 geophone element is designed to offer the highest performance in seismic exploration based upon field-proven I/O Sensor technology. Low distortion, combined with excellent specifications, provide high-fidelity data in 2-D and 3-D surveys. The extended bandwidth allows the full potential of 2-ms/24-bit recording systems to be realized. The tight specifications, unique element design, and exceptional quality of the Sensor SM-24 make it the lowest life cycle cost of ownership geophone in the industry.

Applications: 2-D & 3-D seismic exploration with bandwidth from 10 Hz up to 240 Hz.

Implementation: Can be installed in a variety of I/O Sensor geophone cases.



**SENSOR Nederland b.v.**  
An I/O subsidiary

## Appendix C Vehicle Equipment Listing

Vehicle	Used for	Registration Number	State Registered
<b>LIGHT VEHICLES</b>			
100 Series Landcruiser Wagon	Vibe Crew	772 KCU	QLD
76 Series Landcruiser Wagon	Back Crew	459 LGW	QLD
76 Series Landcruiser Wagon	Back Crew	460 LGW	QLD
76 Series Landcruiser Wagon	Back/Front Crew	463 LGW	QLD
76 Series Landcruiser Wagon	Front Crew	461 LGW	QLD
76 Series Landcruiser Wagon	Front Crew	462 LGW	QLD
76 Series Landcruiser Wagon	PM	1DXL 386	WA
VDJ 79R Series Landcruiser Trayback	Cable	465 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	468 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	470 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	471 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	474 LGW	QLD
VDJ 79R Series Landcruiser Trayback	De-pegger	466 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Gooz	536 RPU	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	467 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	469 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	475 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Line Boss	472 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Mecho's	725 TCF	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	023-RNR	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	473 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	476 LGW	QLD
VDJ 79R Series Landcruiser Troopcarrier	HSE Ambo	477 LGW	QLD
VDJ 79R Series Wagon	Client	829-SMR	QLD
<b>HEAVY VEHICLES</b>			
Hino	Fridge/freezer truck	228 SBT	QLD
Hino	Spread	1CIR 888	WA
Hino	Crane Truck	1CMW 981	WA
I/O AHV-IV Vibrator	Vibrator - 1	C 95557	QLD
I/O AHV-IV Vibrator	Vibrator - 2	C 95556	QLD
I/O AHV-IV Vibrator	Vibrator - 3	C 95555	QLD
I/O AHV-IV Vibrator	Vibrator - 4	C 95558	QLD
International Eagle	Towing	1EKO 575	WA
Isuzu	Recorder	438 RPF	QLD
Kenworth	Towing	675-RDS	QLD
Mac Ex-army truck	Towing	619 TBM	QLD
Mac Truck	Towing	897 TDC	QLD
Nissan MK190	C/Repair	1DDE 233	WA
Paystar	Vibe Service Truck	1DDE 234	WA
Paystar	Waste pod carrying	1DDE 229	WA
<b>VANS AND TRAILERS</b>			
100 Series Landcruiser Wagon	Vibe Crew	772 KCU	QLD
76 Series Landcruiser Wagon	Back Crew	459 LGW	QLD

# Santos Limited

## Delaware 3D Seismic Survey Field Operations Report



Vehicle	Used for	Registration Number	State Registered
76 Series Landcruiser Wagon	Back Crew	460 LGW	QLD
76 Series Landcruiser Wagon	Back/Front Crew	463 LGW	QLD
76 Series Landcruiser Wagon	Front Crew	461 LGW	QLD
76 Series Landcruiser Wagon	Front Crew	462 LGW	QLD
76 Series Landcruiser Wagon	PM	1DXL 386	WA
VDJ 79R Series Landcruiser Trayback	Cable	465 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	468 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	470 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	471 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Cable	474 LGW	QLD
VDJ 79R Series Landcruiser Trayback	De-pegger	466 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Gooz	536 RPU	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	467 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	469 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Jugs	475 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Line Boss	472 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Mecho's	725 TCF	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	023-RNR	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	473 LGW	QLD
VDJ 79R Series Landcruiser Trayback	Trouble Shooter	476 LGW	QLD
VDJ 79R Series Landcruiser Troopcarrier	HSE Ambo	477 LGW	QLD
VDJ 79R Series Wagon	Client	829-SMR	QLD
Box Trailer	Carry Sat. Dish	CM9933	QLD
Dolly		671QMP	QLD
Dual-axle trailer	Carry spread	092 QJR	QLD
Elross	Diner	1TGZ 789	WA
Elross	HSE Office	1THV 393	WA
Elross	Kitchen	1TGZ 790	WA
Elross	PM Office/ Accom.	1 TGL 813	WA
Elross	QC Office	1TMH 835	WA
Elross (2 Room (2 man)	Client Van	1TLB 134	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 663	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 664	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 666	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 811	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 812	WA
Elross (3 Rooms (6 man)	Accomm.	1TGL 815	WA
Elross (3 Rooms (6 man)	Accomm.	1THT 116	WA
Elross (3 Rooms (6 man)	Accomm.	1THT 117	WA
Elross (3 Rooms (6 man)	Accomm.	1THV 394	WA
Elross (3 Rooms (6 man)	Accomm.	1TJB 338	WA
Elross (3 Rooms (6 man)	Accomm.	1TLB 734	WA
Elross (7 person)	Showers	1TKM 922	WA
Elross (ex-accommodation)	Lunch room	761 QVX	QLD
KJM (3 Rooms (6 man)	Accomm.	S280.TDA	SA
Tandem box trailer	Signs/Wash Down	YIE-679	SA

# Santos Limited

## Delaware 3D Seismic Survey Field Operations Report



Vehicle	Used for	Registration Number	State Registered
Trailer	Laundry	1TFB 626	QLD
Trailer	Mech. W/shop	571-QWD	QLD
Trailer	Storage	347-QJX	QLD
Trailer	Storage/Ice Room	501 QJG	QLD
Trailer	6 person toilet	498 QJG	QLD
Trailer ( DOG )	Towing	140 QJT	QLD
Tri-axle trailer	Carry diesel tanks	168 QWN	QLD
Tri-axle trailer	Carry spread	1TPA - 725	WA
Tri-axle trailer	Carry spread	KW7742	WA
Tri-axle trailer	Carry diesel tanks	SY.17.ED	QLD
Tri-axle trailer	Carry spread	1TPQ 897	WA
Tri-axle trailer	Carry spread	1TPQ 898	WA
Tri-axle trailer	Generators	126-QMP	QLD
Tri-axle trailer	Vibe Stores/Cold rooms	507 QJG	QLD
Tri-axle trailer Curtain Side	Carry spread	1TNY - 915	WA
Tri-axle trailer Curtain Side	Carry spread	1TYN - 914	WA
<b>ADVANCED CAMP</b>			
Vansite	Accommodation	853-QWF	QLD
Elross	Accommodation	1TIV-459	WA
Elross	Accommodation	1TIV-459	WA
Elross	Accommodation	1TIV-458	WA
Elross	Accommodation	1TLB-961	WA
Elross	Accommodation	1TMK-619	WA
Elross	Accommodation	1TIV-457	WA
	Cooks Van	500-QUE	QLD
Trailer	Water	544-QXD	QLD
Trailer	Fuel	444-QXB	QLD
Trailer	Shower Block	KW-7813	WA
Trailer	Generator	KW-7783	WA
Trailer	Diner	KW-7810	WA
Trailer	Kitchen	KW-7811	WA
Trailer	Mecho's Workshop	446-QXB	QLD
Trailer	3 Men's/2 Female Toilet	499-QJG	QLD
2 axle Trailer	Survey	744-QXB	QLD
3 axle Trailer	Fire Trailer	416-QXE	QLD
KJM	Survey Office	S284-TDG	SA
Float		1TMG-379	WA
<b>LIGHT VEHICLES - TERREX SPATIAL</b>			
Toyota Landcruiser (Dual Airbag)			
Toyota Landcruiser (Dual Airbag)			
Toyota Landcruiser (Dual Airbag)			
Toyota Landcruiser Dual cab (Dual airbag)			
Toyota Landcruiser 200 Wagon			



## Appendix D Tape Listings

The correlated production data was transcribed as SEG-D onto 14 LTO tapes, with an additional LTO tape with the raw test data.

**Table 20 Archive tape contents.**

Tape#	Media	First File	Last File	First VP	Last VP	Date Acquired
1	LTOII	1	1091	Experimental Data		19/10/2015
2	LTOII	1	6522	5208 1000	5368 1102	21-24/09/2015
3		6524	11396	5376 1096	5272 1175	24-27/09/2015
4		11398	16144	5432 1160	5256 1235	27-30/09/2015
5		16146	20790	5352 1245	5360 1288	30-02/10/2015
6		20792	24294	5216 1303	5200 1329	02-04/10/2015
7		24296	29192	5200 1328	5384 1372	04-07/10/2015
8		29194	33692	5384 1373	5224 1415	07-09/10/2015
9		33694	38060	5216 1415	5352 1440	09-12/10/2015
10		38062	42404	5112 1440	5296 1487	12-14/10/2015
11		42406	46898	5056 1473	5392 1579	14-18/10/2015
12		46900	51516	5136 1519	5416 1559	18-21/10/2015
13		51518	56348	5416 1555	5248 1592	21-24/10/2015
14		56350	62396	5256 1592	5152 1656	24-27/10/2015
15		62398	63470	5152 1671	5248 1703	27/10/2015

## **Appendix E      HSE Policy & OH&S Standards**



# Health Safety Environment and Quality Policy

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Terrex is a Seismic Acquisition and Surveying Contractor providing services to the Oil, Gas, Mineral and Infrastructure Industries.

Our vision is to be one of the world's most operationally efficient, technologically advanced, innovative and safest onshore Seismic Acquisition and Survey service providers.

Our aim is to provide a healthy and safe workplace while minimising the environmental impacts of our activities and satisfying our customers' expectations.

We at Terrex are committed to:

- Providing a healthy and safe workplace for our employees, contractors and the general public.
- Conducting all operations in such a manner as to minimise their impact on the environment.
- Promoting the protection of all Natural and Cultural environments that can be affected by our activities.
- Respecting all forms of indigenous and non-indigenous heritage and maintaining cultural heritage values.
- Seeking to continuously improve in the efficient use of natural resources and energy through recycling and waste management.
- Regularly review and improve our process to minimise health and safety hazards, negative significant impacts to the environment and prevent pollution.
- Establishing measurable objectives and targets for improving our safety and environmental performance.
- Working with our customers, suppliers and employees to seek continual improvement of our activities through consultation and communication.
- Complying with legislation and industry codes of practice wherever we conduct business.

To ensure this commitment we have implemented an Integrated Management System, which meets the requirements of:

- **AS/NZS 4801 Occupational Health and Safety Management Systems**
- **OHSAS 18001 Occupational Health and Safety Management System**
- **AS/NZS ISO 14001 Environmental Management Systems.**
- **AS/NZS ISO 9001 Quality Systems**

This policy is basic to all Terrex operations and adherence is the prime responsibility of management, every employee and all contractors / sub-contractors.

**Greg Dunlop**  
Chief Executive Officer

Dated: 31<sup>st</sup> July 2015



# Drug and Alcohol Policy

---

## Terrex is committed to:

- Ensuring the Safety and Health of its employees and its subcontractors is maintained;
- Maintaining a SAFE and Healthy workforce and workplace through a proactive approach.

## Scope

This policy outlines the responsibilities and applies to all employees of TERREX and all of its subcontractors.

All personnel are considered "on the job" whenever he/she is on:

- Any Company or client property, including parking areas; or
- Company time even if off Company premises – including paid lunch, rest periods, and periods of being on call.

## Responsibilities

- Terrex is responsible for maintaining a Drug-Free Workplace and Workforce.
- As a Duty of Care to all employees and contractors, the company will initiate:
  - Random;
  - Upon suspicion;
  - With cause; and
  - Post-accident / incident Drug and Alcohol Testing.

It is expected all employees and contractors will co-operate with the nominated Company Representative in this matter.

- The Company prohibits the use, unauthorized possession, manufacture, distribution or sale of illegal drugs, illegal inhalants, drug paraphernalia or controlled substances (i.e. all chemical substances or drugs listed in any controlled substances act or regulation applicable under any federal and /or state local laws) by any employee or contractor while on duty, while on Company premises or work sites or conducting Company business, or while operating or occupying any Company vehicle/equipment at any time.
- It is the responsibility of an individual to disclose to the nominated company representative any use of prescription drugs and over-the-counter drugs or designer / "look alike" drugs, prior to entering the work place. As the use of prescription drugs and/or over-the-counter drugs may also affect an employee's job performance and seriously impair his/her ability to work safely and effectively. Misusing prescribed or over-the-counter medication on company property or company assignment is strictly prohibited. Designer or "look alike" drugs are prohibited on all Terrex work sites. Non-disclosure will be treated as a breach of this Policy.
- Subject to Client approval and compliance with the Company's Drug and Alcohol and Fitness for Work Policies, outside of working hours Terrex permits the consumption of mid-strength and light beer only within Terrex camps.
- It is the responsibility of all employees and contractors to have a 0% blood alcohol reading before commencing and during work hours.
- Pertaining to employees and contractors in rehabilitation or self-rehabilitation, confidentiality of personal information will be maintained, although personal information will be released by the Medical Services on a need-to-know basis or as required by law.
- All personnel working on Company premises or performing Company work must have read this Policy and will be asked to cooperate with the administration of this Policy. A breach of this policy and the associated procedure may result in disciplinary action.

**Greg Dunlop**

Chief Executive Officer

Dated: 31<sup>st</sup> July 2015

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# Fitness for Work Policy

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Terrex is committed to providing a safe, healthy and productive workplace for all its employees. The company recognises that alcohol, drugs, substance abuse, some illness and fatigue will impair employees' ability to perform their jobs properly and that any of these factors will have adverse effects on safety, efficiency, and productivity.

## Scope

This policy outlines the responsibilities and applies to all employees of TERREX.

All personnel are considered "on the job" whenever on:

- Any Company or client property, including parking areas; or
- Company time even if off Company premises including paid lunch, rest periods, and periods of being on call.

## Policy

- All personnel are responsible for attending work in a fit condition free of illnesses that may impair their ability to conduct their duties in a safe, efficient and productive manner and must consider the risk of others contracting the illness.
- All personnel are responsible for attending work well rested and free of impairment from fatigue.
- The company prohibits the misuse of legitimate drugs, or the use, possession, distribution or sale of illicit or non-prescribed controlled drugs, or other substances, on Company business or premises.
- Any employee who takes prescription medication should check with their doctor to establish if the use of the medication will impair their work performance, or pose a safety risk to the worker or any other person in the workplace. If so, the worker should seek advice in writing from their doctor and provide a copy of this letter to their manager.
- Drug and Alcohol testing will be conducted by the company on a daily / random or for cause basis.
- The company recognises alcohol, drug or substance dependency as a treatable condition. Employees who suspect they have a dependency problem are encouraged to seek professional advice and to follow appropriate treatment promptly before it results in work performance problems.
- Employees working outdoors are required to undergo periodical medical examinations at the Company's expense.
- All employees are required to comply with the requirements of the Company's Workplace Rehabilitation program and actively support employees who are participating in rehabilitation.
- All employees are required to comply with this Fitness for Work Policy and the relevant company procedures that support this policy that are listed below. Failure to meet the requirement of this policy and its associated procedures will result in disciplinary action, up to, and including, dismissal.
  - TS-PRO-18 Workplace Rehabilitation
  - TS-PRO-19 Drug and Alcohol
  - TS-PRO-20 Code of Conduct
  - TS-PRO-22 Journey Management
  - TS-SOP-GEN009 Fatigue Management



**Greg Dunlop**

Chief Executive Officer

Dated: 31<sup>st</sup> July 2015



## **Appendix F      Terrex Spatial – 2015 CPSAN15 Delaware 3D Seismic Survey Final Report**



J000303

***Final Operations Report***  
*On the*  
***2015 CPSAN15 Delaware 3D Seismic Survey***  
*For*  
***Santos Ltd***  
*And*  
***Terrex Seismic Pty Ltd***  
*August–September 2015*



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The General Manager - Terrex Spatial  
22 Crockford Street  
Banyo Qld 4014

Telephone: 07 3621 0300  
International: +61 7 3621 0300  
Facsimile: 07 3266 7345

E-mail: [info@terrexspatial.com](mailto:info@terrexspatial.com)

***Dynamic Satellite Surveys Pty Ltd trading as Terrex Spatial has a  
Quality Management System, externally certified to  
AS/NZS ISO 9001:2008 standards by SAI Global Pty Ltd (Lic #QEC10046)***

*This project was undertaken for Santos Ltd and Terrex Group.*

*The purpose of the job was to install and survey 3D seismic lines. The use of the data for any other purpose is not authorised.*

*All data contained in this report and sent on Dropbox is deemed to be final and overrides any previous data received from TSp, unless otherwise stated.*

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# 1

## INTRODUCTION

The following report covers the 2015 Delaware 3D Seismic Survey, performed by Terrex Spatial (TSp) Crew 1, whilst contracted to Terrex Seismic Pty Ltd (TS) for Santos Ltd. Terrex Contracting Crew 2 carried out the line preparation and Terrex Seismic Crew 2 carried out the seismic data acquisition.



**Figure 1**                      **Project Location**

The survey area was located 800kms NNW from Adelaide, approximately 35km north west of Innamincka, South Australia, see **Appendix A - Project Map**.

There was reasonably good road access through the prospect. The Cordillo Downs road ran through the eastern side of the prospect. The Bookabourdie road passed through the south and clipped the south western corner of the prospect. The Cuttapirrie road ran from the Bookabourdie road in the south through to the north western corner of the prospect. There were also several landowner tracks and fence lines which gave good access to various parts of the prospect.

There were three main terrain types encountered on the Delaware 3D. In the east a small strip of rolling gibber terrain ran out into large sand flats which merged into predominantly sand dune terrain. Scattered amongst the sand dune terrain were areas of flood plain terrain. The sand dune terrain consisted mainly of small to medium sized dunes with small to large sparsely vegetated sand flats in between. The dunes tended to be quite 'wind-blown' in the north of the prospect. The floodplain terrain was very rough in places with areas of thick old man saltbush and 'crabholes' which, for environmental reasons, were only walked over by the dozers. Some of the floodplain areas were quite large. In the south east of the prospect there were some large dry waterholes with reasonably dense clusters of Coolibah trees along their banks.

A total of 2525.44 linear kilometres of seismic lines were surveyed (1267.20km Source & 1258.24km Receiver). Both Source and Receiver lines were surveyed at 40.0m station intervals. The source lines were recorded in stakeless mode – no source pegs other than check stations were placed in the ground. The vibrators had navigation units installed which guided operators to the surveyed source locations. Dean Hausmann (Survey Operations Manager) was on site to fit equipment and oversee vibrator GPS operations at the start of the recording acquisition. Receiver lines were pegged as per normal methods with a numbered stake every 8<sup>th</sup> station and pinflags for every other station. The line crew had GPS navigation units in every vehicle which were loaded with detailed maps of the prospect.

Terrex Contracting (TC) supplied a camp for the line preparation crew and support staff while Terrex Spatial supplied an office / sleeper caravan and a three room sleeper caravan for its personnel. TC supplied all messing, showering and toilet facilities. Potable water was sourced from Moomba. TC supplied refuelling and mechanical facilities.

During the survey the weather was mainly cold mornings and nights with the days being cool to warm with periods of gusty winds.

The survey operations (actual) were completed between the 26<sup>th</sup> August 2015 and the 21<sup>st</sup> September 2015.

## 1.1 Survey Parameters

The following table gives a summary of the basic survey design parameters for the Delaware 3D seismic survey. The survey was an orthogonal 3D grid, however both receiver and source points were designed with a 3 step stagger pattern based on the conventional point location with the offsets being at the receiver and source bearings.

Parameter	Receiver	Source
Start line	1000	5000
End line	1704	5480
Line increment	8	8
Line spacing	320m	320m
Station interval	40.0m	40.0m
Station Increment	1	1
VP interval	N/A	40.0m
Line bearing (grid)	90°00'00"	0°00'00"
Number of lines	89	61
Inline Stagger 1	-13.3m	-13.3m
Inline Stagger 2	13.3m	13.3m
Inline Stagger 3	0m	0m
Stagger 1 Sequence	R1000/1024 ...	S5000/5024 ...
Stagger 2 Sequence	R1008/1032 ...	S5008/5032 ...
Stagger 3 Sequence	R1016/1040 ...	S5016/5040 ...

Nominal origin points	Easting	Northing
Rec Origin station (10005000)	441211.7	6944817.0
Src Origin station (50001000)	441205.0	6944823.7

## 2



## INSTRUMENTATION AND PERSONNEL

### 2.1 Personnel and Logistics

Terrex Spatial personnel involved in the survey were as follows:

**Table 1**                      **Personnel**

<b>Personnel</b>	<b>Position</b>
Dean Hausmann	Bachelor of Surveying Operations Manager
Eric Amedee	30 years Seismic Surveying Experience Senior Surveyor
Hamed Afshar	Bachelor of Surveying Senior Surveyor/Line Pointer
Justin Matthews	Bachelor of Science – GIS (Masters) Line Pointer/ Survey Technician
Mike Clark	8 years seismic experience Survey Technician
Navneet Jain	Cert IV in Surveying Survey Technician
Ryan Gemmel	Cert IV in Surveying Survey Technician

Personnel and equipment logistics were supported by the Terrex Spatial Brisbane office.

## 2.2 Equipment

Equipment provided by Terrex Spatial and used on this project:

**Table 2 Equipment**

Equipment	Description	Quantity
Mobile Plant	Toyota Landcruisers (Dual Airbag)	3
	Toyota Landcruiser Dual cab (Dual airbag)	1
	Toyota Landcruiser 200 Wagon (Eric Amedee)	1
	Office / sleeper caravan (office / 1 bedroom)	1
	Sleeper caravan ( 3 bedrooms)	1
Communications	Iridium satellite phones	3
	UHF vehicle based radios	5
	UHF Office radios	1
	UHF handheld radios	2
	VHF radios	5
	VHF Office radio	1
Survey Instruments	NovAtel 702G GPS Antennas	6
	NovAtel OEMV GPS Receivers	6
	30Watt Radio transmitter (RTK)	2
	30Watt Radio transmitter (Repeater)	1
	Trimble Fiberglass Bi-pods	2
	Tripods	4
	Tribachs	4
	G-Mouse External GPS Antennas	6
	Trimble R10 GPS receivers	2
	Trimble TDL 450H radio modem	1
	Trimble TSC3 survey controller	1
Computing Hardware	Toshiba Laptops	2
	2TB Network Attached Storage (NAS) Drive	1
	Uninterrupted Power Supply (UPS)	1
	Motion Tablet computers (GPS Controller)	3
	Motion Tablet computers (Machine GPS)	3
	Algiz 10X (Machine GPS) tablets & antennas	7
	Uniden GPS receivers (Crew navigation)	7
	HP Officejet 7500 E910 printer	1
Software	Nav12 setout software	Ver 2.23
	GPSeismic Processing Software	Ver 14.3
	MapInfo Professional	Ver 8.5
	NavMini machine guidance software	Ver 2.63
	GlobalMapper	Ver 16.1
	Waypoint GrafNet static processing software	Ver 8.2
	ArcGIS Desktop	Ver 10.3



## 3



## SURVEY REFERENCE SYSTEMS

### 3.1 Geodetic Datum

This project was based on the Geocentric Datum of Australia 1994 (GDA94), which is based on the Geodetic Reference System 1980 (GRS80) model defined by the following parameters:

Datum:	GDA94 (Geocentric Datum of Australia 1994)
Spheroid:	GRS80
Reference Frame:	ITRF92 (International Terrestrial Reference Frame)
Semi-Major Axis Length:	6 378 137.0
Inverse Flattening:	298.257222101
The Unit of Measure:	International Metre

### 3.2 Map Projection

Final rectangular coordinates were based on the Map Grid of Australia 1994 (MGS94). Parameters for this projection are as follows:

Projection:	Universal Transverse Mercator (MGA Zone 54)
Latitude of Origin:	0°
Central Meridian (CM):	141° E
Scale Factor at CM:	0.9996
False Easting:	500 000
False Northing:	10 000 000
The Unit of Measure:	International Metre

### **3.3 Height Datum**

All elevations obtained relative to GDA94 have been reduced to the Australian Height Datum (AHD) using the AUSGeoid09 Geoid – Ellipsoid separation model to determine the separation (N) for the particular area.

GPS observations are made on the GDA94 datum. The height associated with this datum is an ellipsoidal height (h). The Australian Height Datum (AHD), the height datum associated with MGA94, is an orthometric height, which is measured as the height above mean sea level, or the geoid (H).

The function that defines the relationship between the ellipsoid and orthometric heights is:

$$H = h - N$$

Or

$$AHD = GDA94 - (Geoid-Ellipsoid Separation)$$

AUSGeoid09 is the fourth in a series of national geoid models produced for Australia by the Geoscience Australia. The geoid-ellipsoid data is prepared for the Australian region from:

- EGM2008 Earth Geopotential Model;
- Satellite gravity observations;
- Geoscience Australia's land gravity database;
- Geometric component from GPS and AHD data that accounts for varying offset between a gravimetric quasigeoid and the AHD

AUSGeoid09 N values were interpolated using the in-house NAV12 software and GrafNet Version 8.20 software, distributed by Waypoint Consulting Inc.

## 4



## SURVEY CONTROL

Survey control point DEL2 was established on the Delaware 3D prospect using the Geoscience Australia (GA) AUSPOS<sup>1</sup> online processing service. A GPS static network was established using this point as its datum. The AUSPOS service was also used to check on several of the control network stations. Checks were also done to BKA1 and MUD1 which were RTK base stations on previous 3D seismic surveys.

The GPS datum stations adopted for the survey in MGA Zone 54 Co-ordinates are listed below.

**Table 3 Datum Stations**

Station	Easting	Northing	RL	Comments
BKA1	450471.125	6954973.729	53.341	BOOKABOURDIE 3D
CON6	444286.347	6970497.607	42.837	BMCON6CM
DEL1	452502.171	6959406.654	40.073	RTK BASE
DEL2	453468.578	6950639.984	54.379	RTK BASE (DATUM)
DEL3	456502.090	6959227.499	46.836	RTK BASE
DEL4	444572.915	6961783.332	53.183	RTK BASE
DEL5	452332.436	6968799.564	54.956	RTK BASE
MUD1	439073.478	6958032.512	44.569	RTK BASE
P16A	459855.707	6948878.966	68.116	PONDRINIE 16

The AUSPOS method requires a minimum of 2 hours of static GPS data to be logged which is then post-processed using the AUSPOS online service in a network adjustment with GA Continuously Operating Reference Stations (CORS). This process typically produces accuracies better than 0.05m. Terrex Spatial also commenced using the Trimble Centrepoint RTX<sup>2</sup> online processing service during the Delaware 3D survey.

<sup>1</sup> AUSPOS is Geoscience Australia's on-line post processing engine located at: <http://www.ga.gov.au/earth-monitoring/geodesy/auspos-online-gps-processing-service/faq1.html>

<sup>2</sup> Centrepoint RTX is Trimble Navigation's online post processing engine. User has to register prior to using the free service. It is located at: <http://www.trimblertx.com/UploadForm.aspx>

This service differs from the AUSPOS service in two ways – firstly it uses all GPS systems in its computations whereas AUSPOS uses only Navstar satellites and, secondly, it processes data straight away whereas, with AUSPOS the user has to wait until the end of the day in GMT. The Centrepont RTX results were very close to those of the AUSPOS results ( $<0.05\text{m}$ ).

Static observations were processed in a single network in GrafNet software, which allowed the analysis of data, least squares network adjustment, and output of station coordinates. The relative accuracy between control points will be better than  $10\text{mm} \pm 10\text{ppm}$  at the one sigma level for baselines between 1km and 200km in length.

Primary GPS stations were monumented with a star picket driven in at ground level. A star picket witness post (1.8m) placed within 0.5m of the ground mark. A metal tag detailing prospect name and survey station name was then attached to the witness post.

All raw data and processing files are archived by date and backed-up daily. Field booking sheets are later scanned to digital files. A comprehensive set of data is made available at the project completion including field sketches, processing files, statistical analysis of the network and Permanent Marker station summary diagrams.

The misclose values of control checks can be seen in **Appendix B - Survey Control, Miscloses and Ties**.



**Photograph 1** Trimble R10 on CON6 control station (Fyfe benchmark)

# 5



## **MONUMENTATION**

### **5.1 Environmental Monitoring Points (EMP)**

Environmental Monitoring Points were placed by the Santos Client Representative and no markers were placed as per client instruction.

### **5.2 Permanent Survey Marks (PSM)**

Permanent Survey Marks (PSM's) consist of a 1.8m steel fence post (star picket) witness post with a stamped aluminum tag attached, and 0.6m star picket driven flush with the ground at the base. The level and position of the 0.6m picket is the actual reference mark. A PSM was placed at each of the established survey control stations. A listing can be seen in **CHAPTER 4 – SURVEY CONTROL**.

### **5.3 Line Stations**

Receiver lines were surveyed at 40.0m station intervals. Wooden stakes, painted blue and numbered front and back, were used to mark every eighth receiver station with intermediate stations being marked by blue or pink pinflags. Numbered wooden pegs were also placed on each side of hand carry sections and at fences and tracks. Source lines were not pegged as the vibrators were to be operated in stakeless mode using GPS navigation. Source lines were driven by the surveyors with the source points being automatically recorded by the GPS software. The surveyor also had the option of recording source points manually.

Receiver line ID's started at 1000 and Source lines at 5000. Station numbering increased consecutively progressing along the lines from West to East on receivers and South to North on source. All lines were surveyed in 3D stakeout mode.

A detailed line listing can be seen in **Appendix C - Line Listing**.



## 6



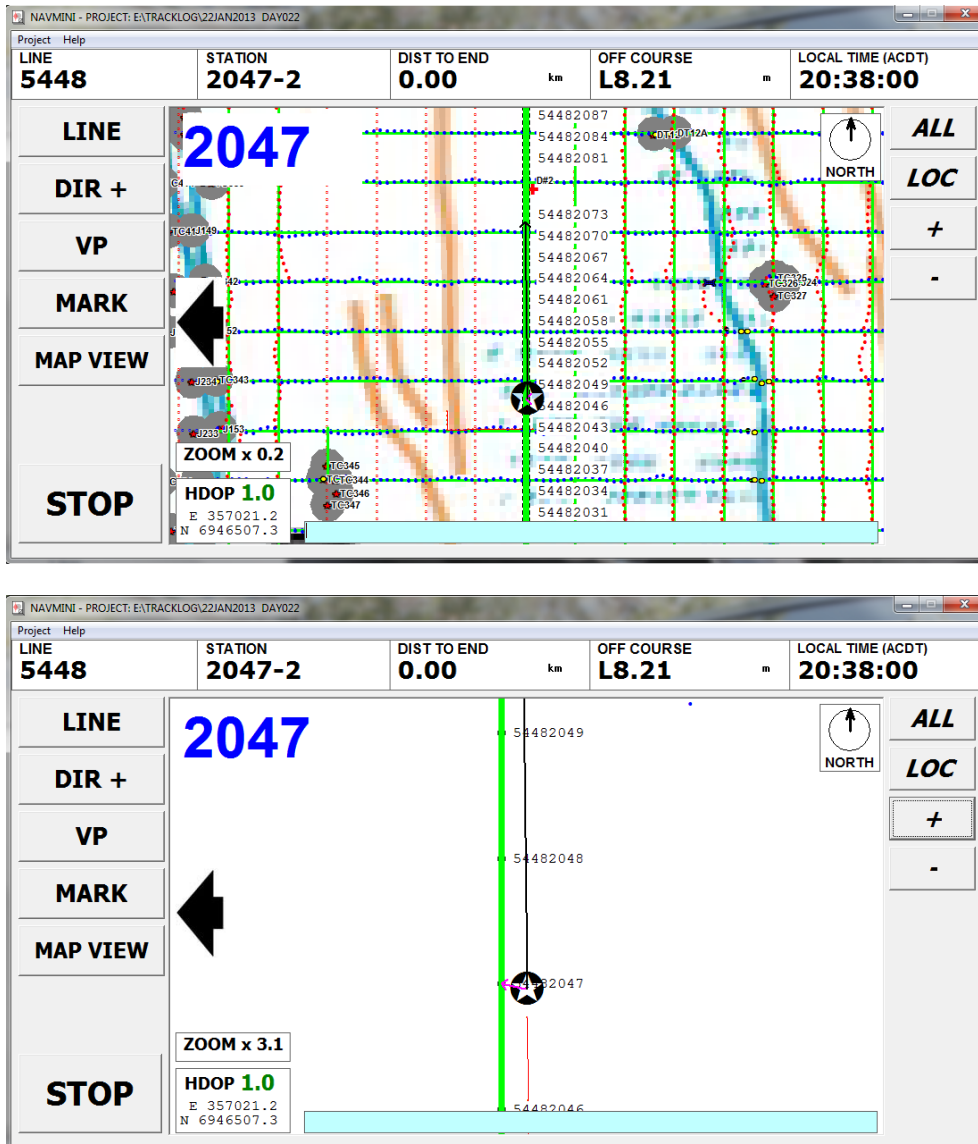
## ***METHOD OF SURVEY***

### **6.1 Line Preparation**

Terrex Contracting (TC) were contracted to carry out the line preparation on the Delaware 3D. Dozing commenced on 26<sup>th</sup> August and was completed on 21<sup>st</sup> September. Grading was completed on 29<sup>th</sup> September. Production was very good averaging 93.53Km / day.

Terrex Contracting supplied five dozers and two graders for the job. Two of the dozers were new and one of the dozers was a hire unit. The dozers performed well throughout the job with minimal breakdowns. The hire dozer was released on 8<sup>th</sup> September and demobilised from crew. There were periods where there was only one grader working due mainly to personnel numbers.

TC line clearing equipment was fitted out with TSp GPS Seismic line clearing units. These units comprise either Algiz 10x or Motion tablets running TSp NavMini machine guidance software in combination with an external Garmin USB or serial GPS receiver. These units ran reasonably well during the survey with only occasional power issues causing problems. These were resolved quickly by the line pointer.



**Figure 2** Example NavMini navigation screens

In the case of GPS accuracy loss, operator's back-track down the line to the last good position fixes to confirm the GPS antenna is still in working order. For small distances, such as passing under trees, operators will use back-sighting down the line to pass the obstacle and reacquire position fix. If, for an extended period of time, GPS fix isn't possible the operator will pull-up and make contact with the line pointer. The line pointer will assess the situation and the best approach to proceed such as walking ahead with a hand-held GPS and flagging the route for the operator.

The TSp Line Pointer worked closely with the operator scouting ahead where possible and on-call for assistance in the field. When in radio range, TC operators also have the available assistance of the senior surveyor at camp, as well as Survey Technicians in the field. Machine operators GIS data and accompanying hardcopy maps were updated daily and toolbox briefings held discussing obstacles likely to be encountered during the day.

The prospect fell within the Yandruwandha / Yawarrarrka (YY) native title area. The prospect was pre-cleared by teams consisting of a Santos Cultural Heritage supervisor, an archaeologist and two YY Cultural Heritage Officers. The Cultural Heritage site information gathered by these crews was then compiled and loaded into Santos' GIS system. Once Cultural Heritage approval was granted for each phase (prospect was broken up into 3 phases) the GIS information and site sketches were sent to the survey crew for loading onto the line preparation GPS navigation units. The Cultural Heritage site data were loaded as "no go" areas which would activate audible and visual alarms if the machine entered into the area.

## **6.2 GPS Surveying**

There are three modes of use in GPS surveying; static, kinematic and real-time kinematic. On assessment, it was decided a real-time kinematic survey utilising a local base station would best enable position and elevation co-ordinates to be acquired in real-time and on the appropriate datum.

This survey method utilised dual frequency (L1/ L2) phase data received from US Navy NAVSTAR satellites and Russian GLONASS satellites to provide three-dimensional positioning. Corrections for the GPS satellite positions are received from a local RTK base station, which transmits them via VHF radio. These corrections are applied in real-time to improve position accuracy.

Using this method of positioning calculation, the NovAtel dual frequency real-time kinematic method can achieve accuracies of better than +/-0.10m in position and elevation, depending on satellite constellation geometry.

Using the TSp in-house developed Nav12 software, checks and ties were examined in real-time operation to assess coordinate integrity.

Terrex Spatial Crew 1 also had two Trimble R10 GPS receivers on crew for doing control and backpacking hand carry sections on receiver lines. For the backpacking one of the R10s was set up at a control station and broadcast corrections using a UHF base transmitter. The second R10 was then used as a rover to survey the hand carry sections. This system was very efficient and could be easily operated by one person with the senior surveyor surveying the majority of hand carry sections. Range was also very good with corrections being received 20Km from the base.

## **6.3 Processing and Quality Control**

All survey data were immediately recorded internally on the Motion Tablets and subsequently downloaded to the office computer each evening.

Quality of the satellite data was monitored by careful examination of the various on-screen quality control statistics produced by the NAV12 software. These checks on data integrity are in the form of standard deviation (or sigma) values for Easting, Northing and Height and are generally better than 0.15 metres.

Any recording of positions where the standard deviation values exceeded 0.15 metres was highlighted to the surveyor at the time of recording. Following this, it was possible to re-initialise the GPS in order

to obtain a more accurate solution. Any recorded position falling outside the required tolerances was flagged for further investigation and re-recording if necessary.

Numerous checks on pre-recorded marks were observed during each day's survey in order to confirm the integrity of the RTK corrections and the placed markers.

All in-field data was recorded to Nav12 files for traceability and archived accordingly. Field booking sheets were used by each surveyor, each day, and scanned at a later date. Additional quality checking information included a database of production, Finals checklist, daily reports and daily production maps.

On return to camp the field data was downloaded into GPSeismic QuickView processing software where further QC checking was done and any points requiring review were flagged. Several QC checks were done and the data was then loaded into a survey database where further checking could be done. The QC checks included the following:

- Base coordinates and elevation were checked on download against the control data.
- Antenna heights were checked.
- Cross line and inline offsets from design were checked for any anomalies.
- GPS quality checks. (Horizontal precision, Vertical precision, Number of satellites and RMS.
- Checkshot comparisons
- Old Permanent Marker comparisons
- Missing station checks.

Once checking was completed in QuickView and loaded into the survey database, data could then be queried using GPSQL and the results exported to mapping software (ArcGIS / MapInfo / GlobalMapper) or to reports. The mapping software allowed for quick visual checking of point locations. Final survey data was also generated through GPSQL. GPSQL also had numerous QC / reporting capabilities including vertical and horizontal profiling, point interpolation, check shot comparisons, offset data recalculation, DEM operations, intersection calculations, station interval calculations, flexible reporting options and extensive data management capabilities.

TSp Crew 1 have also made advances in the handling of report data through GPSeismic. All daily report information can now be produced directly from GPSQL. This process is efficient and reduces the amount of time processing data in the evenings. Daily reports were emailed each day, along with daily production maps, and internal weekly reports as required.



## DATA PRESENTATION

All line files were checked and finalised before the survey crew demobilised from the project.

All final data were in UTM grid coordinate format on the MGA94 Zone 54 projection on the GRS80 reference spheroid. All elevations were on the Australian Height Datum (AHD71).

Data including maps, dozer production files and postplot survey data were submitted regularly to the Santos Client Representative.

Final data produced were:

- **Daily Reports Folder** - XLSX containing tabs for daily report and production map
- **Final Operations Report** - PDF of the final operations report
- **Final Survey Data Folder**
  - **SPS/RPS** - Receiver data in r01 and Source in s01 format
  - **SEG** - Line data in SEG P1 format
  - **UKA** - Line data in UKOOA format
- **GIS\_Data Folder** - Associated shape files
- **Maps Folder** - PDF of General and Trace maps.
- **Photographs Folder** - JPG files of all job photographs

All files are backed up on digital disks in the Brisbane office for future reference.



## 8



## **HEALTH, SAFETY AND ENVIRONMENT**

All personnel were aware of safety conditions concerning all exploration seismic surveys. The Terrex Spatial “**Quality Policy Statement**” and “**Health, Safety and Environment Policy**” documents were adhered to at all times.

Terrex Spatial adhered to the Terrex Seismic ERP and SSSP documents, which governed this project. A Terrex HSE officer was on crew throughout the survey.

Besides site inductions, all TSp personnel have completed 4WD and First Aid training. All personnel had also completed the Santos heat stress online induction.

A paramedic was assigned to the crew. The paramedic spent each day in the field in a central location within radio range of the camp and field personnel.

All TSp vehicles were fitted with UHF and VHF radios, satellite phone, shovel, first-aid kit, dry powder fire extinguishers and rotating beacon. Vehicle prestart checks were carried out each morning and the prestart check books filled out and passed onto the crew HSE officer.

Daily toolbox meetings and weekly safety meetings were chaired by the TC crew manager and documented by the crew HSE officer. All personnel including Client Representative were breathalyzed each morning prior to the toolbox meeting. There was good participation at the toolbox meetings by all parties.

The In Vehicle Monitoring System (IVMS) was used to monitor crew driving during the survey. A block speed limit of 40Km/hr was placed within the extents of the survey area. The survey crew supplied road, track and fence data so that speed zones could be set up in the system to allow for higher speeds in these areas. Santos roads were set at 80Km/hr while tracks and fence lines were set at 60Km/hr. These zones were clearly marked on prospect maps and on the JuggyNav maps in the crew vehicles’ GPS navigation units.

Extra care was required during the survey while driving on the main access roads due to a rig operating at Washington #1 in the north of the prospect east of the Cuttapirrie Road. There were numerous third party trucks and light vehicles using the road at all times of the day.

As mentioned elsewhere in this report special care was taken to reduce the visibility of lines which crossed the Cordillo Downs Road in the south east corner of the prospect. This road is frequented by tourists especially during the time of the survey.

There were also numerous sections of lines which passed through the large saltbush flats that were scattered through the prospect. These sections were walked by the dozers to minimize environmental disturbance to these areas.

## 9



## OPERATIONAL ASPECTS

Terrex Spatial (TSp) Crew 1 commenced mobilisation to site on 21<sup>st</sup> August 2015 with four personnel travelling from Brisbane to Moomba. The crew consisted of Dean Hausmann (Project Manager), Hamed Asfhar (Line Pointer), Mike Clark (Line Surveyor) and Ryan Gemmel (Line Surveyor). The crew initially stayed at Cooper Parks while the camp was readied for moving to the prospect. Eric Amedee (Senior Surveyor) mobilised from Yeppoon to Cooper Parks on 22<sup>nd</sup> and 23<sup>rd</sup> August. The survey crew painted pegs and sorted equipment in preparation for the survey during those two days.

Santos site and Cultural Heritage inductions were conducted at Cooper Parks on the evening of 23<sup>rd</sup> August. These were conducted by Tom Pickett (Santos representative) and Peter Tomlinson (Santos Cultural Heritage Supervisor).

The Terrex Contracting (TC) Crew 2 camp was moved from Cooper Parks to Delaware 3D camp site on 24<sup>th</sup> August. The camp site was located on a large CH cleared site on the west side of the Cuttapirrie Road north of Bookabourdie satellite. The Terrex Seismic Crew 2 camp was located on the north side of the TC camp when it arrived on site.

On 25<sup>th</sup> August TSp Crew 1 personnel set up the navigation GPS units on the dozers, set up the survey GPS units, established initial control and created project data and maps. On the morning of 26<sup>th</sup> August a line preparation start-up meeting was held and line preparation commenced soon after with four dozers in the south of the prospect. Early on it was decided to prepare the receiver lines first so that the source dozers could use the receivers to cross the dunes. This method was used throughout the prospect.

Dozer 2 (fifth dozer) commenced work on 28<sup>th</sup> August in the south east corner of the prospect. This area was very sensitive due to environmental (visibility from Cordillo Downs Road) and Cultural Heritage (large number of sites) issues. Eric Amedee assisted the operator (Michael Grassick) in preparing the seismic lines through this area to minimise line visibility and avoid CH sites. Also on the eastern side of the Cordillo Downs Road in the gibber terrain only the source lines and creek areas on receiver lines were walked. These sections were completed by 4<sup>th</sup> September.

Line preparation operations continued smoothly with high production in easy terrain (low dunes and large flats) allowing the line preparation lead over survey to reach 450Km on 7<sup>th</sup> September. The hired

dozer was demobilised on 8<sup>th</sup> September. This, and the addition of an extra Line Surveyor on 11<sup>th</sup> September, enabled survey to gradually reduce the lead to a more manageable level.

The adoption of the stakeless source method for recording also enabled the survey crew to achieve very high production rates on source lines with the crew achieving over 200Km production on 18<sup>th</sup> September.

There were many source offsets and detours for the Santos oil and gas pipelines, CH sites, dunes and waterholes (in the south). There were twelve (12) vibrator skips due to these obstacles. Most of these were due to avoiding cutting dunes visible from the Cordillo Downs Road. There were larger wind-blown dunes in the north requiring source lines to be offset. There were expanded CH cleared zones on these dunes to allow lines to be offset.

Dozing and survey operations were completed on 21<sup>st</sup> September while grading operations were completed on 29<sup>th</sup> September. Line preparation completed the survey in 27 days averaging 93.53Km per day while survey completed the survey in 26 days averaging 97.13Km per day.

The survey crew demobilised from Delaware 3D on 24<sup>th</sup> September. The majority of the line preparation crew demobilised on 24<sup>th</sup> September as well. A small crew consisting of crew manager, two mechanics and two grader operators remained on site while grading was completed. The camp remained on site pending the start of Beanbush 3D – another Santos 3D located approximately 40 minutes drive to the north at Beanbush field.



**Photograph 2**      **TC2 Camp offices**

# 10



## CONCLUSIONS AND RECOMMENDATIONS

Throughout the Delaware 3D Terrex Spatial Crew 1 achieved excellent production. Overall survey operations ran smoothly with no major operational issues encountered and no reportable/recordable incidents. Initially survey production lagged behind line preparation however with the addition of an extra Line Surveyor, and cutting the number of dozers from five back to four, survey gradually reduced the lead and eventually completed field surveying on the same day as line preparation.

Changes to Terrex Contracting's crew management system and camp equipment have made a positive difference to crew morale with better crew management, improved camp facilities and single accommodation. Having a crew manager on site assists by reducing the workload of the line preparation manager and senior surveyor enabling them to concentrate on their respective departments.

### Survey Statistics:

- The project consisted of 2525.44 kilometres pegged over a period of 26 days
- Averaging 97.13kms per day (including hand-carry and field checks)
- 0 Stand-down/standby days (excluding initial start-up period)
- 713 Hand-carry points, due to infrastructure, CH sites and deviations.
- 12 Vibes Skips due to dunes, pipelines or CH sites.

TSp hopes to utilise the experience gained from this project to further develop and grow in our ability to face evermore challenging projects. We welcome any feedback to aid in continual improvement.

Signed,

Terrex Spatial

*Eric Amedee*

Senior Surveyors

# 11

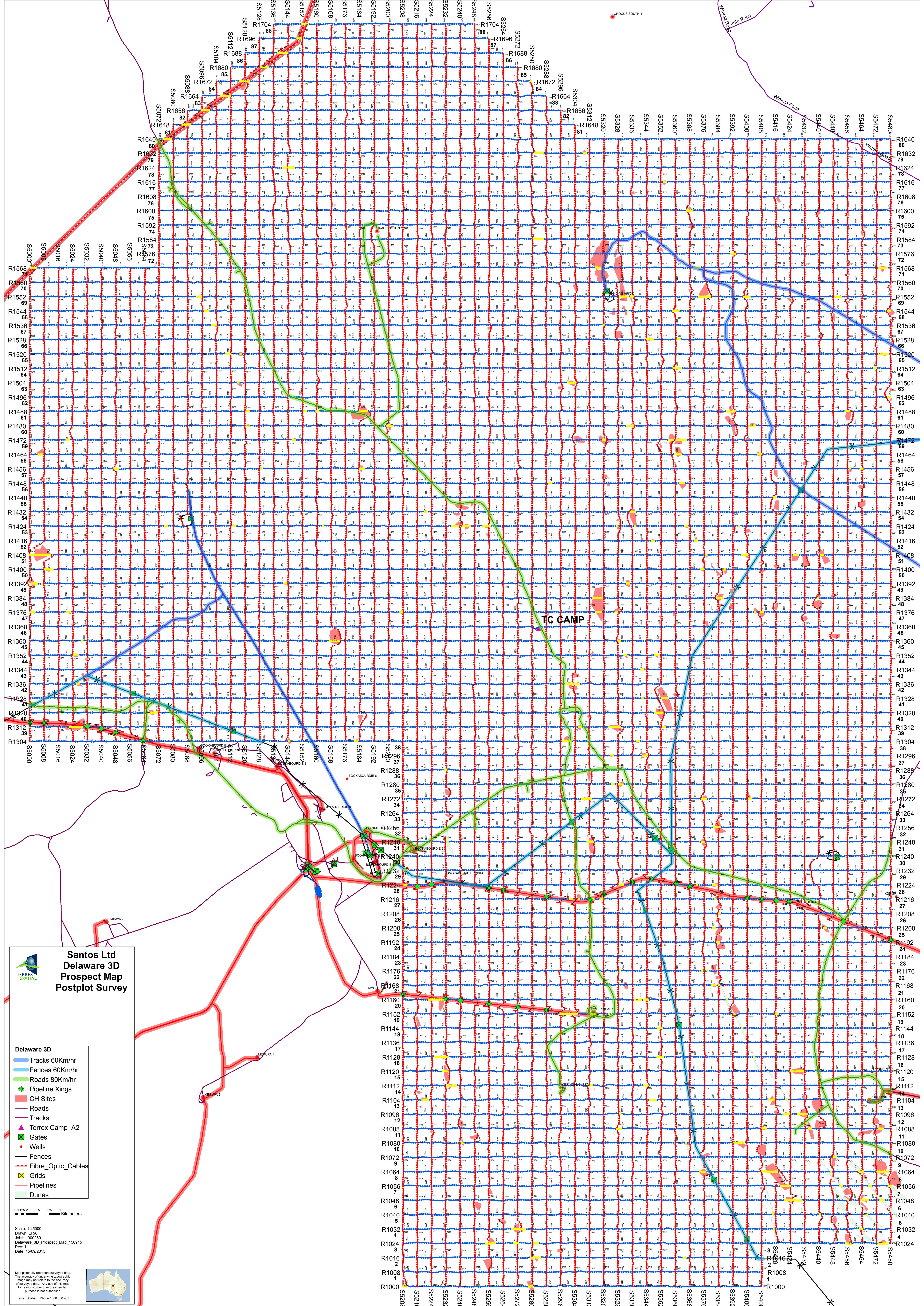



## ***APPENDICES***



## *Appendix A - **Project Map***








**Santos Ltd**  
**Delaware 3D**  
**Prospect Map**  
**Postplot Survey**

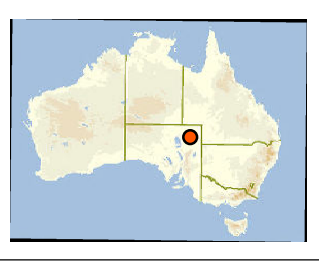
**Delaware 3D**

- Tracks 60Km/hr
- Fences 60Km/hr
- Roads 80Km/hr
- Pipeline Xings
- CH Sites
- Roads
- Tracks
- Terrex Camp\_A2
- Gates
- Wells
- Fences
- Fibre\_Optic\_Cables
- Grids
- Pipelines
- Dunes



Scale: 1:25000  
Drawn: ERA  
Job#: 3000269  
Delaware\_3D\_Prospect\_Map\_150915  
Rev: 1  
Date: 15/09/2015

Map prioritarily represent surveyed data. The accuracy of underlying topographic image may not relate to the accuracy of surveyed data. Any use of this map for reasons other than the intended purpose is not authorised.



Terrex Spatial - Phone 1800 980 407



## *Appendix B - Survey Control, Miscloses and Ties*

**Survey Control and Miscloses**  
**All values are MGA94 (Zone 54), AHD71 (Ausgeoid09)**

**Survey Control Stations:**

Survey Reference System:		MGA Zone 54 / AHD71 (AUSGeoid09)			
Initial Control Datum Used:					
DAY	STATION	EASTING	NORTHING	RL	COMMENTS (Origins and Accuracy)
	BAKA1	450471.125	6954973.729	53.341	Static network
	CON6	444286.347	6970497.607	42.837	Static network
	DEL1	452502.171	6959406.654	40.073	Static network
	DEL2	453468.578	6950639.984	54.379	Static network (Datum – AUSPOS)
	DEL3	456502.090	6959227.499	46.836	Static network
	DEL4	444572.915	6961783.332	53.183	Static network
	DEL5	452332.436	6968799.564	54.956	Static network
	MUD1	439073.478	6958032.512	44.569	Static network
	P16A	459855.707	6948878.966	68.116	Static network

**Control Miscloses:**

DAY	STATION	EASTING	NORTHING	RL	COMMENTS
237	DEL1	452502.174	6959406.664	40.095	GIVEN AUSPOS 237
		452502.171	6959406.654	40.073	OURS Network
		<b>-0.003</b>	<b>-0.010</b>	<b>-0.022</b>	MISCLOSE (OURS - GIVEN)
257	DEL3	456502.078	6959227.526	46.793	GIVEN AUSPOS 257
		456502.090	6959227.499	46.836	OURS Network
		<b>0.012</b>	<b>-0.027</b>	<b>0.043</b>	MISCLOSE (OURS - GIVEN)
247	DEL4	444572.909	6961783.338	53.179	GIVEN AUSPOS 247
		444572.915	6961783.332	53.183	OURS Network
		<b>0.006</b>	<b>-0.006</b>	<b>0.004</b>	MISCLOSE (OURS - GIVEN)
257	DEL5	452332.383	6968799.57	54.91	GIVEN AUSPOS 257
		452332.436	6968799.564	54.956	OURS Network
		<b>0.053</b>	<b>-0.006</b>	<b>0.046</b>	MISCLOSE (OURS - GIVEN)
237	MUD1	439073.463	6958032.517	44.553	GIVEN AUSPOS 237
		439073.478	6958032.512	44.569	OURS Network
		<b>0.015</b>	<b>-0.005</b>	<b>0.016</b>	MISCLOSE (OURS - GIVEN)
NA	MUD1	439073.437	6958032.47	44.582	GIVEN Mudrangie 3D (2015)
		439073.478	6958032.512	44.569	OURS Network
		<b>0.041</b>	<b>0.042</b>	<b>-0.013</b>	MISCLOSE (OURS - GIVEN)
NA	BAKA1	450471.220	6954973.610		GIVEN Bookabourdie 3D (2007) - X,Y only (dumpy disturbed)
		450471.125	6954973.729		OURS
		<b>-0.095</b>	<b>0.119</b>	<b>0</b>	MISCLOSE (OURS - GIVEN)
242	P16A	459855.71	6948878.961	68.091	GIVEN AUSPOS 242
		459855.707	6948878.966	68.116	OURS Network

DAY	STATION	EASTING	NORTHING	RL	COMMENTS
		<b>-0.003</b>	<b>0.005</b>	<b>0.025</b>	MISCLOSE (OURS - GIVEN)
NA	<b>P16A</b>	459855.719	6948878.139	68.104	GIVEN Santos Pondrinie #16 well sketch (converted from AGD84)
		459855.707	6948878.966	68.116	OURS Network
		<b>-0.012</b>	<b>0.827</b>	<b>0.012</b>	MISCLOSE (OURS - GIVEN)

## *Appendix C - **Line Listing***



## Delaware 3D Seismic Survey

### Receiver Line Lengths Summary

Line	From	To	PTS	km
CPSAN15-R1000	5208	5407	200	8.00
CPSAN15-R1008	5208	5407	200	8.00
CPSAN15-R1016	5208	5407	200	8.00
CPSAN15-R1024	5208	5479	272	10.88
CPSAN15-R1032	5208	5479	272	10.88
CPSAN15-R1040	5208	5479	272	10.88
CPSAN15-R1048	5208	5479	272	10.88
CPSAN15-R1056	5208	5479	272	10.88
CPSAN15-R1064	5208	5479	272	10.88
CPSAN15-R1072	5208	5479	272	10.88
CPSAN15-R1080	5208	5479	272	10.88
CPSAN15-R1088	5208	5479	272	10.88
CPSAN15-R1096	5208	5479	272	10.88
CPSAN15-R1104	5208	5479	272	10.88
CPSAN15-R1112	5208	5479	272	10.88
CPSAN15-R1120	5208	5479	272	10.88
CPSAN15-R1128	5208	5479	272	10.88
CPSAN15-R1136	5208	5479	272	10.88
CPSAN15-R1144	5208	5479	272	10.88
CPSAN15-R1152	5208	5479	272	10.88
CPSAN15-R1160	5208	5479	272	10.88
CPSAN15-R1168	5208	5479	272	10.88
CPSAN15-R1176	5208	5479	272	10.88
CPSAN15-R1184	5208	5479	272	10.88
CPSAN15-R1192	5208	5479	272	10.88
CPSAN15-R1200	5208	5479	272	10.88
CPSAN15-R1208	5208	5479	272	10.88
CPSAN15-R1216	5208	5479	272	10.88
CPSAN15-R1224	5208	5479	272	10.88
CPSAN15-R1232	5208	5479	272	10.88
CPSAN15-R1240	5208	5479	272	10.88
CPSAN15-R1248	5208	5479	272	10.88
CPSAN15-R1256	5208	5479	272	10.88
CPSAN15-R1264	5208	5479	272	10.88
CPSAN15-R1272	5208	5479	272	10.88
CPSAN15-R1280	5208	5479	272	10.88
CPSAN15-R1288	5208	5479	272	10.88
CPSAN15-R1296	5208	5479	272	10.88
CPSAN15-R1304	5000	5479	480	19.20
CPSAN15-R1312	5000	5479	480	19.20

Line	From	To	PTS	km
CPSAN15-R1320	5000	5479	480	19.20
CPSAN15-R1328	5000	5479	480	19.20
CPSAN15-R1336	5000	5479	480	19.20
CPSAN15-R1344	5000	5479	480	19.20
CPSAN15-R1352	5000	5479	480	19.20
CPSAN15-R1360	5000	5479	480	19.20
CPSAN15-R1368	5000	5479	480	19.20
CPSAN15-R1376	5000	5479	480	19.20
CPSAN15-R1384	5000	5479	480	19.20
CPSAN15-R1392	5000	5479	480	19.20
CPSAN15-R1400	5000	5479	480	19.20
CPSAN15-R1408	5000	5479	480	19.20
CPSAN15-R1416	5000	5479	480	19.20
CPSAN15-R1424	5000	5479	480	19.20
CPSAN15-R1432	5000	5479	480	19.20
CPSAN15-R1440	5000	5479	480	19.20
CPSAN15-R1448	5000	5479	480	19.20
CPSAN15-R1456	5000	5479	480	19.20
CPSAN15-R1464	5000	5479	480	19.20
CPSAN15-R1472	5000	5479	480	19.20
CPSAN15-R1480	5000	5479	480	19.20
CPSAN15-R1488	5000	5479	480	19.20
CPSAN15-R1496	5000	5479	480	19.20
CPSAN15-R1504	5000	5479	480	19.20
CPSAN15-R1512	5000	5479	480	19.20
CPSAN15-R1520	5000	5479	480	19.20
CPSAN15-R1528	5000	5479	480	19.20
CPSAN15-R1536	5000	5479	480	19.20
CPSAN15-R1544	5000	5479	480	19.20
CPSAN15-R1552	5000	5479	480	19.20
CPSAN15-R1560	5000	5479	480	19.20
CPSAN15-R1568	5000	5479	480	19.20
CPSAN15-R1576	5072	5479	408	16.32
CPSAN15-R1584	5072	5479	408	16.32
CPSAN15-R1592	5072	5479	408	16.32
CPSAN15-R1600	5072	5479	408	16.32
CPSAN15-R1608	5072	5479	408	16.32
CPSAN15-R1616	5072	5479	408	16.32
CPSAN15-R1624	5072	5479	408	16.32
CPSAN15-R1632	5072	5479	408	16.32
CPSAN15-R1640	5072	5479	408	16.32
CPSAN15-R1648	5080	5303	224	8.96

Line	From	To	PTS	km
CPSAN15-R1656	5088	5295	208	8.32
CPSAN15-R1664	5096	5287	192	7.68
CPSAN15-R1672	5104	5279	176	7.04
CPSAN15-R1680	5112	5271	160	6.40
CPSAN15-R1688	5120	5263	144	5.76
CPSAN15-R1696	5128	5255	128	5.12
CPSAN15-R1704	5136	5247	112	4.48
		<b>Total:</b>	<b>31456</b>	<b>1258.24</b>
		<b># Lines:</b>	<b>89</b>	

## Delaware 3D Seismic Survey

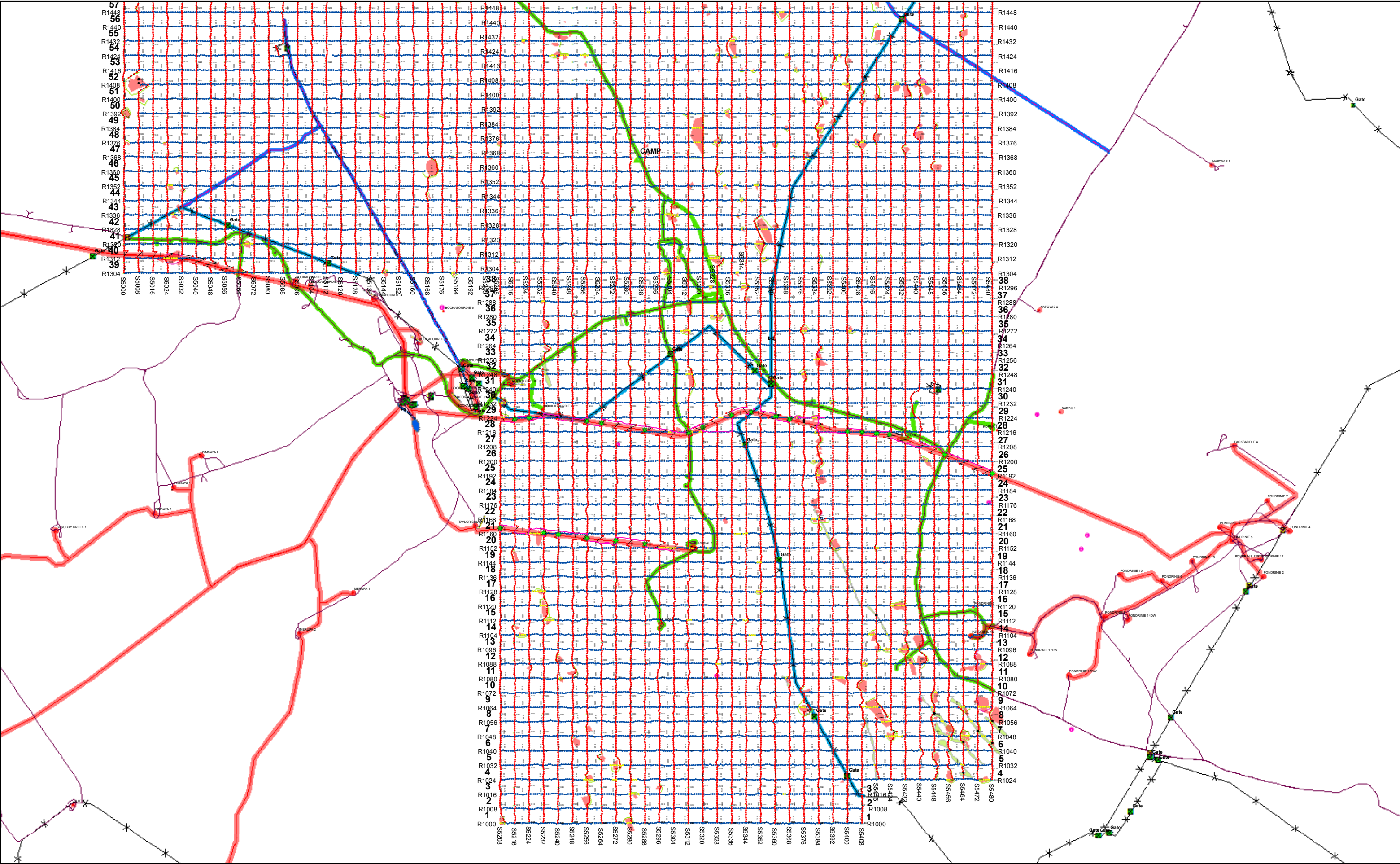
### Source Line Lengths Summary

Line	From	To	PTS	km
CPSAN15-S5000	1304	1567	264	10.56
CPSAN15-S5008	1304	1567	264	10.56
CPSAN15-S5016	1304	1567	264	10.56
CPSAN15-S5024	1304	1567	264	10.56
CPSAN15-S5032	1304	1567	264	10.56
CPSAN15-S5040	1304	1567	264	10.56
CPSAN15-S5048	1304	1567	264	10.56
CPSAN15-S5056	1304	1567	264	10.56
CPSAN15-S5064	1304	1567	264	10.56
CPSAN15-S5072	1304	1639	336	13.44
CPSAN15-S5080	1304	1647	344	13.76
CPSAN15-S5088	1304	1655	352	14.08
CPSAN15-S5096	1304	1663	360	14.40
CPSAN15-S5104	1304	1671	368	14.72
CPSAN15-S5112	1304	1679	376	15.04
CPSAN15-S5120	1304	1687	384	15.36
CPSAN15-S5128	1304	1695	392	15.68
CPSAN15-S5136	1304	1703	400	16.00
CPSAN15-S5144	1304	1703	400	16.00
CPSAN15-S5152	1304	1703	400	16.00
CPSAN15-S5160	1304	1703	400	16.00
CPSAN15-S5168	1304	1703	400	16.00
CPSAN15-S5176	1304	1703	400	16.00
CPSAN15-S5184	1304	1703	400	16.00
CPSAN15-S5192	1304	1703	400	16.00
CPSAN15-S5200	1304	1703	400	16.00
CPSAN15-S5208	1000	1703	704	28.16
CPSAN15-S5216	1000	1703	704	28.16

Line	From	To	PTS	km
CPSAN15-S5224	1000	1703	704	28.16
CPSAN15-S5232	1000	1703	704	28.16
CPSAN15-S5240	1000	1703	704	28.16
CPSAN15-S5248	1000	1703	704	28.16
CPSAN15-S5256	1000	1695	696	27.84
CPSAN15-S5264	1000	1687	688	27.52
CPSAN15-S5272	1000	1679	680	27.20
CPSAN15-S5280	1000	1671	672	26.88
CPSAN15-S5288	1000	1663	664	26.56
CPSAN15-S5296	1000	1655	656	26.24
CPSAN15-S5304	1000	1647	648	25.92
CPSAN15-S5312	1000	1639	640	25.60
CPSAN15-S5320	1000	1639	640	25.60
CPSAN15-S5328	1000	1639	640	25.60
CPSAN15-S5336	1000	1639	640	25.60
CPSAN15-S5344	1000	1639	640	25.60
CPSAN15-S5352	1000	1639	640	25.60
CPSAN15-S5360	1000	1639	640	25.60
CPSAN15-S5368	1000	1639	640	25.60
CPSAN15-S5376	1000	1639	640	25.60
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CPSAN15-S5392	1000	1639	640	25.60
CPSAN15-S5400	1000	1639	640	25.60
CPSAN15-S5408	1000	1639	640	25.60
CPSAN15-S5416	1024	1639	616	24.64
CPSAN15-S5424	1024	1639	616	24.64
CPSAN15-S5432	1024	1639	616	24.64
CPSAN15-S5440	1024	1639	616	24.64
CPSAN15-S5448	1024	1639	616	24.64
CPSAN15-S5456	1024	1639	616	24.64
CPSAN15-S5464	1024	1639	616	24.64
CPSAN15-S5472	1024	1639	616	24.64
CPSAN15-S5480	1024	1639	616	24.64
		<b>Total:</b>	<b>31680</b>	<b>1267.20</b>
		<b># Lines:</b>	<b>61</b>	

## *Appendix D - **Panel Maps***





Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_Line\_Crew\_150915  
Rev: 1  
Date: 15/09/2015



# Delaware 3D Prospect Map R1000 - 1168

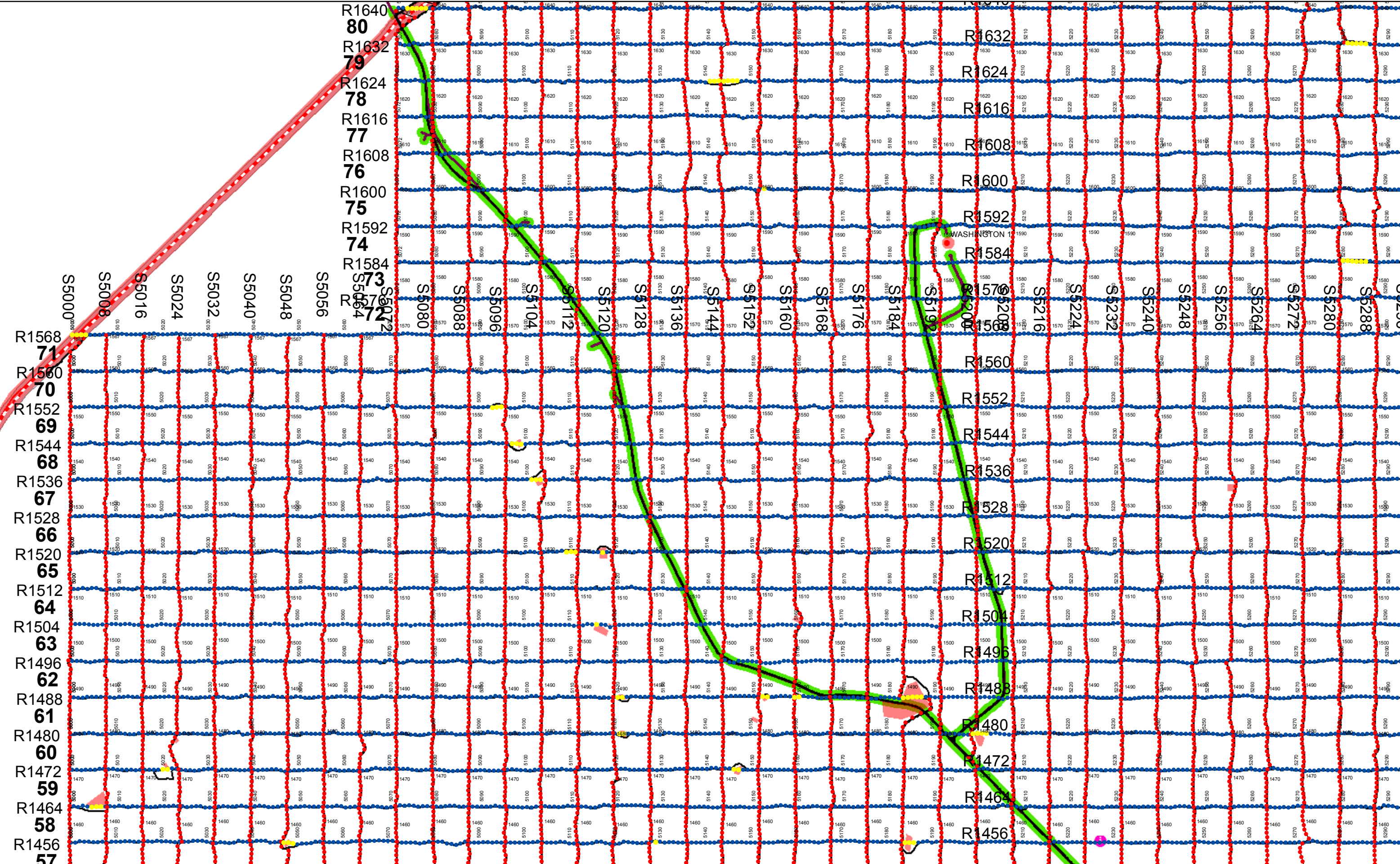
- |                  |                       |             |                  |
|------------------|-----------------------|-------------|------------------|
| • Pipeline Xings | CH Sites              | — X Fences  | — Roads 80Km/hr  |
| • Skips          | • New CH Sites        | • Grids     | — Tracks 60Km/hr |
| • Hand_Carry     | • Dunes - no vehicles | • Pipelines | — Fences 60Km/hr |
| • Source         | • Roads               |             |                  |
| • Receiver       | • Tracks              |             |                  |
|                  | • Gates               |             |                  |

00025.9.751  
Kilometers

Map pictorially represent surveyed data. The accuracy of underlying topographic image may not relate to the accuracy of surveyed data. Any use of this map for reasons other than the intended purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_R1464-1632\_West\_LC  
Rev: 1  
Date: 22/09/2015

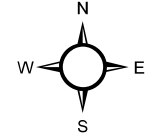


# Delaware 3D Prospect Map

## R1464 - 1632 West

- Receiver
- Source
- Hand\_Carry
- Pipeline Xings
- CH Sites
- New CH Sites
- Water pipes
- Dunes - no vehicles
- Roads
- Tracks
- Fences
- Gates
- Grids
- Pipelines
- Roads 80Km/hr
- Tracks 60Km/hr
- Fences 60Km/hr

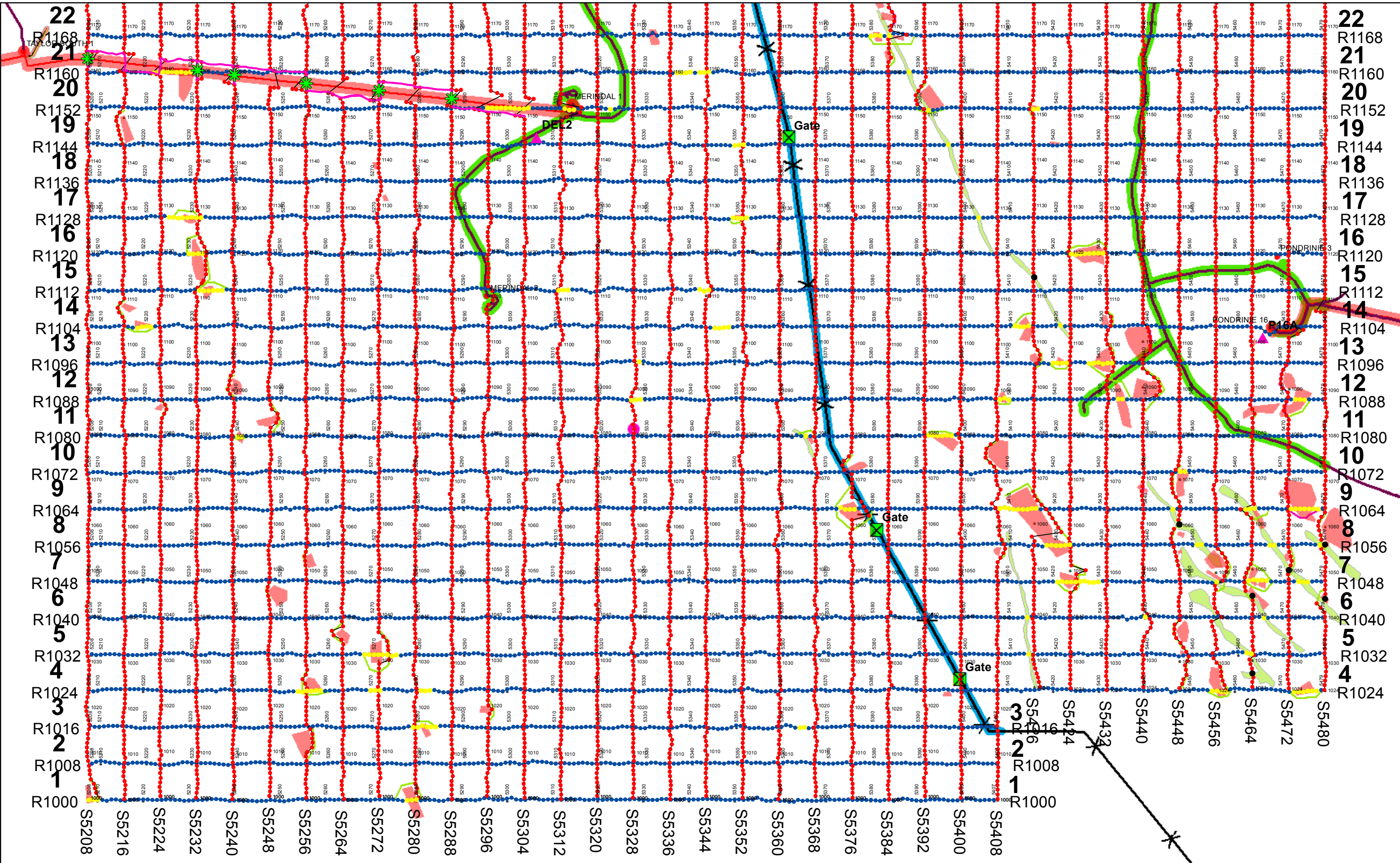
00.125.25 0.5 0.75 1 Kilometers



Map pictorially represent surveyed data. The accuracy of underlying topographic image may not relate to the accuracy of surveyed data. Any use of this map for reasons other than the intended purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_Line\_Crew\_150915  
Rev: 1  
Date: 15/09/2015



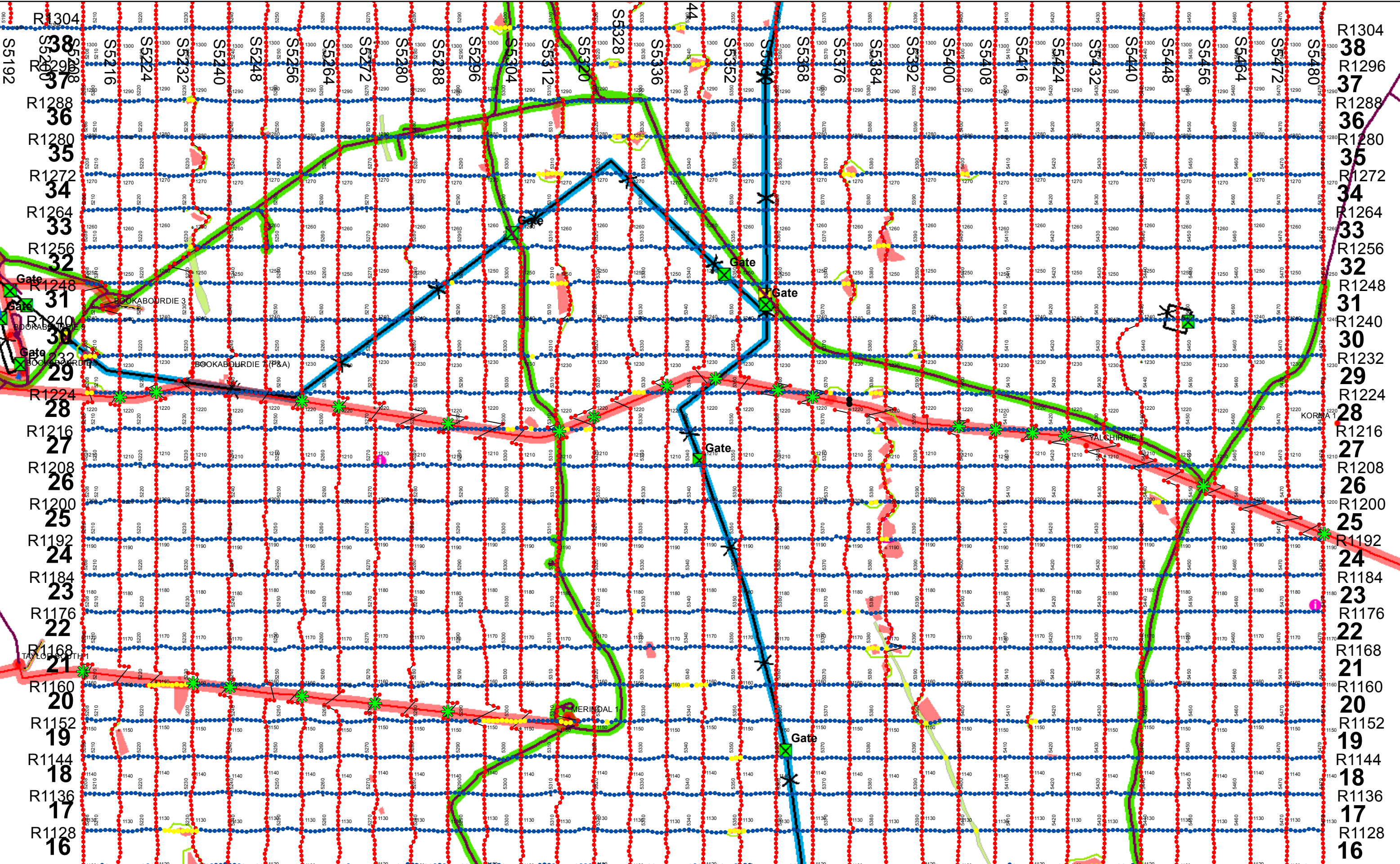
## Delaware 3D Prospect Map R1000 - 1168

00.125 0.25 0.5 0.75 1  
Kilometers

Map pictorially represent surveyed data.  
The accuracy of underlying topographic  
image may not relate to the accuracy  
of surveyed data. Any use of this map  
for reasons other than the intended  
purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_Line\_Crew\_150915  
Rev: 1  
Date: 15/09/2015



# Delaware 3D Prospect Map R1000 - 1168

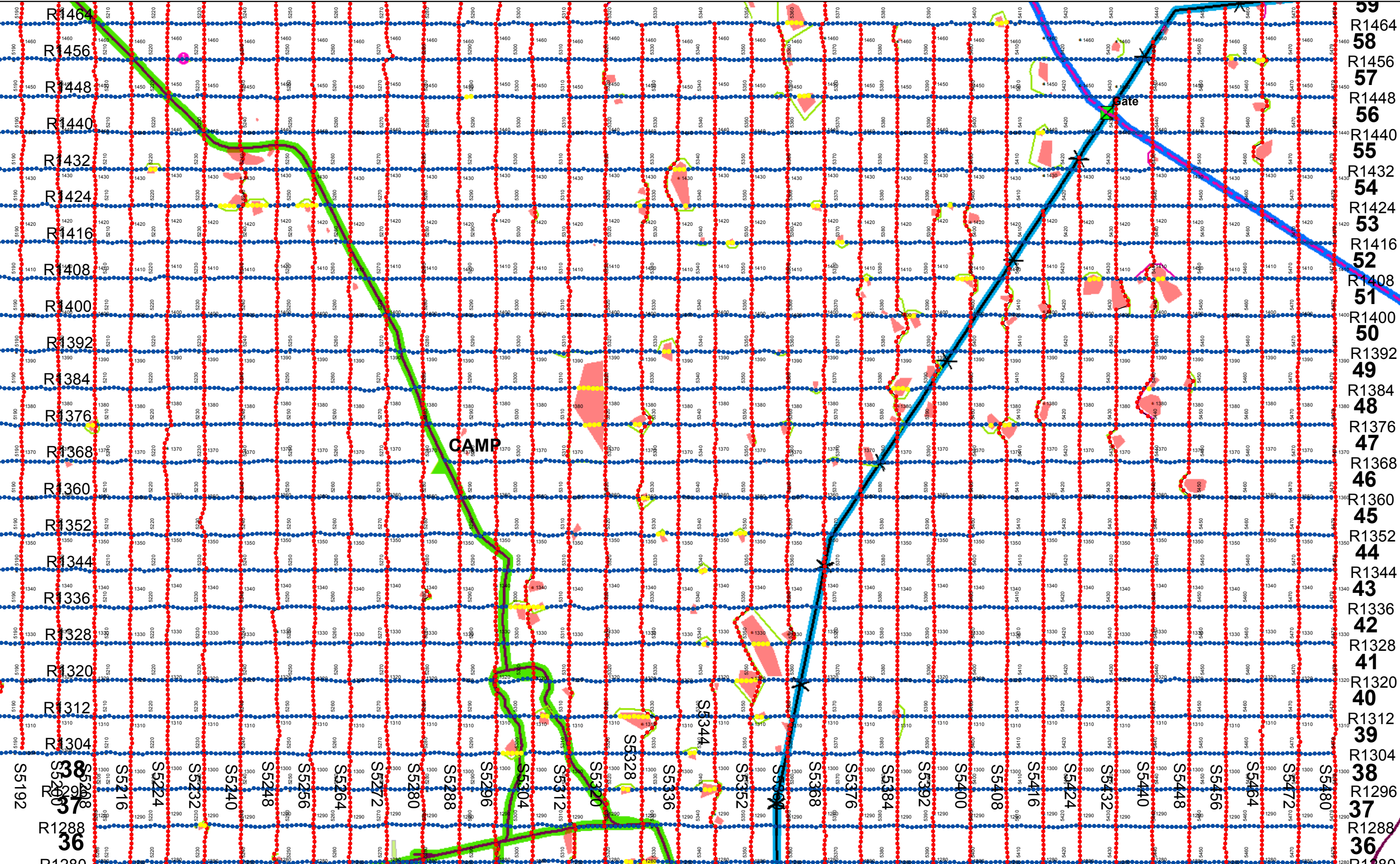
- |              |                       |                  |                  |
|--------------|-----------------------|------------------|------------------|
| ● Hand_Carry | CH Sites              | — Fences         | ● Roads 80Km/hr  |
| ● Source     | ● New CH Sites        | ⊗ Grids          | ● Tracks 60Km/hr |
| ● Receiver   | ■ Dunes - no vehicles | — Pipelines      | ● Fences 60Km/hr |
|              | ■ Roads               | ✱ Pipeline Xings |                  |
|              | ■ Tracks              |                  |                  |
|              | ✱ Gates               |                  |                  |



Map pictorially represent surveyed data.  
The accuracy of underlying topographic  
image may not relate to the accuracy  
of surveyed data. Any use of this map  
for reasons other than the intended  
purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





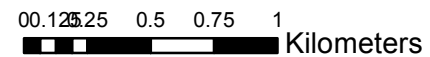
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Rev: 1  
Date: 20/09/2015



# Delaware 3D Prospect Map

## R1288 - 1464 East

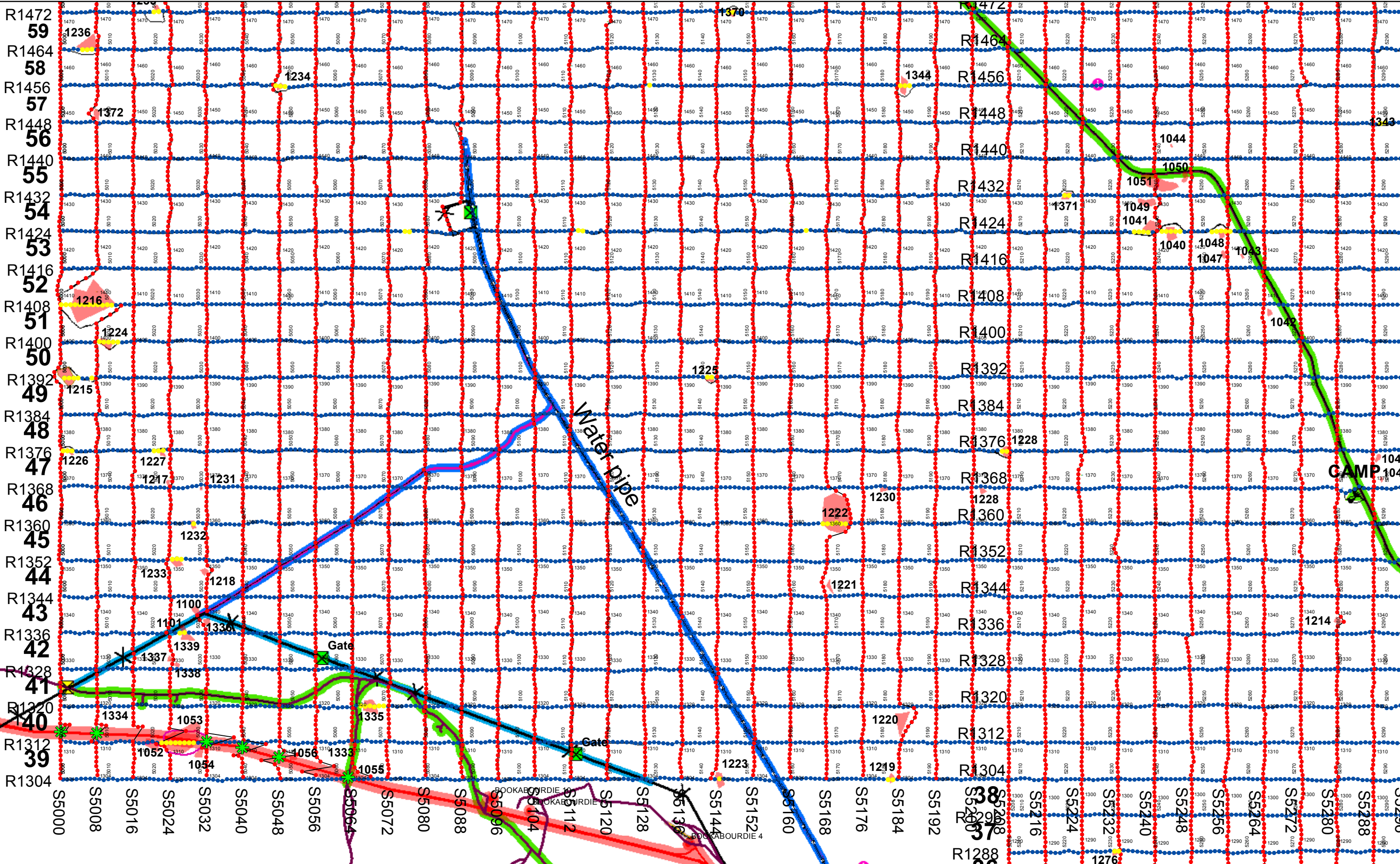
- Hand\_Carry
- Source
- Receiver
- CH Sites
- New CH Sites
- Dunes - no vehicles
- Roads
- Tracks
- Gates
- Fences
- Grids
- Pipelines
- Pipeline Xings
- Roads 80Km/hr
- Tracks 60Km/hr
- Fences 60Km/hr



Map pictorially represent surveyed data. The accuracy of underlying topographic image may not relate to the accuracy of surveyed data. Any use of this map for reasons other than the intended purpose is not authorised.

Terrex Spatial : Phone 1800 060 407



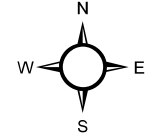
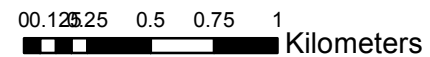


Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_R1264-1464\_West\_LC  
Rev: 1  
Date: 23/09/2015



# Delaware 3D Prospect Map R1288 - 1464 West

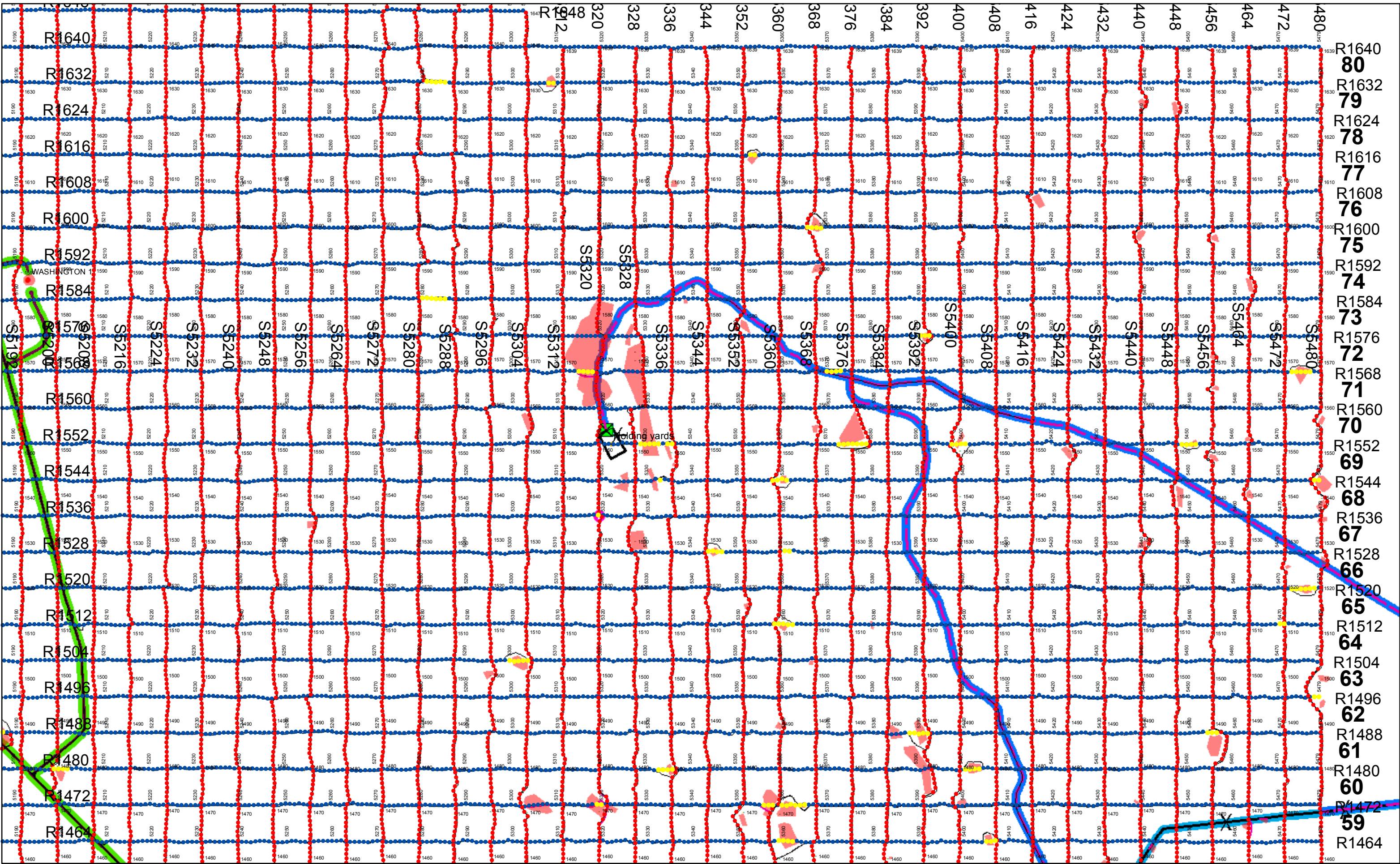
- |                |                     |           |                |
|----------------|---------------------|-----------|----------------|
| Receiver       | CH Sites            | Fences    | Roads 80Km/hr  |
| Source         | New CH Sites        | Gates     | Tracks 60Km/hr |
| Hand_Carry     | Water pipes         | Grids     | Fences 60Km/hr |
| Pipeline Xings | Dunes - no vehicles | Pipelines |                |
|                | Roads               |           |                |
|                | Tracks              |           |                |



Map pictorially represent surveyed data.  
The accuracy of underlying topographic  
image may not relate to the accuracy  
of surveyed data. Any use of this map  
for reasons other than the intended  
purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





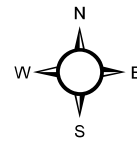
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Drawn: ERA  
Job#: J000303  
Delaware\_3D\_R1464-1640\_East\_LC  
Rev: 1  
Date: 22/09/2015



## Delaware 3D Prospect Map R1464 - 1640 East

- |                  |                       |             |                  |
|------------------|-----------------------|-------------|------------------|
| ● Receiver       | CH Sites              | — Fences    | — Roads 80Km/hr  |
| ● Source         | ● New CH Sites        | — Gates     | — Tracks 60Km/hr |
| ● Hand_Carry     | — Water pipes         | — Grids     | — Fences 60Km/hr |
| ✱ Pipeline Xings | — Dunes - no vehicles | — Pipelines |                  |
| — Roads          |                       |             |                  |
| — Tracks         |                       |             |                  |

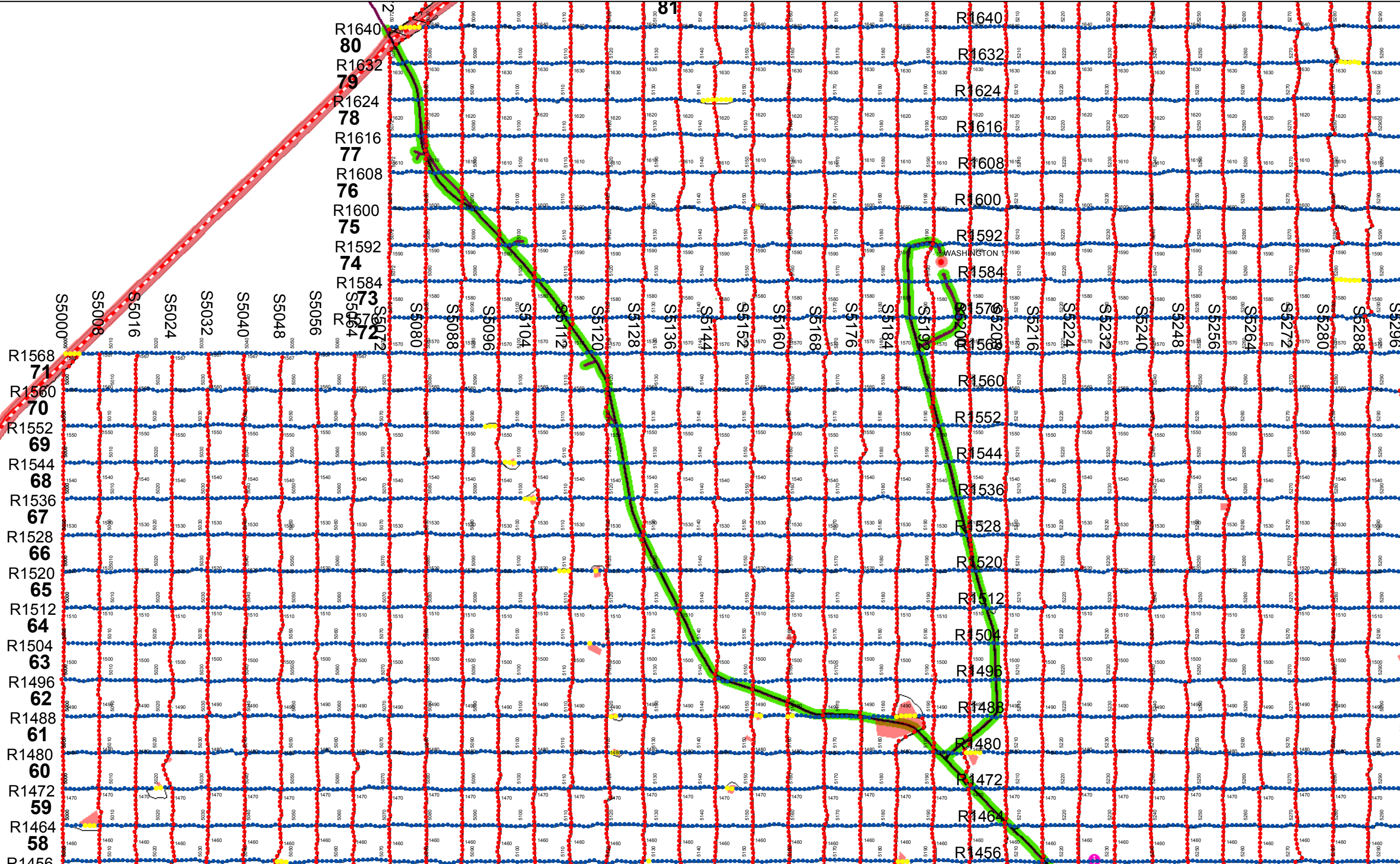
0.125 0.25 0.5 0.75 1  
Kilometers



Map pictorially represent surveyed data.  
The accuracy of underlying topographic  
image may not relate to the accuracy  
of surveyed data. Any use of this map  
for reasons other than the intended  
purpose is not authorised.

Terrex Spatial : Phone 1800 060 407





Scale: 1:30000  
Drawn: ERA  
Job#: J000303  
Delaware\_3D\_R1464-1640\_West\_LC  
Rev: 1  
Date: 23/09/2015

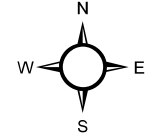


# Delaware 3D Prospect Map

## R1464 - 1640 West

- |                |                     |           |                |
|----------------|---------------------|-----------|----------------|
| Receiver       | CH Sites            | Fences    | Roads 80Km/hr  |
| Source         | New CH Sites        | Gates     | Tracks 60Km/hr |
| Hand_Carry     | Water pipes         | Grids     | Fences 60Km/hr |
| Pipeline Xings | Dunes - no vehicles | Pipelines |                |
| Roads          |                     |           |                |
| Tracks         |                     |           |                |

0 0.125 0.25 0.5 0.75 1 Kilometers



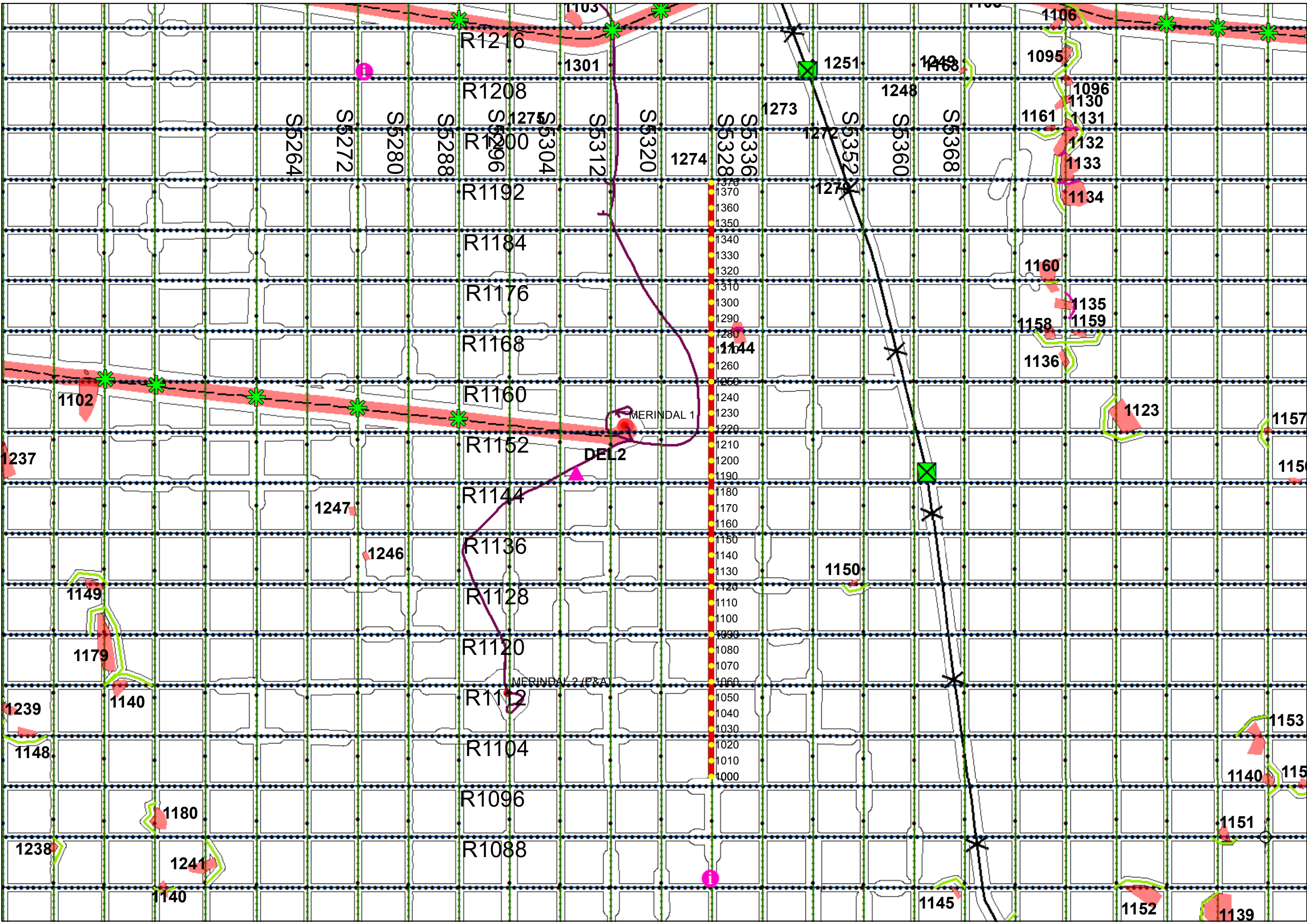
Map pictorially represent surveyed data. The accuracy of underlying topographic image may not relate to the accuracy of surveyed data. Any use of this map for reasons other than the intended purpose is not authorised.

Terrex Spatial : Phone 1800 060 407









## *Appendix E - **Photographs***





**Photograph 3**      **Innamincka Causeway**



**Photograph 4**      **Kangaroos**

## **Appendix G     HSE – Delaware 3D End of Contract Report**





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## Delaware 3D Seismic Survey

*25<sup>th</sup> August 2015 – 27<sup>th</sup> October 2015*

**HSE End of Contract**

---

Client: Santos  
Location: Bookabourdie Gas fields  
Permit: PEL 570  
Project No: J00303

### Crew A2

**Terry Ernst - Operations Manager**

Email: [terry@terrexseismic.com](mailto:terry@terrexseismic.com)

Mobile: 0429 872 339

#### PERTH HEAD OFFICE

Level 4 76 Kings Park Rd  
West Perth WA 6005

T +61 8 9235 4600

F +61 8 9324 3640

E [info@terrexseismic.com](mailto:info@terrexseismic.com)

#### BRISBANE OPERATIONS OFFICE

22 Crockford Street

Banyo QLD 4014

T +61 7 3621 0300

F +61 7 3266 7345

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## 1 Summary

23 <sup>rd</sup> – Aug – 2015	Santos, Terrex, Cultural Heritage Inductions – 21 people
24 <sup>th</sup> – Aug – 2015	Mobilisation and camp setup of TC2
25 <sup>th</sup> – Aug – 2015	1 HIR Card
26 <sup>th</sup> – Aug – 2015	4 HIR Cards Fit For Purpose Inspection Santos, Terrex, Cultural Heritage Inductions – 4 people Visitor's inductions – 3 people (Terrex)
27 <sup>th</sup> – Aug – 2015	4 HIR Cards Santos, Terrex, Cultural Heritage Inductions – 1 person Visitor's inductions – 1 person (Santos: Andrew White)
28 <sup>th</sup> – Aug – 2015	2 HIR Cards
30 <sup>th</sup> – Aug – 2015	5 HIR Cards Santos Camp Audit Safety Sunday: Interaction with Earthmoving Equipment presentation and assessment
31 <sup>st</sup> – Aug – 2015	3 HIR Cards Santos Kitchen Audit
2 <sup>nd</sup> – Sep – 2015	2 HIR Cards SOP Training; All – 2 people
3 <sup>rd</sup> – Sep – 2015	7 HIR Cards HSE Observation against SOP; Operation of a dozer Visitor Induction – 1 person (Terrex) SOP Training; Operation of a dozer – 1 person
4 <sup>th</sup> – Sep – 2015	Santos, Terrex, Cultural Heritage Inductions – 4 people
5 <sup>th</sup> – Sep – 2015	3 HIR Cards CHI - Cultural Heritage Incursion by dozer
6 <sup>th</sup> – Sep – 2015	7 HIR Cards HSE Observation; Camp attendant HSE Observation; Camp inspection Safety Sunday: Communication between crew
7 <sup>th</sup> - Sep – 2015	5 HIR Cards
8 <sup>th</sup> – Sep – 2015	2 HIR Cards Santos, Terrex, Cultural Heritage Inductions – 1 person

9 <sup>th</sup> – Sep – 2015	1 HIR Card
10 <sup>th</sup> – Sep – 2015	1 HIR Card Santos, Terrex, Cultural Heritage Inductions – 2 people
11 <sup>th</sup> – Sep – 2015	1 HIR Card
12 <sup>th</sup> – Sep – 2015	Visitors induction – 1 person
13 <sup>th</sup> – Sep – 2015	2 HIR Cards HSE Observation – Camp inspection HSE Observation – Kitchen inspection HSE Observation – Mechanic Workshop Inspection Safety Sunday: Snake bite first aid and practical by all crew
14 <sup>th</sup> – Sep – 2015	1 HIR Card Santos, Terrex, Cultural Heritage Inductions – 9 people
15 <sup>th</sup> – Sep – 2015	1 HIR Card
16 <sup>th</sup> – Sep – 2015	2 HIR Cards Visitors Induction – 2 people
16 <sup>th</sup> – Sep – 2015	Recording crew A2, Project and Cultural Inductions Santos Delaware 3D.
17 <sup>th</sup> – Sep – 2015	Emergency Response communications, Issue crew IVMS Keys.
18 <sup>th</sup> – Sep – 2015	1 x HIR Card, 1 x Take 5 2 x Visitor Inductions, Road Signage.
19 <sup>th</sup> – Sep – 2015	1 x HIR Card, 1 x Take 5 Santos HSE rep, Brian Bellchambers compliance inspection on crew A2.
20 <sup>th</sup> – Sep – 2015	Safety Sunday, HSE Observation, Camp Inspection
21 <sup>st</sup> – Sep – 2015	2 x Visitor Inductions, (Mike Giles and Michael Dello-Iacovo) HSE Observation, Waste Register update, 1 x Large First Aid Kit 1 x Small First Aid Kit. 6 x HIR Cards
22 <sup>nd</sup> – Sep – 2015	Visitor Induction Terrex CEO Greg Dunlop Issue Client Rep IVMS key (Michael Dello-Iacovo) 2 x HIR Cards, 1 x Take 5
23 <sup>rd</sup> – Sep – 2015	IVMS Santos Rag Report 1 x HIR Card A2 RFDS Checklist Load Chart Check




24 <sup>th</sup> – Sep – 2015	Field Observation 1 x HIR, 4 x Take 5 2 x First Aid Kit Audits
25 <sup>th</sup> – Sep – 2015	Camp Fire Plans Field Observation 2 x HIR Cards
26 <sup>th</sup> – Sep – 2015	Road Signage Santos HSE Brian Bellchambers site visit.
27 <sup>th</sup> – Sep – 2015	Safety Sunday HSE Observation HSE Weekly Interim Stats.
28 <sup>th</sup> – Sep – 2015	Incident #33
29 <sup>th</sup> – Sep - 2015	2 x First Aid Kits. 2 x HIR Cards, 1 x Take 5's 2 x DOA Tests
30 <sup>th</sup> – Sep – 2015	RFDS Kit Audit, PPE and Uniform Stocktake.
2 <sup>nd</sup> – Oct – 2015	HSE Field Observation, PTW, Requisition.
4 <sup>th</sup> – Oct – 2015	2 x HIR Cards, 3 x Take 5's 1 x HSE observation – Terrex Contracting Safety Sunday Video – Camp Hygiene
5 <sup>th</sup> – Oct – 2015	5 x HIR cards.
6 <sup>th</sup> – Oct – 2015	1 x Project and CH Induction. Review IVMS Exceptions for Week Ending 04/10/2015. 1 x PTW, 1 X HIR card
9 <sup>th</sup> – Oct – 2015	4 x Project and CH Inductions 1 x New Hire Induction
11 <sup>th</sup> – Oct – 2015	Safety Sunday, Weekly Interim Stats. Camp inspection, 2 x Project Inductions Road Signage.
12 <sup>th</sup> – Oct – 2015	1 x HSE Field Observation 1 x PTW, 1 X HIR card.
13 <sup>th</sup> – Oct – 2015	2 x Project and CH inductions. Review IVMS Rag report RFDS Audit

15 <sup>th</sup> – Oct – 2015	7 x New Hire Inductions 3 x Re-induction 7 x Project and CH Induction
17 <sup>th</sup> – Oct – 2015	3 x HIR Cards, 3 x Take 5's HSE Observation
18 <sup>th</sup> – Oct – 2015	Safety Sunday (Heat Stress) Weekly Safety Stats Interim HSE Observation – Field Operations
20 <sup>th</sup> – Oct – 2015	1 x Visitor induction (Andrew White) 3 x HIR Card 2 x Camp Inductions (TC)
21 <sup>st</sup> - Oct – 2015	6 x Re-inductions Delaware 3D
23 <sup>rd</sup> – Oct – 2015	Field Observation working Line crew, Beanbush 3D scout. 1 x Site specific and CH induction (CPA Paramedic) 1 x Re-induction
24 <sup>th</sup> – Oct – 2015	Santos Cultural and Site Specific induction Beanbush 3D
25 <sup>th</sup> – Oct – 2015	Safety Sunday Vehicle extraction scenario. Beanbush 3D site observation.

## 2 Statistical Summary

**Table 1 Contract Statistics – Monthly Breakdown**

Crew A2 Monthly Safety Stats			
	Sep	Oct	YTD
Terrex Seismic Man-hours	18888.00	36840.00	55728.00
Sub-Contractor Man-hours	2544.00	3792.00	6336.00
Fatalities	0	0	0.00
LTI's	0	0	0.00
MTI's	0	0	0.00
Days since last MTI/LTI			0.00
Serious Potential Incidents (SPI)	0	0	0.00
First Aid Incidents	0	0	0.00
Environmental Incidents <small>Land Spill (&gt;5 litres)</small>	0	0	0.00
Cultural Heritage Incidents	0	0	0.00
Incident / Accident Reports	0	0	0.00
Near Miss Reports	0	0	0.00
Work Days Lost			0.00
Hazard Identification Reports	30	37	67.00
Training Hours	204.50	372.60	577.10
Tool Box / Safety Meeting Man-hours	230.70	465.90	696.60
Audits / Inspections	3	5	8.00
Drills	0	0	0.00
			<b>62064.00</b>

**Table 2 Overall Terrex Safety Performance vs Terrex Targets**

Lead Indicators	Sep	Oct	YTD
Hazard Identification Reports Received	30	37	67.00
Hazard Reports Closed - <small>No. Closed out in ATR</small>	30	33	63.00
Audits/Site Inspections <small>inc HSE abt/inv.</small>	3	5	8.00
Equipment Inspections	207	498	705.00
Training & Induction Hours	205	373	577.10
Tool Box / Safety Meeting Man-hours	231	466	696.60
Tool Box Meetings Conducted	12	27	39.00
HSE Meeting Conducted	2	4	6.00
Risk Assessments Conducted	0	0	0.00
JSA's &/or PTW Conducted	5	3	8.00
SOP's Reviewed	3	3	6.00
IVMS Kms Driven	25,447	65,844	91291.00
IVMS Breaches	87	267	354.00
Drills	0	0	0.00
BAC Conducted	769	1,544	2313.00
BAC Passed	769	1,544	2313.00
Drug Test Conducted	4	0	4.00
Drug Test Passed	4	0	4.00
New Hires Commenced this week	0	7	7.00
Employees terminated /left this week	0	0	0.00

## 2.1 Key Performance Indicators

Key Performance Indicator	Measure	Achieved (yes/no)	Performance Score
All personnel to complete Santos Level 1, 2 & Heat Stress Inductions as well as Santos Approved 4WD training	100% Compliance	YES	100%
Land Transportation Incidents per month	<2	YES	100%
Emergency Drills Conducted per project (specifically fire or medical)	1+	YES	100%
ATR/Hazard Reports Closed out within 90 days	90%	YES	100%
IVMS Exceptions per project	<10	YES	100%
Inspections per month	4	YES	100%
Documented Department Head Inspections per month (Line Boss, Mechanic, Cable Repair)	each department head once per month	YES	100%
Site Audit of Subcontractor Activity	each contractor 3 monthly	NO	
Consistency in Hazard Reporting volume & Quality throughout all departments based the ratio of number of people in each department	At least 1 per person per month (all departments)	YES	100% HIR Cards Received.



## 3 Land Transportation

### 3.1 IVMS Risk Management Report



SANTOS RAG  
Report 14 - 20 Septe



SANTOS RAG  
Report 21 - 27 Septe



SANTOS RAG  
Report 28 Septembe



Terrex A2 Report 5 -  
11 October 2015.xls



SANTOS RAG  
Report 12 - 18 Octol

## 4 Risk Assessments

See **Site Specific Risk Register**






HSSSE Risk Register  
Santos Delaware 3D










## 5 Meetings












### 5.1 Induction












#### Site Induction PowerPoint Presentations

 Delaware Santos Site Specific Inducti	 DELAWARE 3D SEISMIC INDUCTION	 EHS 11 CH Training including Northern
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#### Induction Registers

 20150823 Terrex Induction.pdf	 20150826 Terrex Induction.pdf	 20150828 Terrex Induction.pdf	 20150904 Terrex Induction.pdf	 20150908 Terrex Induction.pdf	 20150910 Terrex Induction.pdf
 20150911 Terrex Induction.pdf	 20150914 Terrex Induction.pdf	 20150916 Terrex Induction.pdf	 20150917 Terrex Induction.pdf	 20151001 Terrex Induction.pdf	 20151017 Terrex Induction.pdf
 20151021 Terrex Induction.pdf					
























 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_
 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	 CH Awareness Induction Register_	

 20150823 Santos JHA Induction Delay	 20150826 Santos JHA Induction Delay	 20150828 Santos JHA Induction Delay	 20150904 Santos JHA Induction Delay	 20150908 Santos JHA Induction Delay	 20150910 Santos JHA Induction Delay
 20150911 Santos JHA Induction Delay	 20150914 Santos JHA Induction Delay	 20150916 Santos JHA Induction Delay	 20151009 Santos JHA Induction Delay	 20151016 Santos JHA Induction Delay	










 20150826 Visitor Induction.pdf	 20150826(2) Visitor Induction.pdf	 20150827 Visitor Induction.pdf	 20150903 Visitor Induction.pdf	 20150917 Visitor Induction.pdf	 20150917B Visitor Induction.pdf
--	---	--	--	--	---

## 5.2 Daily Toolbox

 TBM 20150825.pdf	 TBM 20150826.pdf	 TBM 20150827.pdf	 TBM 20150828.pdf	 TBM 20150829.pdf	 TBM 20150831.pdf
 TBM 20150901.pdf	 TBM 20150902.pdf	 TBM 20150903.pdf	 TBM 20150904.pdf	 TBM 20150905.pdf	 TBM 20150907.pdf
 TBM 20150908.pdf	 TBM 20150909.pdf	 TBM 20150910.pdf	 TBM 20150911.pdf	 TBM 20150912.pdf	 TBM 20150914.pdf
 TBM 20150915.pdf	 TBM 20150916.pdf	 TBM 20150917.pdf	 TBM 20150918.pdf	 TBM 20150919.pdf	 TBM 20150921.pdf
 TBM 20150922.pdf	 TBM 20150923.pdf	 TBM 20150924.pdf	 TBM 20150925.pdf	 TBM 20150926.pdf	 TBM 20150928.pdf

 TBM 20150929.pdf	 TBM 20150930.pdf	 TBM 20151001.pdf	 TBM 20151002.pdf	 TBM 20151003.pdf	 TBM 20151005.pdf
 TBM 20151006.pdf	 TBM 20151007.pdf	 TBM 20151009.pdf	 TBM 20151010.pdf	 TBM 20151012.pdf	 TBM 20151013.pdf
 TBM 20151014.pdf	 TBM 20151015.pdf	 TBM 20151016.pdf	 TBM 20151017.pdf	 TBM 20151019.pdf	 TBM 20151020.pdf
 TBM 20151021.pdf	 TBM 20151022.pdf	 TBM 20151023.pdf	 TBM 20151024.pdf	 TBM 20151026.pdf	

### 5.3 Weekly Meeting – Safety Sunday

 SS 20150830.pdf	 SS 20150906.pdf	 SS 20150913.pdf	 TBM 20150920.pdf	 TBM 20150927.pdf	 TBM 20151004.pdf
 TBM 20151011.pdf	 TBM 20151018.pdf	 TBM 20151025.pdf			


















## 6 Audits and Inspections

### 6.1 External Audit

 Delaware 3D - Contractor Startup C	 Delaware 3D - SC03 Base Camp Walk-arc	 Delaware 3D - SC05 Kitchen and Mess In			
---	--	---	--	--	--

### 6.2 Inspections

 08 - TC2 - Aug 2015-08-26 FFP Insp	 08 - TC2 - Aug 2015-08-30 - PJO.pdf	 08 - TC2 - Aug 2015-08-30 HSE Ob	 08 - TC2 - Aug 2015-08-30 HSE Ob.	 09 - TC2 - September 2015-09-	 09 - TC2 - September 2015-09-
 09 - TC2 - September 2015-09-	 09 - TC2 - September 2015-09-	 09 - TC2 - September 2015-09-	 09 - TC2 - September 2015-09-	 09 - TC2 - September 2015-09-	 09 - A2 - Sep 2015-09-18 HSE Obs
 09 - A2 - Sep 2015-09-19 HSE Obs	 09 - A2 - Sep 2015-09-25 HSE Obs	 10 - A2 - Sep 2015-10-06 HSE Obs			

## 7 Training




### Training Summary A2

#### Delaware 3D

	<i>Personnel Participating</i>	<i>Training Time (Hrs.)</i>	<i>Total Time (Hrs.)</i>
<i>Santos Cultural Induction:</i>	74	1.0hrs	74.0hrs
<i>Santos Job Specific Induction:</i>	74	1.0hrs	74.0hrs
<i>Terrex Site Inductions:</i>	74	1.0hrs	74.0hrs
<i>Terrex Visitor Induction:</i>	8	0.5hrs	4.0hrs
<i>Terrex Re-inductions:</i>	9	0.5hrs	4.5hrs
<i>Safety Sunday:</i>	312	18/60	93.5hrs
<b>Total Training Hours:</b>			<b>323.5hrs</b>

## 8 Events Reporting

### 8.1 Incident Reporting

					
IncidentSummary.pdf	IncidentSummary_3 (1).pdf	IncidentSummary_29.pdf			
#26	#33	#29			

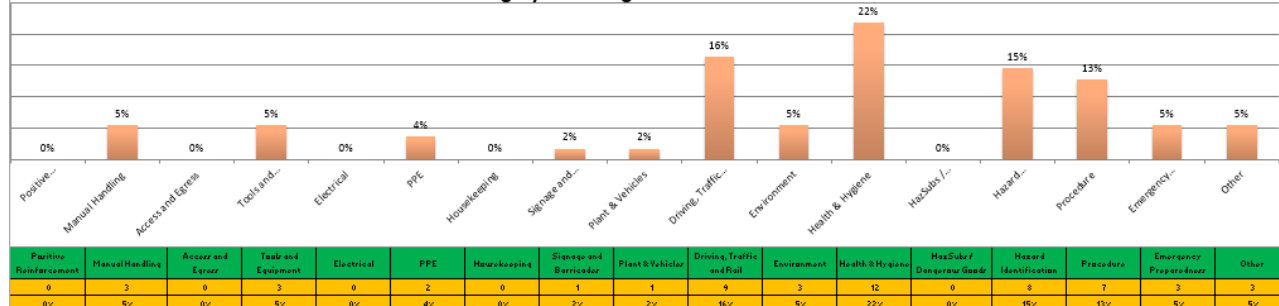
### 8.2 Hazard Reporting

#### HIR cards submitted over the project

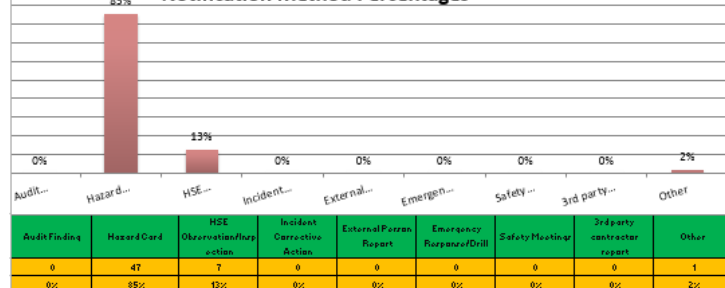
Total	
HIR Cards	47
% Closed	100%

#### Graphs and Tables

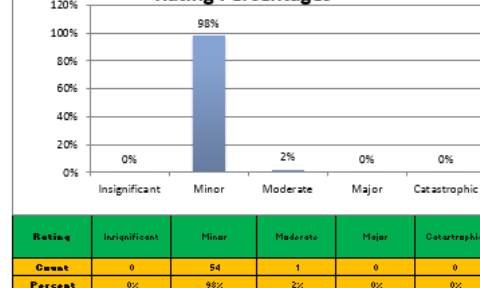
Category Percentages



Notification Method Percentages



Rating Percentages



### 8.3 Action Tracking Register



10 - A2 - Oct 2015 -  
ATR.xls

## 9 Health Performance

### 9.1 Alcohol Testing

#### BAC Tests Conducted over the project

	Aug	Sep	Oct	Total
No. Tested	158	990	1352	2501
% Passed	100%	100%	100%	100%

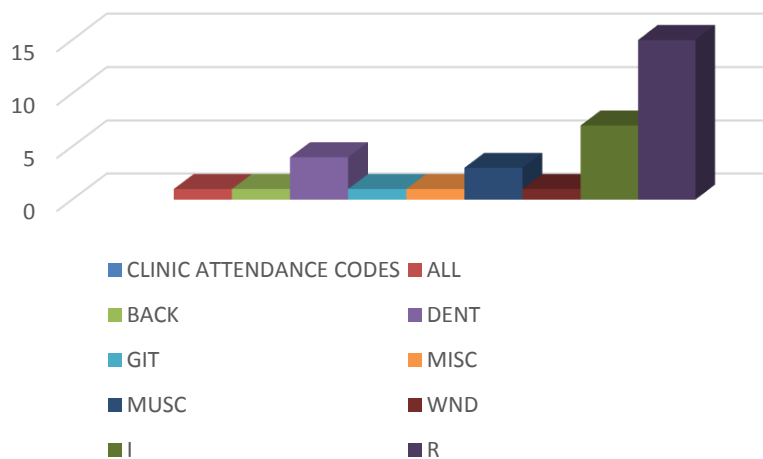
### 9.2 Drug Testing

#### Preliminary Drug Tests over the project

	Aug	Total
No. Tested	9	9
% Passed	100%	100%

### 9.3 Illnesses

Delaware Clinical Attendance





## 10 Field Operations



Figure 1.0 – Correct Action CPA group Paramedic Craig Ellem demonstrates soft tissue injury management



Figure 1.1 - HSE Field Observation working Line crew



Figure 1.2 – Crew Entertainment NRL Grand Final

## Appendix H Personnel Crew List and Numbers

DEPARTMENT		NUMBER ON CREW
<b>Support Staff</b>		
Operations Manager	Richard Barnes	Perth Office
Geophysicists	Richard Barnwell	Brisbane Office
HSE Manager	Sean Breaker Ben Ingram	Brisbane Office
TC Ops Manager	Graeme Stringfellow	
<b>Admin Staff</b>		
Crew Manager	Shane Goossens	
HSE Advisor	Jason Sherras	
<b>Camp Staff</b>		
Mechanic	Julien Goossens Mejak Steve Madsen Ben	
Cook	Cuff Jamie Jai Ackland Gill Mark	
Kitchen Hands	Harvey Sarah	
Supply	Fuller Patrick Matthew Budden Jones Michael	
Campy	Carter Sophie Walker Danielle Schwieger Mel	
<b>Recording Crew</b>		
Observers	Juergen Rieger O'Donnell Peter	
Troubleshooters	Foote Michael Hobson Dylan	
QCs	Grace Andrew Ian James Hagay Haviv	
Cable Repair	French Daniel	
<b>Vibrator Crew</b>		
Vibe Techs	Paul Marco Rauckman Stuart	
Vibe Op	Auckram Raymond Mullaly John-Paul Brendan Horsten Samios Luke Cust Peter Draper Neville Shane McArthur June Harland	
<b>Field Crew</b>		
Line Boss	Cameron Adam	

# Santos Limited

## Delaware 3D Seismic Survey Field Operations Report



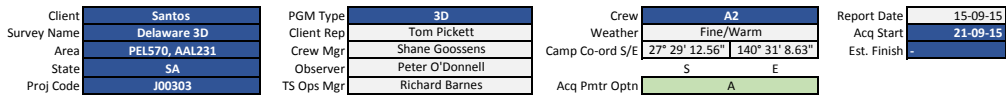
DEPARTMENT			NUMBER ON CREW
Line Crew	Arnall Jacob	Mahony Louis	
	Barker Daniel	Manalo Jechrico	
	Breakspear Chrys	Matthewson Miles	
	Browne Matthew	Midgley Thomas	
	Byrne Liam	Morris Jack	
	Cheyne Andrew	Ollerenshaw Shane	
	Condon John	Peka Jack	
	Dyball Elias	Pihama Jacob	
	Farrands Nicholas	Stolz Emma	
	Fazldeen Lachlan	Tabone Ben	
	Ford Steven	Tabone Daniel	
	Gillen Liam	Thomas Scott	
	Glover Alisha	Waiomio Jonathon	
	Grams Christopher	Walker Jaimie	
	Greaney Ben	Ward Ryan	
	Jacob Marie	Weare Steven	
	Johnson (Alex) Leigh	Welch Christopher	
	Jones Lachlan	Williams Andrew	
	Kaukau Matt	Woolley Matthew	
<b>Advanced Party Administration</b>			
Crew Manager	Jonathon O'Neil	Dave Keats	
Field Supervisor	Michael Grassick		
HSE	Courtney O'Connor		
Paramedics	Victor Rogers		
Mechanics	Robert Garden	Wayne Jessen	
Offsiders	Steven Turner		
Electrician	Wayne Hubbard		
Cook	Brenton Radel		
Camp Attendant	Chris O'Donnell		
<b>Survey Crew</b>			
Senior Surveyors	Dean Hausmann	Eric Amedee	
Surveyors	Hamed Afshar	Ryan Gemmell	
	Mike Clark	Navneet Jain	
	Justin Mathwes		
<b>Line Clearing crew</b>			
Operators	Michael Birrer	Ray Talbot	
	Benjamin Lurton	Ian Williams	
	Ty Nisbet	Matt Higgins (Mascott)	

## **Appendix I      Recording Statistics**



Page 1 of 1

## **Appendix J      Survey Daily Reports**

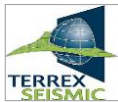


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
<b>Daily Total</b>							-	-	-	-	-
						Cumulative PGM Total	-	-	-	-	-
						Remaining		31,680.0	31,680.0	1,267.200	396.493
						% Completed		0.0%	0.0%	0.0%	0.0%
						Average Daily Production		-	-	-	-

[illegible]

Mobilisation	12.00						12.00
Demobe/Remobe							
Camp Setup/Packup							
Inductions							-
Toolbox							-
Safety Meeting							-
Travel							-
Recorder Setup							-
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing							-
Recording							-
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other							-
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.00	-	-	-	-	12.00
<b>CUM TOTAL</b>	0.00	12.00	0.00	0.00	0.00	0.00	12.00

- \* Crew departed Brisbane office on bus, overnight stay in Charleville
- \* Camp set up ready for crew to arrive
- \* QC van & 2 QC personnel arrived on crew



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 15-09-15  
Acq Start 21-09-15  
Est. Finish

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	12.0			12.0	2		
				0.0			
				0.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

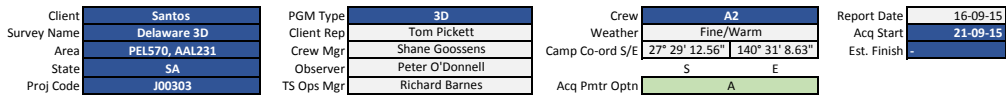
Client Representative: Tom Pickett

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

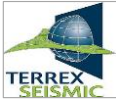
KM	Approx Days

[illegible][illegible]

Mobilisation		10.00					10.00	
Demobe/Remobe								
Camp Setup/Packup								
Inductions							-	
Toolbox							-	
Safety Meeting							-	
Travel							-	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing							-	
Recording							-	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	10.00	-	-	-	-	10.00	
<b>CUM TOTAL</b>	0.00	22.00	0.00	0.00	0.00	0.00	22.00	

- \* Bus continued after overnight stay in Charleville
- \* Crew inductions performed by Tom Pickett (Client Rep) & Jason Sherras (Terrex HSE)





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 16-09-15  
Acq Start 21-09-15  
Est. Finish

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0			54.0	43	1	
				0.0			
				0.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: Tom Pickett

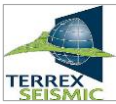
Signature

##### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 17-09-15  
Acq Start 21-09-15  
Est. Finish

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0		2.0	56.0			Test & tag guys on crew
	23.0			23.0			
	15.0			15.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

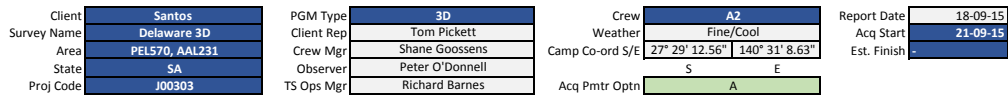
Client Representative: Tom Pickett

Signature

##### 10. ADVANCE PARTY LEAD

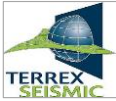
Lead  
Survey  
LC

KM	Approx Days

[illegible][illegible]

Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	1.00						1.00
Recorder Setup							-
Initial Layout/Pick up	11.20						11.20
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing							-
Recording							-
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other							-
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50
<b>CUM TOTAL</b>	0.00	47.00	0.00	0.00	0.00	0.00	47.00

- \* Spread layout on Delaware 3D continued
- \* Nik Helme arrived on crew to troubleshoot recorder problems, diagnosed with faulty server
- \* Sergey Vlasov arrived on crew from Santos Adelaide
- \* Geophone sleep testing commenced, 1400 strings in total to be tested.
- \* Spare recorder arrived on site to help troubleshoot problems, this spare recorder will be used to troubleshoot spread and record 2D test line.



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 18-09-15  
Acq Start 21-09-15  
Est. Finish

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0		2.0	56.0			Test & tag guys on crew
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: Tom Pickett

Signature

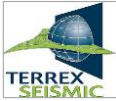
#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days







Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 19-09-15  
Acq Start 21-09-15  
Est. Finish

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0	1.0	2.0	57.0			Test & tag departed crew
	23.0			23.0			Paramedic moved in to main camp
	15.0			15.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

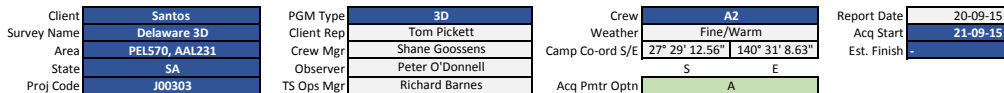
Client Representative: Tom Pickett

Signature

##### 10. ADVANCE PARTY LEAD

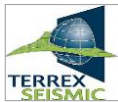
Lead  
Survey  
LC

KM	Approx Days

[illegible][illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.20						1.20	
Recorder Setup							-	
Initial Layout/Pick up	8.90						8.90	
Experimental	1.60						1.60	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing							-	
Recording							-	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other	0.50						0.50	
<b>TOTAL</b>	<b>1.60</b>	<b>10.90</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>12.50</b>	
<b>CUM TOTAL</b>	<b>3.40</b>	<b>68.70</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>72.10</b>	

- \* Spread layout & troubleshooting continued
- \* Experimental 2D test line completed & data returned to camp for QC analysis
- \* Main 3D recorder problems repaired, complete software re-install performed
- \* Main recorder will head to the field tomorrow to start acquisition on the Delaware 3D
- \* Sweep parameters chosen: 6-90Hz, 12 sec sweep, 4 sec listen, 70% drive, 2 x groups 2 vibrators



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 20-09-15  
Acq Start 21-09-15  
Est. Finish

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0	1.0	1.0	56.0			
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

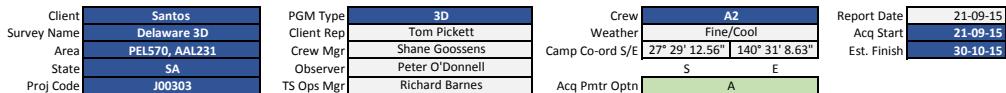
Client Representative: Tom Pickett

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



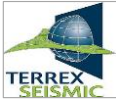
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5208-5408			1,000.0	1,007.0	1			208.0	208.0	8.320	2.603
5208-5408			1,008.0	1,015.0	2			208.0	208.0	8.320	2.603
5208-5400			1,016.0	1,023.0	3			184.0	184.0	7.360	2.303
5208-5400			1,024.0	1,031.0	4			180.0	180.0	7.200	2.253
<b>Daily Total</b>							-	780.0	780.0	31.200	9.762
					Cumulative		-	780.0	780.0	31.200	9.762
					PGM Total			31,680.0	31,680.0	1,267.200	396.493
					Remaining			30,900.0	30,900.0	1,236.000	386.731
					% Completed			2.5%	2.5%	2.5%	2.5%
					Average Daily Production			780.0	780.0	31.2	9.8

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing							-	
Recording	6.80						6.80	
Troubleshooting	1.80						1.80	Transmission errors in transverse
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other	2.40						2.40	Swapping recorders after recording test line
<b>TOTAL</b>	-	12.30	-	-	-	-	12.30	
<b>CUM TOTAL</b>	3.40	81.00	0.00	0.00	0.00	0.00	84.40	

<ul style="list-style-type: none"> <li>* Acquisition started on Delaware 3D</li> <li>* 'Other' downtime time due to swapping recorders after shooting 2D test line with spare recorder</li> <li>* 'Troubleshooting' time due transmission errors in transverse line</li> <li>* Mike Giles &amp; Michael Dello-Iacovo arrived on crew from Santos Adelaide</li> <li>* Good production for first day, 116 VP's per hour</li> </ul>
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Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 21-09-15  
Acq Start 21-09-15  
Est. Finish 30-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0	1.0	3.0	58.0			
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

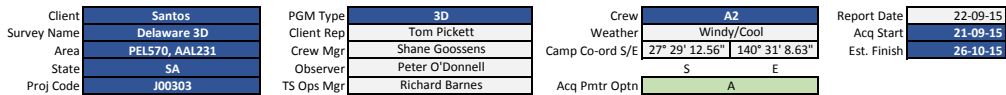
Client Representative: Tom Pickett

Signature

#### 10. ADVANCE PARTY LEAD

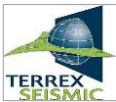
Lead  
Survey  
LC

KM	Approx Days

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Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing							-	
Recording	9.00						9.00	
Troubleshooting	2.00						2.00	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours	0.20						0.20	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	93.50	0.00	0.00	0.00	0.00	96.90	

- \* Acquisition continued on Delaware 3D
- \* High wind causing issues with noise on spread, decision made to send line crew out tomorrow morning to rekick all phones in an attempt to reduce noise
- \* Vibe skips due to sand dunes near Cordillo Downs Road, programmed skips to avoid dune cuts
- \* Greg Dunlop, Terrex CEO, arrived on crew
- \* Troubleshooting time due to transmission errors on transverse cables
- \* Excellent production



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 22-09-15  
Acq Start 21-09-15  
Est. Finish 26-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0	1.0	4.0	59.0			
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

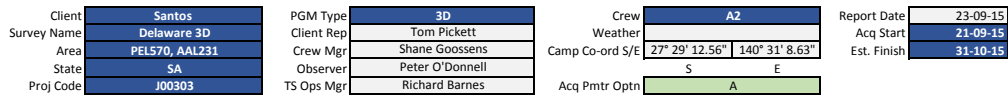
Client Representative: Tom Pickett

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

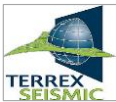
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Line Layout	Layout Station # From	Layout Station # To	Layout Total
1304	5194	5000	195
1312	5115	5000	116
<b>Total Stations Laid Out</b>			<b>311</b>

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
<b>Total Stations Picked Up</b>			<b>0</b>

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing							-	
Recording	6.60						6.60	
Troubleshooting	4.70						4.70	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down	0.10						0.10	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.70	-	-	-	-	12.70	
<b>CUM TOTAL</b>	3.40	106.20	0.00	0.00	0.00	0.00	109.60	

- \* Decision made to re-kick geophones on active spread to try to reduce wind noise, approx 55km/h w/d gusts during morning
- \* 4.7 hours total to re-kick phones and move cable out of shrubs
- \* Mike Giles, Sergey Vlasov & Greg Dunlop departed crew
- \* John Seanson arrived on crew, Tom Pickett departing tomorrow
- \* Good production considering down time to sort spread
- \* Vibrator down time due to DSD reboot in vibe #7



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep Tom Pickett  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 23-09-15  
Acq Start 21-09-15  
Est. Finish 31-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	54.0	2.0	4.0	60.0			
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: Tom Pickett

Signature

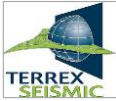
#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days







Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 24-09-15  
Acq Start 21-09-15  
Est. Finish 29-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	52.0	1.0	1.0	54.0		1	
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

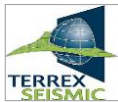
Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Cool  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 25-09-15  
Acq Start 21-09-15  
Est. Finish 28-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	52.0	1.0	1.0	54.0			
	23.0			23.0			
	15.0			15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature

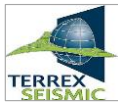
#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days







Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 26-09-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	52.0	1.0	55.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

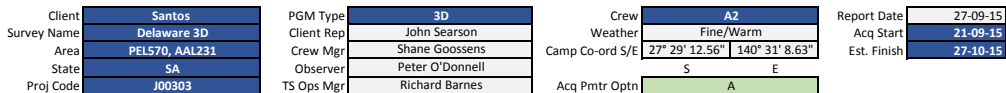
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



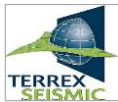
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5208-5416			1,144.0	1,151.0	19		1.0	143.0	144.0	5.760	1.802
5208-5416			1,152.0	1,159.0	20			170.0	170.0	6.800	2.128
5208-5480			1,160.0	1,167.0	21			280.0	280.0	11.200	3.504
5208-5480			1,168.0	1,175.0	22			280.0	280.0	11.200	3.504
5336-5480			1,176.0	1,183.0	23			24.0	24.0	0.960	0.300
5336-5480			1,184.0	1,191.0	24			24.0	24.0	0.960	0.300
<b>Daily Total</b>							1.0	921.0	922.0	36.880	11.539
							8.0	5,984.0	5,992.0	239.680	74.993
							Cumulative				
							PGM Total	31,680.0	31,680.0	1,267.200	396.493
							Remaining	25,696.0	25,688.0	1,027.520	321.500
							% Completed	18.9%	18.9%	18.9%	18.9%
							Average Daily Production	854.9	856.0	34.2	10.7

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1384	5479	5000	480
1392	5315	5000	316
Total Stations Laid Out			796

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1048	5479	5208	272
1056	5479	5208	272
1064	5300	5208	93
1072	5350	5208	143
Total Stations Picked Up			780

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread	0.50						0.50	
QC / Testing	0.10						0.10	
Recording	9.60						9.60	
Troubleshooting	0.50						0.50	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours	0.50						0.50	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	156.20	0.00	0.00	0.00	0.00	159.60	

<p>* Troubleshooting time due to transmission errors on transverse line</p> <p>* Detour time due to both fleets detouring pipeline &amp; fence simultaneously</p>
---



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 27-09-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	52.0	1.0	55.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

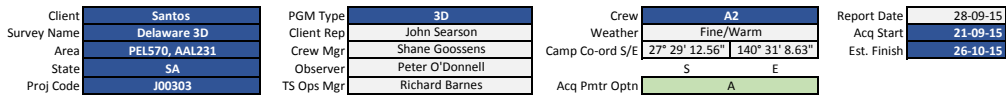
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

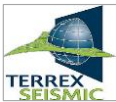


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5208-5472			1,176.0	1,183.0	23			256.0	256.0	10.240	3.204
5208-5472			1,184.0	1,191.0	24			256.0	256.0	10.240	3.204
5208-5448			1,192.0	1,199.0	25			192.0	192.0	7.680	2.403
5208-5448			1,200.0	1,207.0	26			190.0	190.0	7.600	2.378
<b>Daily Total</b>							-	894.0	894.0	35.760	11.189
							8.0	6,878.0	6,886.0	275.440	86.182
							Cumulative PGM Total	31,680.0	31,680.0	1,267.200	396.493
							Remaining	24,802.0	24,794.0	991.760	310.311
							% Completed	21.7%	21.7%	21.7%	21.7%
							Average Daily Production	859.8	860.8	34.4	10.8

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1392	5479	5316	164
1400	5479	5000	480
1408	5410	5000	411
Total Stations Laid Out			1,055

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1064	5479	5301	179
1072	5479	5351	129
1080	5479	5208	272
1088	5479	5208	272
Total Stations Picked Up			852

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		1.00					1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread		1.00					1.00	
QC / Testing		0.10					0.10	
Recording		9.80					9.80	
Troubleshooting		0.30					0.30	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
TOTAL	-	12.50	-	-	-	-	12.50	
CUM TOTAL	3.40	168.70	0.00	0.00	0.00	0.00	172.10	



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 28-09-15  
Acq Start 21-09-15  
Est. Finish 26-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0	1	5	
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

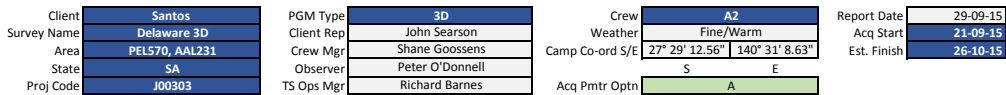
Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



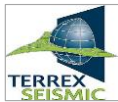
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Line Layout	Layout Station # From	Layout Station # To	Layout Total
1408	5479	5411	69
1416	5479	5000	480
1424	5327	5000	328
Total Stations Laid Out			877

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1096	5479	5208	272
1104	5479	5208	272
1112	5479	5411	69
1120	5479	5405	75
Total Stations Picked Up			688

Mobilisation						-	
Demobe/Remobe						-	
Camp Setup/Packup						-	
Inductions						-	
Toolbox		0.30				0.30	
Safety Meeting						-	
Travel		0.50				0.50	
Recorder Setup						-	
Initial Layout/Pick up						-	
Experimental						-	
H/Wires, SIMS, Sweep Tests						-	
QC Spread		1.00				1.00	
QC / Testing		0.10				0.10	
Recording		9.20				9.20	
Troubleshooting		0.20				0.20	
Recorder Moveup		1.00				1.00	
Spread Chewage						-	
Spread Damage Other						-	
Detours		0.20				0.20	
Waiting On Spread						-	
Line Move						-	
Prospect Move						-	
Camp Move						-	
Traverse Move						-	
Swath Move						-	
Vibe Travel						-	
Weather						-	
Recorder Down						-	
Vibes Down						-	
Human Error						-	
Washdown						-	
Other						-	
<b>TOTAL</b>	-	12.50	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	181.20	0.00	0.00	0.00	184.60	

- \* Morning spread QC time due to cattle
- \* Recorder moved up closer to camp
- \* Slower production due to detours around fence & pipelines



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 29-09-15  
Acq Start 21-09-15  
Est. Finish 26-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

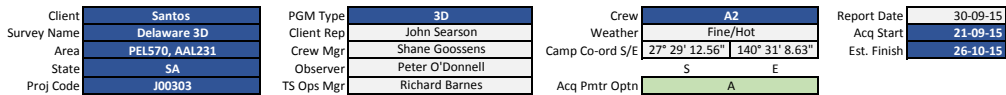
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



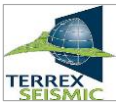
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM	
5208-5424			1,224.0	1,231.0	29		1.0	215.0	216.0	8.640	2.703	
5208-5424			1,232.0	1,239.0	30			224.0	224.0	8.960	2.803	
5208-5464			1,240.0	1,247.0	31			238.0	238.0	9.520	2.979	
5208-5464			1,248.0	1,255.0	32			242.0	242.0	9.680	3.029	
<b>Daily Total</b>							1.0	919.0	920.0	36.800	11.514	
							Cumulative PGM Total Remaining % Completed Average Daily Production	11.0	8,653.0 31,680.0 23,027.0 27.3% 865.3	8,664.0 31,680.0 23,016.0 27.3% 866.4	346.560 1,267.200 920.640 27.3% 34.7	108.435 396.493 288.058 27.3% 10.8

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1424	5479	5328	152
1432	5479	5000	480
1440	5200	5000	201
Total Stations Laid Out			833

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1112	5410	5208	203
1120	5404	5208	197
1128	5479	5208	272
1136	5479	5208	272
Total Stations Picked Up			944

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.30					0.30	
Recorder Setup		0.30					0.30	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		9.20					9.20	
Troubleshooting		1.70					1.70	
Recorder Moveup		0.50					0.50	
Spread Chewage							-	
Spread Damage Other							-	
Detours		0.10					0.10	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
TOTAL	-	12.50	-	-	-	-	12.50	
CUM TOTAL	3.40	193.70	0.00	0.00	0.00	0.00	197.10	

- \* Recorder move completed from previous day
- \* Troubleshooting time due to transmission errors in transverse line
- \* Detour time due to fence & pipeline
- \* Short travel time while working close to camp
- \* Mansell's transport commenced rig move from Washington well pad, trucks causing minor problems with cable crossings over main road



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 30-09-15  
Acq Start 21-09-15  
Est. Finish 26-10-15

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature

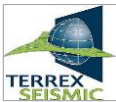
##### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days







Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 1-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	50.0	1.0	53.0	3	2	
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

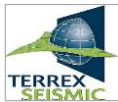
Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 2-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0		1	
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

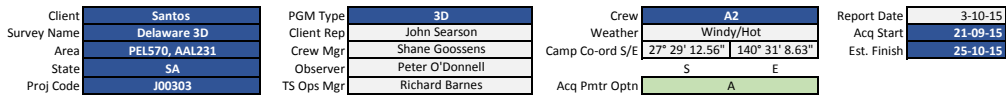
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



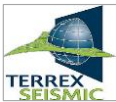
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5000-5416			1,304.0	1,311.0	39			320.0	320.0	12.800	4.005
5000-5416			1,312.0	1,319.0	40		1.0	319.0	320.0	12.800	4.005
5000-5424			1,320.0	1,327.0	41			263.0	263.0	10.520	3.292

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1472	5479	5278	202
1480	5479	5000	480
1488	5255	5000	256
Total Stations Laid Out			938

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1200	5479	5465	15
1208	5479	5208	272
1216	5479	5208	272
Total Stations Picked Up			559

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.50					0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests		0.60					0.60	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		9.80					9.80	
Troubleshooting		0.20					0.20	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other		1.00					1.00	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	231.20	0.00	0.00	0.00	0.00	234.60	

- \* Windy conditions for most of morning
- \* Rig move still progressing with traffic travelling through spread
- \* Spread damage caused by cattle dragging phones overnight
- \* Troubleshooting time due to transmission errors in transverse line



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 3-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

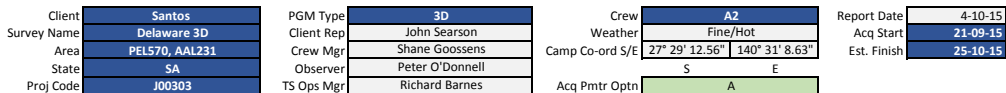
Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature



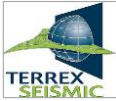


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5072-5480			1,320.0	1,327.0	41			225.0	225.0	9.000	2.816
5016-5480			1,328.0	1,335.0	42			472.0	472.0	18.880	5.907
5016-5376			1,336.0	1,343.0	43			156.0	156.0	6.240	1.952
<b>Daily Total</b>							-	853.0	853.0	34.120	10.676
						Cumulative	12.0	12,504.0	12,516.0	500.640	156.645
						PGM Total		31,680.0	31,680.0	1,267.200	396.493
						Remaining		19,176.0	19,164.0	766.560	239.848
						% Completed		39.5%	39.5%	39.5%	39.5%
						Average Daily Production		893.1	894.0	35.8	11.2

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	0.50						0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests	0.30						0.30	
QC Spread							-	
QC / Testing	0.10						0.10	
Recording	9.40						9.40	
Troubleshooting	0.50						0.50	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.60						0.60	
Detours	0.30						0.30	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.00	-	-	-	-	12.00	
<b>CUM TOTAL</b>	3.40	243.20	0.00	0.00	0.00	0.00	246.60	

<ul style="list-style-type: none"> <li>* Spread damage caused by cattle dragging spread overnight</li> <li>* Troubleshooting time due to transmission errors in transverse line</li> <li>* Hardwire time - performing hardwires on spare vibrator</li> <li>* Later toolbox due to daylight saving time</li> <li>* Shorter day due to recorder maintenance</li> </ul>
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Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 4-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0		1	
	1.0	24.0	1.0	26.0			
		15.0		15.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

##### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

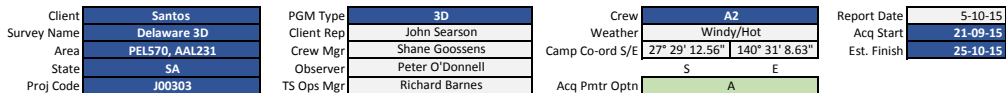
KM	Approx Days

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature

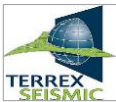


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5000-5008			1,328.0	1,335.0	42			16.0	16.0	0.640	0.200
5000-5480			1,336.0	1,343.0	43			332.0	332.0	13.280	4.155
5000-5480			1,344.0	1,351.0	44			488.0	488.0	19.520	6.108
5424-5480			1,352.0	1,359.0	45			64.0	64.0	2.560	0.801
<b>Daily Total</b>							-	900.0	900.0	36.000	11.264
							Cumulative 12.0	13,404.0	13,416.0	536.640	167.909
							PGM Total	31,680.0	31,680.0	1,267.200	396.493
							Remaining	18,276.0	18,264.0	730.560	228.584
							% Completed	42.3%	42.3%	42.3%	42.3%
							Average Daily Production	893.6	894.4	35.8	11.2

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	0.50						0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.20						0.20	
Recording	10.30						10.30	
Troubleshooting	0.30						0.30	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.70						0.70	
Detours	0.30						0.30	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.60	-	-	-	-	12.60	
<b>CUM TOTAL</b>	3.40	255.80	0.00	0.00	0.00	0.00	259.20	

- \* Spread damage caused by cattle dragging phones overnight
- \* Troubleshooting time due to transmission errors in transverse line
- \* Good production while working close to camp
- \* Paramedic back to back arrived on crew



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 5-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	48.0	2.0	52.0	1		
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

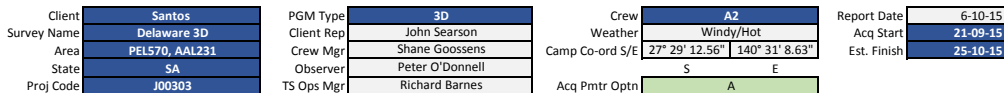
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5032-5416			1,352.0	1,359.0	45			392.0	392.0	15.680	4.906
5032-5480			1,360.0	1,367.0	46			455.0	455.0	18.200	5.695
<b>Daily Total</b>							-	847.0	847.0	33.880	10.601
						Cumulative	12.0	14,251.0	14,263.0	570.520	178.509
						PGM Total		31,680.0	31,680.0	1,267.200	396.493
						Remaining		17,429.0	17,417.0	696.680	217.983
						% Completed		45.0%	45.0%	45.0%	45.0%
						Average Daily Production		890.7	891.4	35.7	11.2

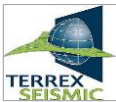
Line Layout	Layout Station # From	Layout Station # To	Layout Total
1496	5075	5000	76
1504	5479	5000	480
1512	5479	5430	50
Total Stations Laid Out			606

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1240	5479	5299	181
1248	5479	5000	480
1256	5479	5251	229
1264	5479	5296	184
Total Stations Picked Up			1,074

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	0.50						0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.10						0.10	
Recording	8.80						8.80	
Troubleshooting	0.30						0.30	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.30						0.30	
Detours	0.20						0.20	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down	2.00						2.00	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	268.30	0.00	0.00	0.00	0.00	271.70	

- \* Spread damage due to cattle dragging geophones overnight
- \* Recorder downtime due to timebreak error, fault traced to a vibrator VE464 electronics problem, replaced with unit out of spare machine
- \* Troubleshooting time due to transmission errors in transverse line
- \* 1 x paramedic departed crew
- \* 1 x mechanic arrived on crew





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 6-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0	1	1	
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

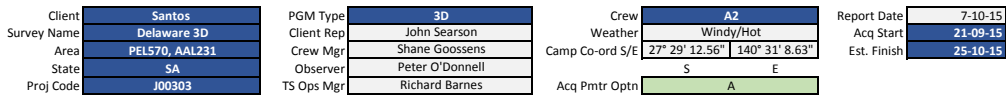
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



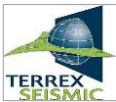
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5000-5024			1,352.0	1,359.0	45			32.0	32.0	1.280	0.400
5000-5024			1,360.0	1,367.0	46			33.0	33.0	1.320	0.413
5000-5480			1,368.0	1,375.0	47			488.0	488.0	19.520	6.108
5040-5480			1,376.0	1,383.0	48			344.0	344.0	13.760	4.305
<b>Daily Total</b>							-	897.0	897.0	35.880	11.226
							Cumulative 12.0	15,148.0	15,160.0	606.400	189.736
							PGM Total	31,680.0	31,680.0	1,267.200	396.493
							Remaining	16,532.0	16,520.0	660.800	206.757
							% Completed	47.8%	47.9%	47.9%	47.9%
							Average Daily Production	891.1	891.8	35.7	11.2

<b>Line Layout</b>	<b>Layout Station # From</b>	<b>Layout Station # To</b>	<b>Layout Total</b>
1512	5249	5000	250
1520	5479	5000	480
1528	5323	5000	324
<b>Total Stations Laid Out</b>			<b>1,054</b>

<b>Line Pickup</b>	<b>Pickup Station # From</b>	<b>Pickup Station # To</b>	<b>Pickup Total</b>
1256	5250	5208	43
1264	5295	5208	88
1272	5479	5251	229
<b>Total Stations Picked Up</b>			<b>360</b>

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.50					0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		10.70					10.70	
Troubleshooting		0.30					0.30	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other		0.60					0.60	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	280.80	0.00	0.00	0.00	0.00	284.20	

- \* Spread damage caused by cattle dragging phones overnight
- \* Troubleshooting time due to transmission errors in transverse line
- \* Good production while working close to camp
- \* Very windy conditions, extremely dusty in camp



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 7-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	24.0	1.0	26.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

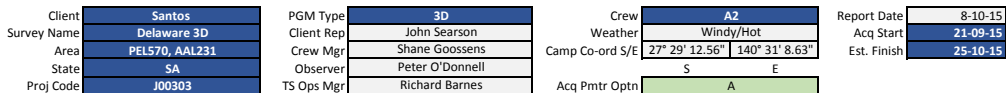
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

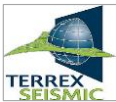
Lead  
Survey  
LC

KM	Approx Days

[illegible][illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.50					0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.20					0.20	
Recording		11.10					11.10	
Troubleshooting		0.20					0.20	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other		0.20					0.20	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>		<b>12.50</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>12.50</b>	
<b>CUM TOTAL</b>	<b>3.40</b>	<b>293.30</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>296.70</b>	

<ul style="list-style-type: none"> <li>* Spread damage caused by cattle dragging phones overnight</li> <li>* Troubleshooting time due to transmission errors in transverse line</li> <li>* Good production while shooting through camp</li> <li>* Crew change via Moomba, 4 in &amp; 4 out</li> <li>* Terrex Contracting &amp; Terrex Spatial arrived back on site to start lineprep on Beanbush 3D</li> </ul>
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Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 8-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0	4	4	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

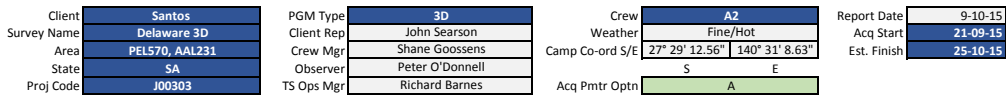
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5000-5392			1,392.0	1,399.0	50			200.0	200.0	8.000	2.503
5000-5480			1,400.0	1,407.0	51			488.0	488.0	19.520	6.108
5128-5480			1,408.0	1,415.0	52			195.0	195.0	7.800	2.441
<b>Daily Total</b>							-	883.0	883.0	35.320	11.051
							12.0	16,951.0	16,963.0	678.520	212.301
							Cumulative	31,680.0	31,680.0	1,267.200	396.493
							PGM Total	14,729.0	14,717.0	588.680	184.191
							Remaining	53.5%	53.5%	53.5%	53.5%
							% Completed	892.2	892.8	35.7	11.2
							Average Daily Production				

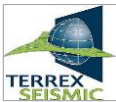
Line Layout	Layout Station # From	Layout Station # To	Layout Total
1528	5091	5000	92
1536	5363	5000	364
Total Stations Laid Out			456

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1296	5479	5208	272
1304	5479	5000	480
Total Stations Picked Up			752

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.50					0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		10.60					10.60	
Troubleshooting		0.40					0.40	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other		0.30					0.30	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down		0.30					0.30	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	305.80	0.00	0.00	0.00	0.00	309.20	

- \* Spread damage caused by cattle dragging geophones overnight
- \* Troubleshooting time due to flaky LAUL on active patch
- \* Good production while recording close to camp
- \* Recorder down time due to lock up, reboot recording system
- \* Terrex Contracting commenced moving machines from camp to Beanbush 3D





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 9-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

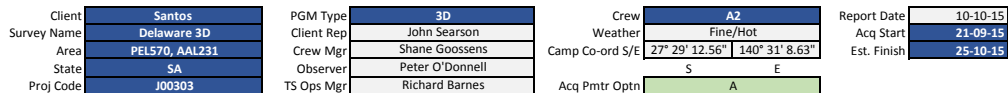
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



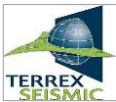
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM	
5000-5408			1,408.0	1,415.0	52		2.0	290.0	292.0	11.680	3.655	
5000-5480			1,416.0	1,423.0	53			488.0	488.0	19.520	6.108	
5200-5480			1,424.0	1,431.0	54			136.0	136.0	5.440	1.702	
<b>Daily Total</b>							2.0	914.0	916.0	36.640	11.464	
							Cumulative PGM Total	14.0	17,865.0	17,879.0	715.160	223.766
							Remaining		31,680.0	31,680.0	1,267.200	396.493
							% Completed		13,815.0	13,801.0	552.040	172.727
							Average Daily Production		56.4%	56.4%	56.4%	56.4%
									893.3	894.0	35.8	11.2

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1536	5479	5364	116
1544	5479	5000	480
1552	5231	5000	232
<b>Total Stations Laid Out</b>			<b>828</b>

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1312	5479	5000	480
1320	5479	5000	480
<b>Total Stations Picked Up</b>			<b>960</b>

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	0.50						0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.20						0.20	
Recording	11.00						11.00	
Troubleshooting	0.40						0.40	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.20						0.20	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.60	-	-	-	-	12.60	
<b>CUM TOTAL</b>	3.40	318.40	0.00	0.00	0.00	0.00	321.80	

- \* Spread damage caused by cattle dragging phones overnight
- \* Troubleshooting time due to line break caused by truck breaking cable on road crossing
- \* Line prep commenced on Beanbush 3D



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 10-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

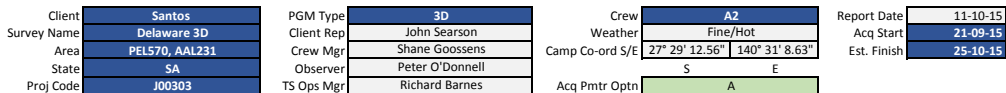
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



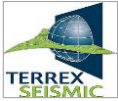
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5000-5392			1,424.0	1,431.0	54			352.0	352.0	14.080	4.405
5000-5480			1,432.0	1,439.0	55			488.0	488.0	19.520	6.108
5440-5480			1,440.0	1,447.0	56			48.0	48.0	1.920	0.601
Daily Total							-	888.0	888.0	35.520	11.114
						Cumulative	14.0	18,753.0	18,767.0	750.680	234.880
						PGM Total		31,680.0	31,680.0	1,267.200	396.493
						Remaining		12,927.0	12,913.0	516.520	161.613
						% Completed		59.2%	59.2%	59.2%	59.2%
						Average Daily Production		893.0	893.7	35.7	11.2

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1552	5479	5232	248
1560	5479	5000	480
1568	5179	5000	180
Total Stations Laid Out			908

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1328	5479	5000	480
1336	5320	5000	321
Total Stations Picked Up			801

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	0.50						0.50	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.10						0.10	
Recording	10.90						10.90	
Troubleshooting	0.40						0.40	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.30						0.30	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.50	-	-	-	-	12.50	
<b>CUM TOTAL</b>	3.40	330.90	0.00	0.00	0.00	0.00	334.30	

<ul style="list-style-type: none"> <li>* Spread damage due to cattle dragging phones overnight</li> <li>* troubleshooting time due to line break on active spread</li> <li>* Crew change via Thargomindah, 2 in &amp; 2 out</li> </ul>
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Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 11-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0	2	2	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

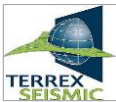
KM	Approx Days

[illegible]

Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	0.30						0.30
Recorder Setup	0.20						0.20
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing	0.20						0.20
Recording	10.10						10.10
Troubleshooting	0.90						0.90
Recorder Moveup	0.50						0.50
Spread Chewage							-
Spread Damage Other	0.30						0.30
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80
<b>CUM TOTAL</b>	3.40	343.70	0.00	0.00	0.00	0.00	347.10

- \* Spread damage due to cattle dragging phones overnight
- \* Troubleshooting time due to transmission problems in transverse & line cables due to static - windy conditions
- \* Recorder moved part way to next setup, parked in camp overnight





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 12-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

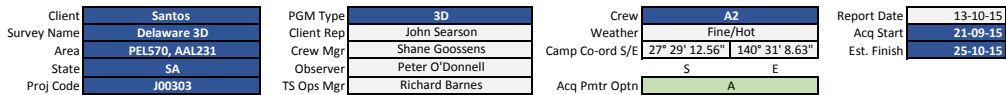
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



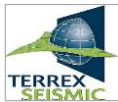
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKm
5232-5480			1,448.0	1,455.0	57			32.0	32.0	1.280	0.400
5000-5480			1,456.0	1,463.0	58			488.0	488.0	19.520	6.108
5000-5480			1,464.0	1,471.0	59			354.0	354.0	14.160	4.431

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1584	5479	5324	156
1592	5479	5072	408
1600	5307	5072	236
Total Stations Laid Out			800

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1352	5479	5321	159
1360	5479	5000	480
Total Stations Picked Up			639

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		0.50					0.50	
Recorder Setup		0.30					0.30	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		9.00					9.00	
Troubleshooting		0.50					0.50	
Recorder Moveup		0.50					0.50	
Spread Chewage							-	
Spread Damage Other		0.80					0.80	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down		0.80					0.80	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>		<b>12.80</b>					<b>12.80</b>	
<b>CUM TOTAL</b>	<b>3.40</b>	<b>356.50</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>359.90</b>	

- \* Spread damage time due to cattle dragging geophones overnight
- \* Recorder move continued from previous day
- \* Troubleshooting time due to transmission errors in transverse line
- \* Recorder downtime due to intermittent LCI problems



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 13-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	52.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

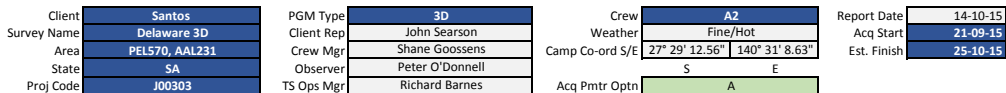
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

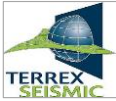


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5144-5480			1,464.0	1,471.0	59		1.0	134.0	135.0	5,400	1,690
5000-5480			1,472.0	1,479.0	60		1.0	487.0	488.0	19,520	6,108
5000-5424			1,480.0	1,487.0	61			240.0	240.0	9,600	3,004
<b>Daily Total</b>							2.0	861.0	863.0	34,520	10,801
						Cumulative	16.0	21,384.0	21,400.0	856,000	267,833
						PGM Total		31,680.0	31,680.0	1,267,200	396,493
						Remaining		10,296.0	10,280.0	411,200	128,660
						% Completed		67.5%	67.6%	67.6%	67.6%
						Average Daily Production		891.0	891.7	35.7	11.2

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests	0.50						0.50	
QC Spread							-	
QC / Testing	0.10						0.10	
Recording	8.40						8.40	
Troubleshooting	0.50						0.50	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.50						0.50	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down	1.50						1.50	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	369.30	0.00	0.00	0.00	0.00	372.70	

- \* Spread damage due to cattle dragging phones overnight
- \* Troubleshooting time due to transmission errors in line & transverse cables
- \* Recorder downtime caused by timebreak error, thought to be due to GPS satellite coverage issues, vibrators hardwired to confirm
- \* 1 x person out via Moomba



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 14-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	48.0	1.0	51.0		1	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

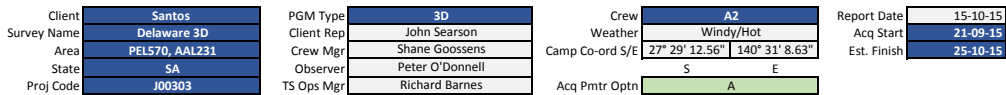
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



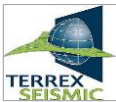
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5056-5480			1,480.0	1,487.0	61			248.0	248.0	9.920	3.104
5000-5480			1,488.0	1,495.0	62			487.0	487.0	19.480	6.095
5248-5272			1,496.0	1,503.0	63			32.0	32.0	1.280	0.400
<b>Daily Total</b>							-	767.0	767.0	30.680	9.599
						Cumulative	16.0	22,151.0	22,167.0	886.680	277,432
						PGM Total		31,680.0	31,680.0	1,267.200	396,493
						Remaining		9,529.0	9,513.0	380.520	119,060
						% Completed		69.9%	70.0%	70.0%	70.0%
						Average Daily Production		886.0	886.7	35.5	11.1

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Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox		0.30					0.30
Safety Meeting							-
Travel		1.00					1.00
Recorder Setup							-
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing		0.20					0.20
Recording		7.60					7.60
Troubleshooting		0.30					0.30
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other		0.30					0.30
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other				3.10			3.10
<b>TOTAL</b>	-	9.70	-	3.10	-	-	12.80
<b>CUM TOTAL</b>	3.40	379.00	0.00	3.10	0.00	0.00	385.50

- \* Spread damage time due to cattle dragging geophones overnight
- \* Troubleshooting time due to transmission errors in spread caused by wind (static)
- \* Crew change via Moomba





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Windy/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 15-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	48.0	1.0	51.0	8	8	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

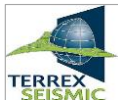
Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 16-10-15  
Acq Start 21-09-15  
Est. Finish 25-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	1.0	54.0	3		
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

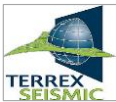
Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 17-10-15  
Acq Start 21-09-15  
Est. Finish 26-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	1.0	54.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

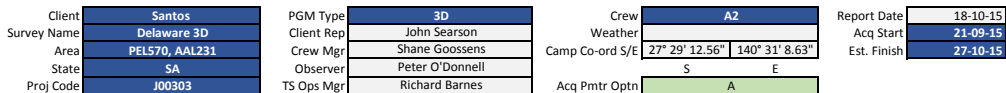
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



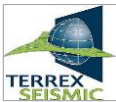
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5040-5464			1,512.0	1,519.0	65			344.0	344.0	13.760	4.305
Daily Total							-	344.0	344.0	13.760	4.305
						Cumulative	17.0	23,535.0	23,552.0	942.080	294.767
						PGM Total		31,680.0	31,680.0	1,267.200	396.493
						Remaining		8,145.0	8,128.0	325.120	101.726
						% Completed		74.3%	74.3%	74.3%	74.3%
						Average Daily Production		840.5	841.1	33.6	10.5

[illegible]

Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	1.00						1.00
Recorder Setup							-
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing	0.30						0.30
Recording	3.00						3.00
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other							-
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other				8.60			8.60
<b>TOTAL</b>	-	4.60	-	8.60	-	-	13.20
<b>CUM TOTAL</b>	3.40	399.00	0.00	21.50	0.00	2.30	426.20

\* Line crew restricted to 8 hour day due to no spread clearance  
\* 1 x personnel out via Thargomindah





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 18-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	50.0	1.0	53.0		1	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

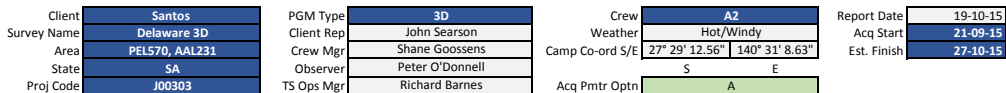
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

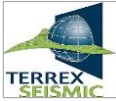
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Line Layout	Layout Station # From	Layout Station # To	Layout Total
1680	5271	5112	160
1688	5263	5120	144
1696	5255	5128	128
1704	5247	5136	112
Total Stations Laid Out			544

Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1416	5479	5000	480
1424	5479	5000	480
Total Stations Picked Up			960

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.20						0.20	
Recording	11.00						11.00	
Troubleshooting	0.30						0.30	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	411.80	0.00	21.50	0.00	2.30	439.00	

- \* Troubleshooting time due to line break
- \* Windy conditions
- \* Spread layout completed, back crew loading spread on to trucks



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Hot/Windy  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 19-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	50.0	1.0	53.0			
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

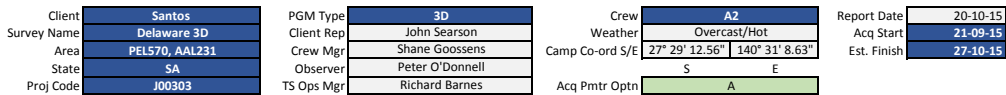
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

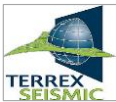


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5136-5240			1,528.0	1,535.0	67			112.0	112.0	4.480	1.402
5000-5480			1,536.0	1,543.0	68			488.0	488.0	19.520	6.108
5000-5432			1,544.0	1,551.0	69			304.0	304.0	12.160	3.805
<b>Daily Total</b>							-	904.0	904.0	36.160	11.314
							17.0	25,351.0	25,368.0	1,014.720	317.495
								31,680.0	31,680.0	1,267.200	396.493
								6,329.0	6,312.0	252.480	78.998
								80.0%	80.1%	80.1%	80.1%
								845.0	845.6	33.8	10.6

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		1.00					1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing		0.10					0.10	
Recording		10.90					10.90	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other		0.50					0.50	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	424.60	0.00	21.50	0.00	2.30	451.80	

- \* Spread damage due to cattle dragging phones overnight
- \* Terrex Contracting demobilised site back to Cooper Parks, 1 x offsider & 1 x grader operator on site performing resto work on Delaware 3D
- \* 2nd paramedic demobilised back to Adelaide
- \* Andrew White (Santos Adelaide) arrived on crew for field visit



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Overcast/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 20-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	1.0	2.0	53.0	1	1
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

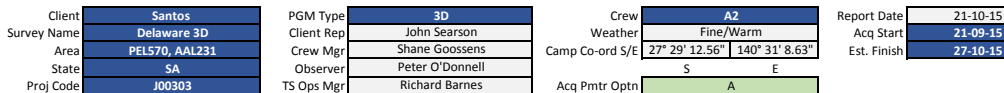
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



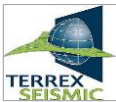
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5112-5480			1,544.0	1,551.0	69			184.0	184.0	7.360	2.303
5000-5480			1,552.0	1,559.0	70			488.0	488.0	19.520	6.108
5000-5344			1,560.0	1,567.0	71			264.0	264.0	10.560	3.304
<b>Daily Total</b>							-	936.0	936.0	37.440	11.715
						Cumulative	17.0	26,287.0	26,304.0	1,052.160	329.209
						PGM Total		31,680.0	31,680.0	1,267.200	396.493
						Remaining		5,393.0	5,376.0	215.040	67.283
						% Completed		83.0%	83.0%	83.0%	83.0%
						Average Daily Production		848.0	848.5	33.9	10.6

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread							-	
QC / Testing	0.10						0.10	
Recording	11.10						11.10	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other	0.30						0.30	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	437.40	0.00	21.50	0.00	2.30	464.60	

- \* Spread pick up continued, with spread loaded on to trucks
- \* Andrew White & Andrew Dello-Iacovo (Santos Adelaide) departed crew
- \* Crew change via Ballera, 5 in & 5 out





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 21-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	1.0	2.0	55.0	5	5
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

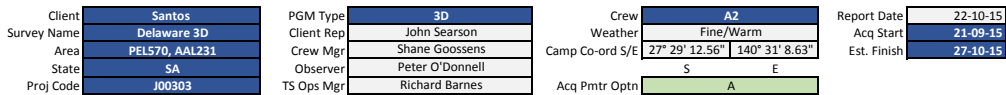
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

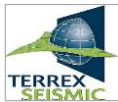


Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5160-540			1,560.0	1,567.0	71			224.0	224.0	8.960	2.803
5072-5480			1,568.0	1,575.0	72			416.0	416.0	16.640	5.206
5072-5392			1,576.0	1,583.0	73			256.0	256.0	10.240	3.204
<b>Daily Total</b>							-	896.0	896.0	35.840	11.214
							17.0	27,183.0	27,200.0	1,088.000	340.423
Cumulative PGM Total								31,680.0	31,680.0	1,267.200	396.493
Remaining								4,497.0	4,480.0	179.200	56.070
% Completed								85.8%	85.9%	85.9%	85.9%
Average Daily Production								849.5	850.0	34.0	10.6

[illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		1.00					1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread		0.40					0.40	
QC / Testing		0.20					0.20	
Recording		10.90					10.90	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	450.20	0.00	21.50	0.00	2.30	477.40	

- \* Spread QC time spent relicking dragged phones
- \* Spread pick up continued, loaded on to spread trucks



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 22-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	1.0	53.0	2	1	
	1.0	25.0	1.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

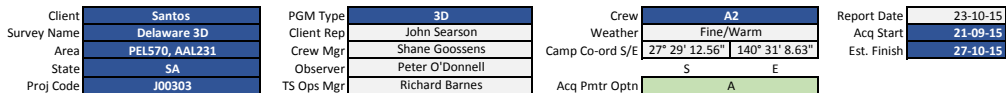
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

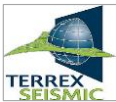
Lead  
Survey  
LC

KM	Approx Days

[illegible][illegible]

Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox	0.30						0.30	
Safety Meeting							-	
Travel	1.00						1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread	0.50						0.50	
QC / Testing	0.10						0.10	
Recording	10.40						10.40	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down	0.50						0.50	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80	
<b>CUM TOTAL</b>	3.40	463.00	0.00	21.50	0.00	2.30	490.20	

- \* Spread QC time due to replanting geophones *dragged* during the night
- \* Recorder downtime due to system lockup requiring reboot
- \* 2nd paramedic arrived on site for Beanbush 3D layout
- \* Excellent production



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Warm  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 23-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	2.0	54.0	2		
	1.0	24.0	2.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

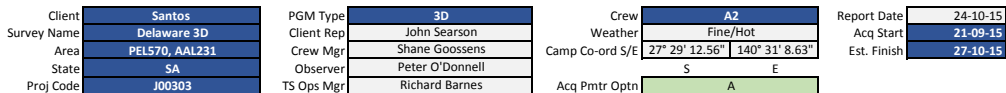
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

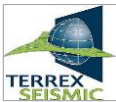
KM	Approx Days

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Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	1.00						1.00
Recorder Setup							-
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing	0.20						0.20
Recording	10.80						10.80
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other	0.50						0.50
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80
<b>CUM TOTAL</b>	3.40	475.80	0.00	21.50	0.00	2.30	503.00

\* Spread damage time due to cattle dragging phones overnight  
\* Spread pick up continued  
\* Spread layout started on Beanbush 3D, not worth starting new daily report to show this, added above in spread layout section





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 24-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

##### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	2.0	54.0			
	1.0	24.0	2.0	27.0			
		15.0		15.0			

##### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

##### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

##### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

##### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

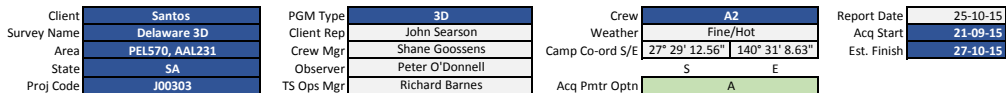
Client Representative: John Searson

Signature

##### 10. ADVANCE PARTY LEAD

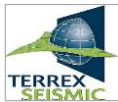
Lead  
Survey  
LC

KM	Approx Days

[illegible][illegible]

Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	1.00						1.00
Recorder Setup							-
Initial Layout/Pick up							-
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing	0.10						0.10
Recording	10.80						10.80
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other	0.60						0.60
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move							-
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80
<b>CUM TOTAL</b>	3.40	488.60	0.00	21.50	0.00	2.30	515.80

- \* Spread damage time due to cattle dragging geophones overnight
- \* Spread layout continued on Beanbush 3D
- \* Hot conditions



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 25-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	51.0	2.0	54.0			
	1.0	24.0	2.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

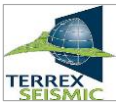
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 26-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 1. PRODUCTION

Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPs	Charge VPs	L/km	SqKM
5072-5448			1,632.0	1,639.0	80			292.0	292.0	11.680	3.655
5080-5304			1,640.0	1,647.0	81			232.0	232.0	9.280	2.904
5088-5296			1,648.0	1,655.0	82			216.0	216.0	8.640	2.703
5096-5288			1,656.0	1,663.0	83			96.0	96.0	3.840	1.201
5104			1,664.0	1,671.0	84			15.0	15.0	0.600	0.188
5112			1,672.0	1,679.0	85			20.0	20.0	0.800	0.250
5120			1,680.0	1,687.0	86			21.0	21.0	0.840	0.263
5128			1,688.0	1,695.0	87			24.0	24.0	0.960	0.300
5136-5144			1,696.0	1,703.0	88			16.0	16.0	0.640	0.200
Daily Total							-	932.0	932.0	37.280	11.665
							Cumulative	17.0	30,895.0	30,912.0	1,236.480
							PGM Total		31,680.0	31,680.0	1,267.200
							Remaining		785.0	768.0	30.720
							% Completed		97.5%	97.6%	97.6%
							Average Daily Production		858.2	858.7	34.3

#### 2. SPREAD MOVEMENT

Line Layout	Layout Station # From	Layout Station # To	Layout Total
1088	5247	5088	160
1096	5247	5000	248
1104	5255	5000	256
1112	5263	5000	264
1120	5215	5000	216
Total Stations Laid Out			1,144

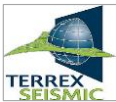
Line Pickup	Pickup Station # From	Pickup Station # To	Pickup Total
1528	5479	5354	126
1536	5479	5000	480
1544	5439	5000	440
Total Stations Picked Up			1,046

#### 3. HOURS

	Hourly Rate	T-Key / L-Sum	Working Rate	Standby	Stand Down	No Chg / Other	Total	Comments
Mobilisation							-	
Demobe/Remobe							-	
Camp Setup/Packup							-	
Inductions							-	
Toolbox		0.30					0.30	
Safety Meeting							-	
Travel		1.00					1.00	
Recorder Setup							-	
Initial Layout/Pick up							-	
Experimental							-	
H/Wires, SIMS, Sweep Tests							-	
QC Spread		0.50					0.50	
QC / Testing		0.20					0.20	
Recording		10.80					10.80	
Troubleshooting							-	
Recorder Moveup							-	
Spread Chewage							-	
Spread Damage Other							-	
Detours							-	
Waiting On Spread							-	
Line Move							-	
Prospect Move							-	
Camp Move							-	
Traverse Move							-	
Swath Move							-	
Vibe Travel							-	
Weather							-	
Recorder Down							-	
Vibes Down							-	
Human Error							-	
Washdown							-	
Other							-	
TOTAL	-	12.80	-	-	-	-	12.80	
CUM TOTAL	3.40	501.40	0.00	21.50	0.00	2.30	528.60	

#### 4. OTHER COMMENTS

- \* Spread layout continued on Beanbush 3D
- \* Very hot conditions, 40 degrees
- \* 1 x crew member in via Quilpie, 3 out via Moomba



Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 26-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	2.0	52.0	1	3	
	1.0	24.0	2.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item	Units
Crew manager	
Line crew	
HSE	
Channels	
Landcruiser	
AHV IV	
Hemi 60	
Hemi 50	
Hemi 44	
Envirovibe	
Accommodation	
Other crew	
Other vehicle	

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

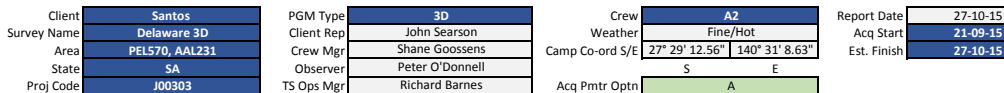
Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days



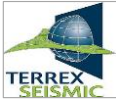
Line	File From	File To	Stn From	Stn To	Swath #	Stn's	Skips	VPS	Charge VPs	L/km	SqKM
5112-5208			1,656.0	1,663.0	83			104.0	104.0	4.160	1.302
5120-5280			1,664.0	1,671.0	84			169.0	169.0	6.760	2.115
5128-5272			1,672.0	1,679.0	85		1.0	147.0	148.0	5.920	1.852
5136-5264			1,680.0	1,687.0	86			131.0	131.0	5.240	1.640
5152-5256			1,688.0	1,695.0	87			112.0	112.0	4.480	1.402
5152-5248			1,696.0	1,703.0	88			104.0	104.0	4.160	1.302
Daily Total							1.0	767.0	768.0	30.720	9.612
Cumulative PGM Total							18.0	31,662.0	31,680.0	1,267.200	396.493
% Completed								99.9%	100.0%	100.0%	100.0%
Average Daily Production								855.7	856.2	34.2	10.1
Remaining								18.0	-	-	0.000

[illegible]

Mobilisation							-
Demobe/Remobe							-
Camp Setup/Packup							-
Inductions							-
Toolbox	0.30						0.30
Safety Meeting							-
Travel	1.50						1.50
Recorder Setup	0.90						0.90
Initial Layout/Pick up	1.80						1.80
Experimental							-
H/Wires, SIMS, Sweep Tests							-
QC Spread							-
QC / Testing	0.10						0.10
Recording	6.50						6.50
Troubleshooting							-
Recorder Moveup							-
Spread Chewage							-
Spread Damage Other							-
Detours							-
Waiting On Spread							-
Line Move							-
Prospect Move	1.70						1.70
Camp Move							-
Traverse Move							-
Swath Move							-
Vibe Travel							-
Weather							-
Recorder Down							-
Vibes Down							-
Human Error							-
Washdown							-
Other							-
<b>TOTAL</b>	-	12.80	-	-	-	-	12.80
<b>CUM TOTAL</b>	3.40	514.20	0.00	21.50	0.00	2.30	541.40

<ul style="list-style-type: none"> <li>* Acquisition completed on Delaware 3D</li> <li>* Spread layout continued on Beanbush 3D</li> <li>* Vibrators &amp; recorder travelled to Beanbush 3D</li> <li>* Recording should start following day on Beanbush 3D</li> <li>* Spread pickup continued on Delaware 3D</li> </ul>
--





Client Santos  
Survey Name Delaware 3D  
Area PEL570, AAL231  
State SA  
Proj Code J00303

PGM Type 3D  
Client Rep John Searson  
Crew Mgr Shane Goossens  
Observer Peter O'Donnell  
TS Ops Mgr Richard Barnes

Crew A2  
Weather Fine/Hot  
Camp Co-ord S/E 27° 29' 12.56" 140° 31' 8.63"  
S E  
Acq Pmtr Optn A

Report Date 27-10-15  
Acq Start 21-09-15  
Est. Finish 27-10-15

#### 5. PEOPLE & VEHICLES

Headcount  
Light Vehicles  
Heavy Vehicles

Client	Terrex Crew	Other	Visitors	Total On Crew	In	Out	Comments
	1.0	49.0	2.0	52.0			
	1.0	24.0	2.0	27.0			
		15.0		15.0			

#### 6. GROUND EQUIPMENT

Item  
Channels  
Active Channels  
Geophones 6 String  
Geophones 12 String  
Geophones Nodes  
LAUL  
LAUX  
2 Link Cable  
4 Link Cable  
Laser Links  
Repeaters  
Transverse  
Batteries  
Acquisition System  
Vibe Elect

On Crew	In Use
14,100	1,410
5,408	
14,100	14,100
360	360
30	30

#### 7. ADDITIONAL CHARGE ITEMS

Item  
Crew manager  
Line crew  
HSE  
Channels  
Landcruiser  
AHV IV  
Hemi 60  
Hemi 50  
Hemi 44  
Envirovibe  
Accommodation  
Other crew  
Other vehicle

Units

#### 8. VIBE DOWNTIME

Vibrator Rego	Issue	Hours

#### 9. ACQ SYSTEM DOWNTIME

Name	Issue	Hours
Pelton		
VE 464		
Sercel 428		
Z Nodal		
Others		
Others		

Terrex Crew Manager: Shane Goossens

Signature

Client Representative: John Searson

Signature

#### 10. ADVANCE PARTY LEAD

Lead  
Survey  
LC

KM	Approx Days

#### PERTH OFFICE

Level 4, 76 Kings Park Rd  
West Perth WA 6005  
Australia

PO Box 1975  
West Perth WA 6872  
Australia

**T** +61 8 9235 4600

**F** +61 8 9324 3640

#### BRISBANE OFFICE

22 Crockford St  
Banyo QLD 4014  
Australia

**T** +61 7 3621 0300

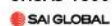
**F** +61 7 3266 7345

**E** [info@terrexseismic.com](mailto:info@terrexseismic.com)

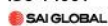
**[www.terrexseismic.com](http://www.terrexseismic.com)**



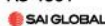
Health & Safety  
OHSAS 18001



Environment  
ISO 14001



Health & Safety  
AS 4801



Terrex Seismic and Terrex Spatial are certified  
to OHSAS 18001, ISO 14001 and AS 4801.

## **APPENDIX 2 - TAPE LIST**

## Tape listing for 2015 Delaware 3D Seismic Survey

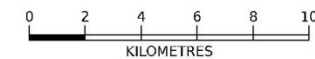
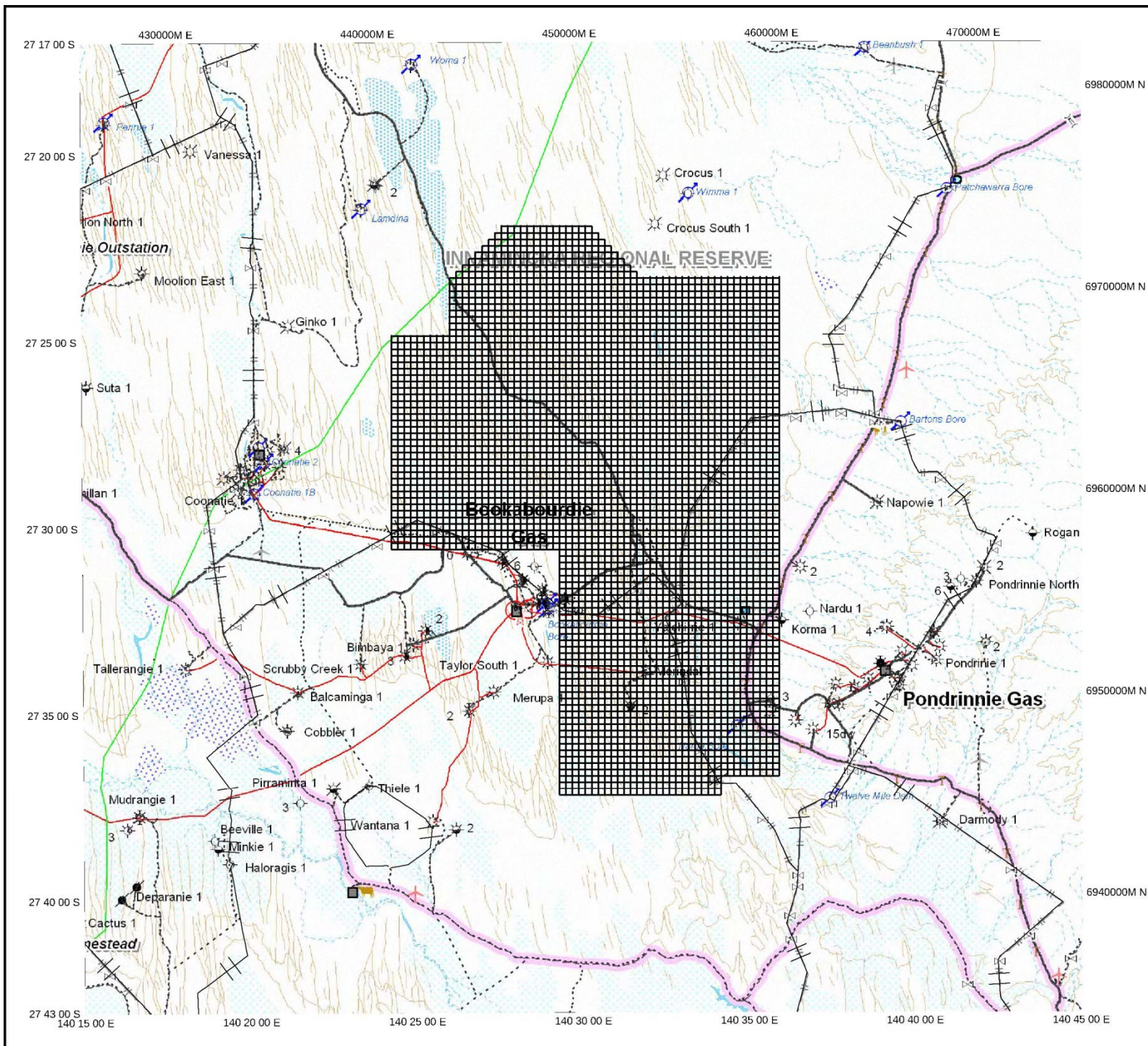
<b>Tape #</b>	<b>Media</b>	<b>First FFID</b>	<b>Last FFID</b>	<b>Comments</b>
2A	LTO2	2	6522	SEG-D
3A	LTO2	6524	11396	SEG-D
4A	LTO2	11397	16144	SEG-D
5A	LTO2	16146	20790	SEG-D
6A	LTO2	20792	24294	SEG-D
7A	LTO2	24296	29192	SEG-D
8A	LTO2	29194	33692	SEG-D
9A	LTO2	33694	38060	SEG-D
10A	LTO2	38062	42404	SEG-D
11A	LTO2	42406	46898	SEG-D
12A	LTO2	46900	51516	SEG-D
13A	LTO2	51518	56348	SEG-D
14A	LTO2	56349	62396	SEG-D
15A	LTO2	62397	63470	SEG-D
	USB			Obs logs / SPS



## **APPENDIX 3 - MAPS**



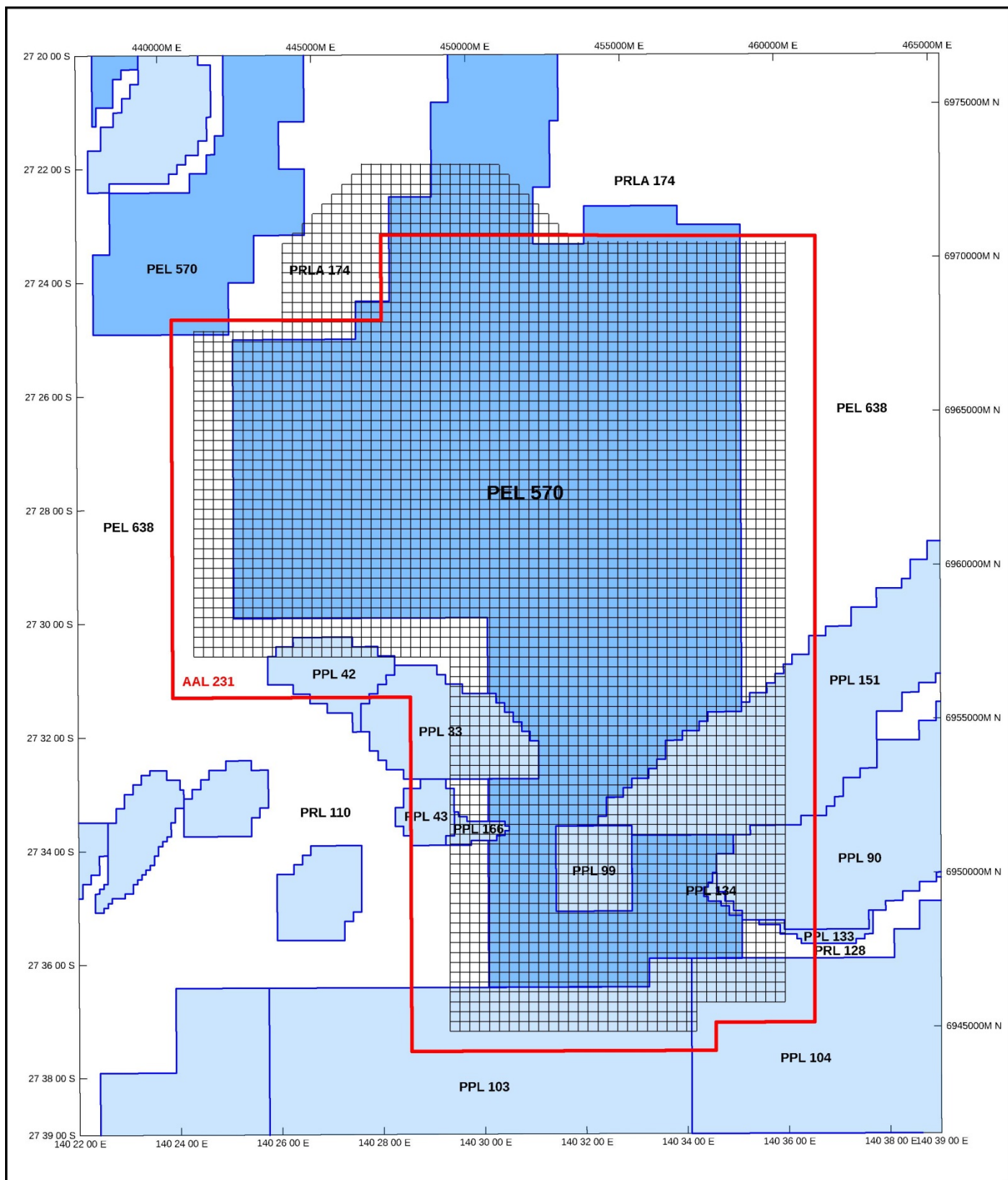








 	
<b>PEL 570</b> <b>DELAWARE 3D</b>	
<small>DATE: 10/10/2011</small> <small>COMPILED BY: [Name]</small> <small>APPROVED BY: [Name]</small>	<small>DATE: 10/10/2011</small> <small>FILE NO.: [Number]</small> <small>DATE: 10/10/2011</small>

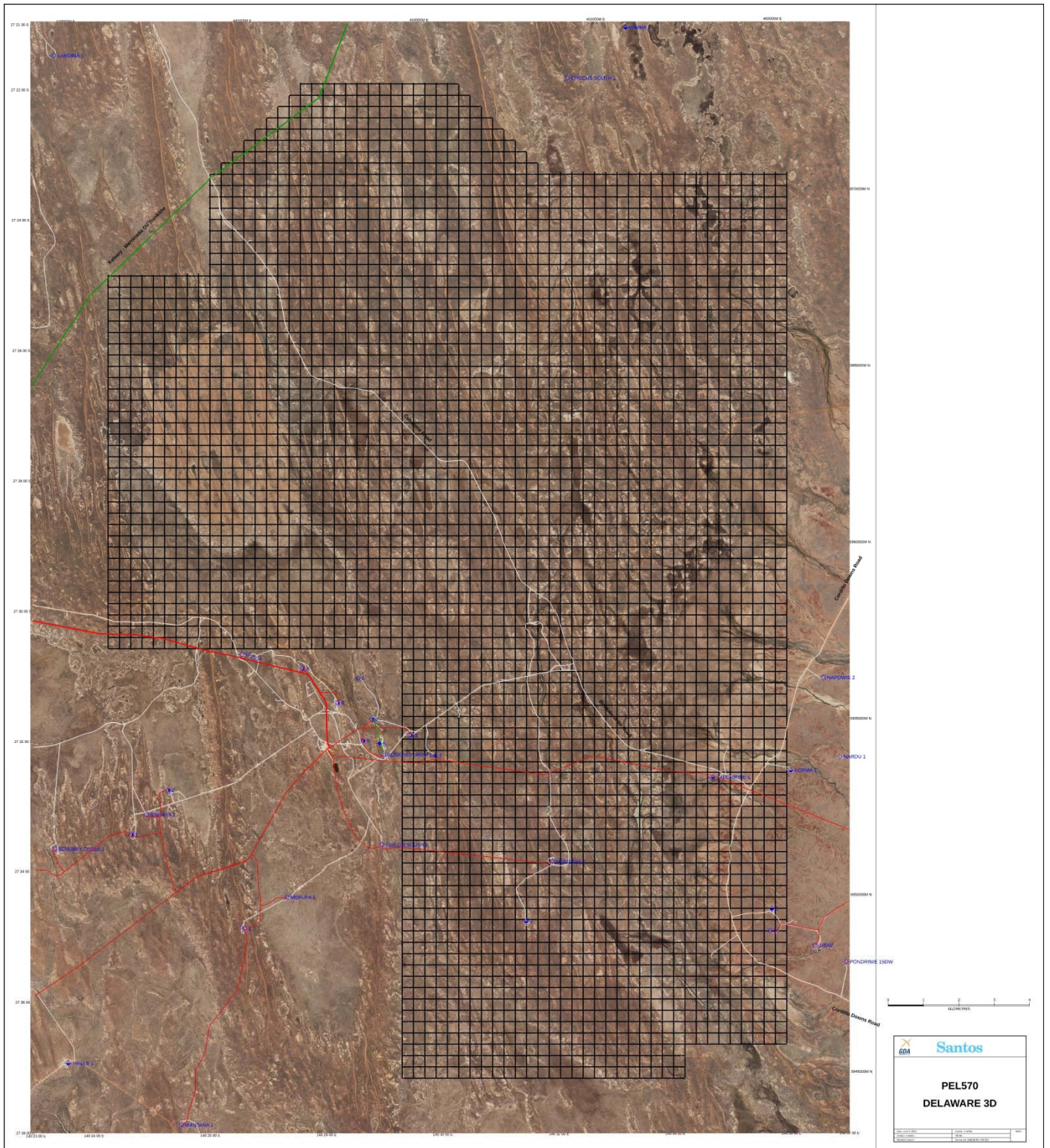




0 1 2 3 4 5  
KILOMETRES

 	
<b>PEL 570</b> <b>DELAWARE 3D</b> <b>TENURE MAP</b>	
<small>         Date: 10/10/2018          User: [illegible]          Version: 1.0       </small>	<small>         Date: 10/10/2018          User: [illegible]          Version: 1.0       </small>





## **APPENDIX 4 - PROCESSING REPORT**





## Santos Delaware 3D / Beanbush 3D Processing Report

Prepared By: Zachary Fisher and Amanda Rosso

Date: July 11, 2017



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## Key Contacts

### Santos (Client)

1. Michael Giles – Manager, Operations Geophysics - Focal Point/Point of Contact
2. Malcolm Horton – Staff Geophysicist, Operations Geophysics
3. Alison Goedecke – Staff Geophysicist, Asset Team
4. Kristina Dukic – Senior Geophysicist, Operations Geophysics

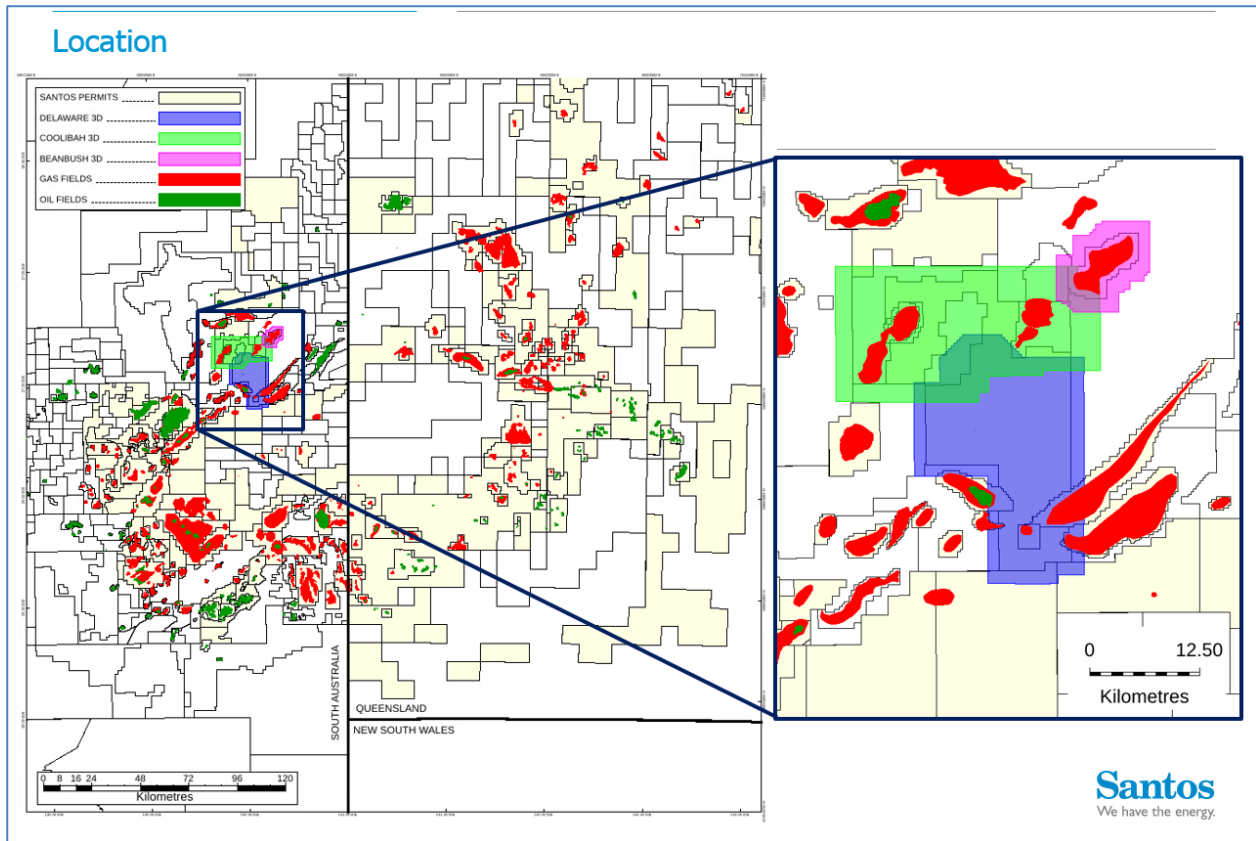
### NEOS (Contractor)

5. Robert Jefferson - Production Manager – Focal Point/Point of Contact
6. Joe Fuller – Project Lead – Focal Point/Point of Contact
7. Sissy Theisen (Director, SIG)
8. Scott Schapper (Project Geophysicist)
9. Bruce Golob (Well Log Integrator)
10. Zachary Fisher (P-wave processing)
11. Amanda Rosso (P-wave processing)
12. Rose Byrnes (Data Prep geometry/refraction statics)
13. Mei Schlagenhauf (Data Prep geometry/refraction statics)

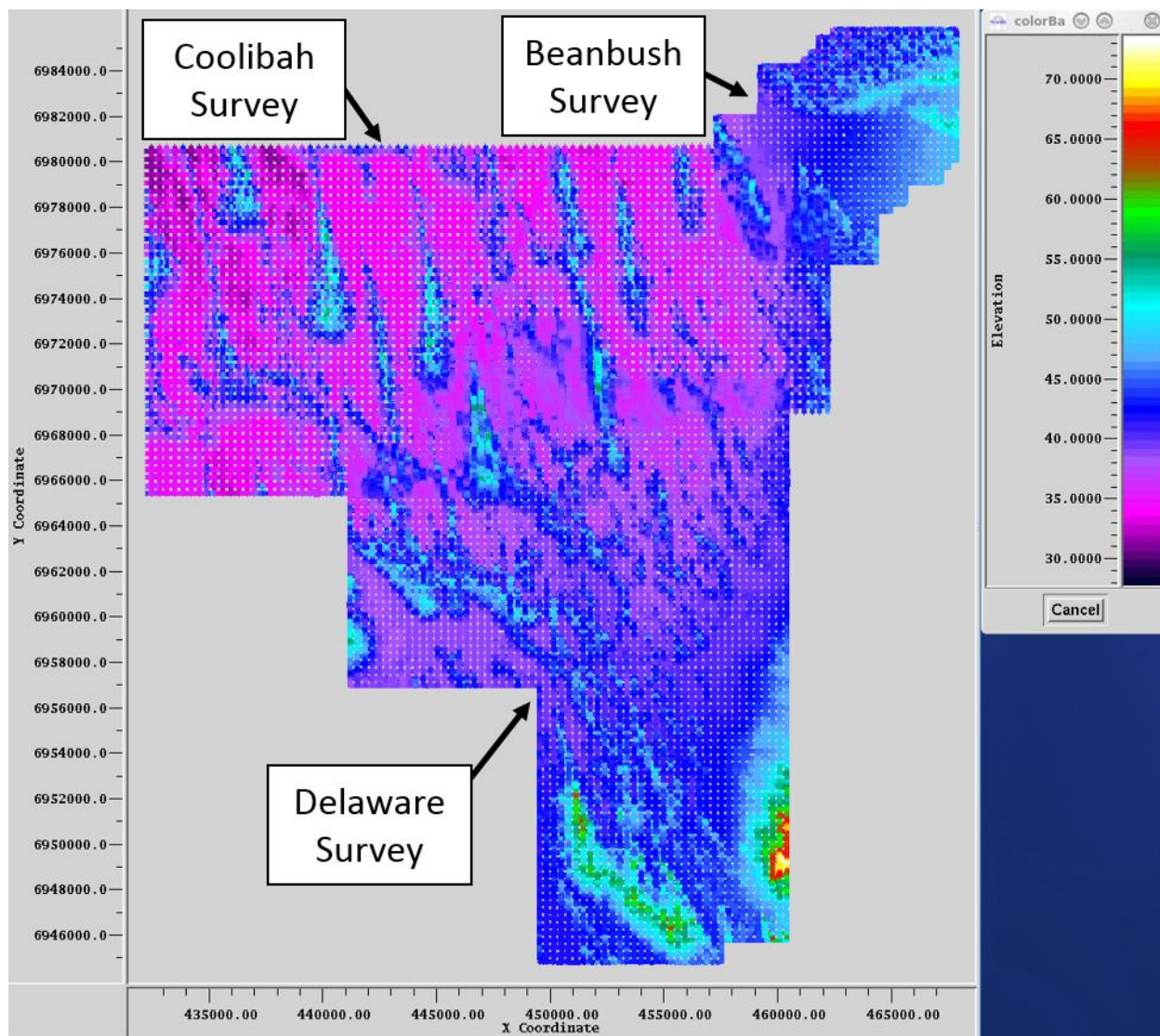
## INTRODUCTION and OBJECTIVES

This report covers time processing imaging from field tapes to 3D Pre-Stack 5D Offset Vector Tile (OVT) VTI HTI Time Migration carried out on the Delaware Merge 3D project for Santos. The survey is in the Cooper Basin of Australia. The objectives were to deliver a 5D OVT VTI HTI PSTM and azimuthal attributes by the end of June 2017.

### Cooper Basin Area:

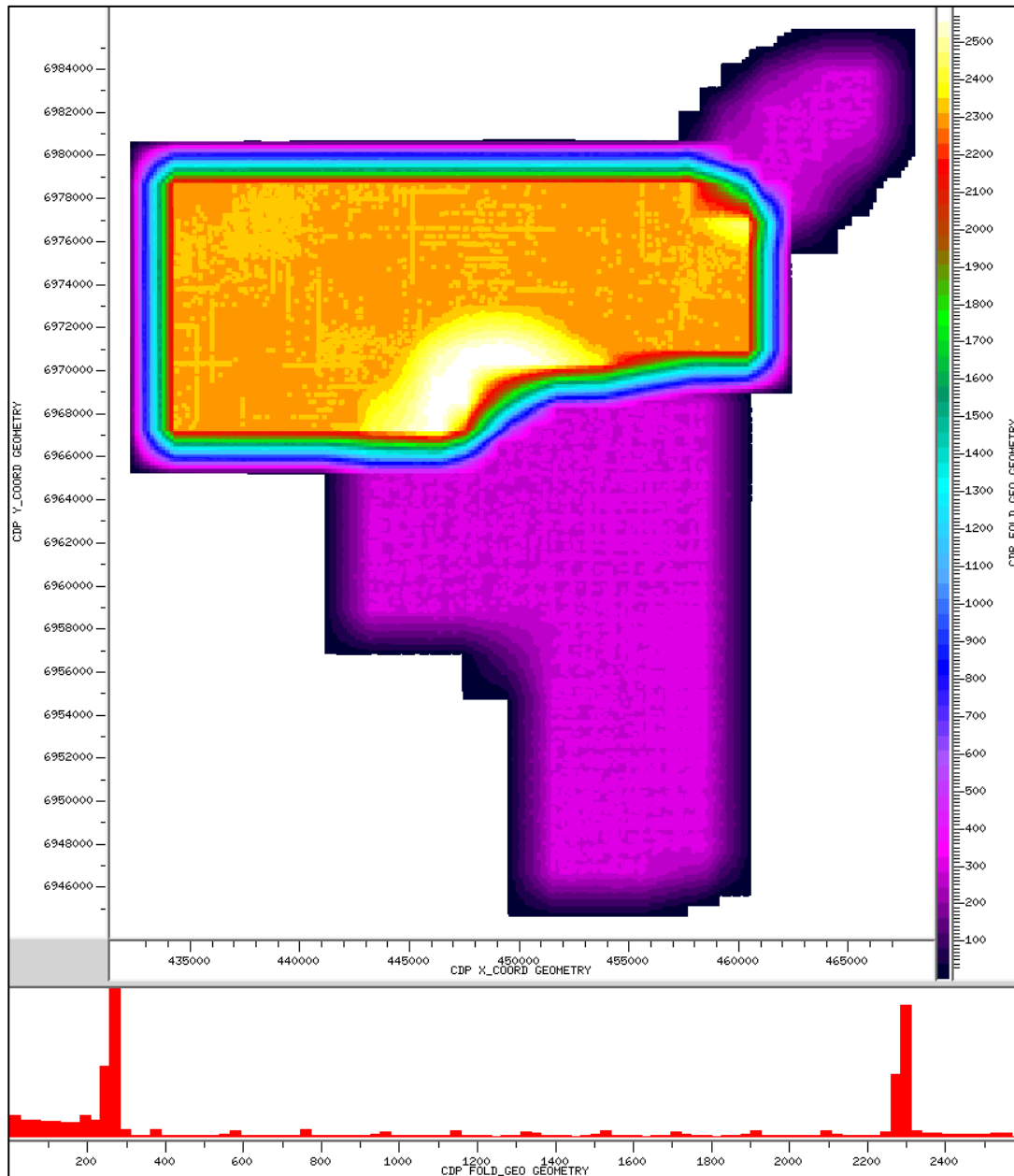


Surface elevations and positions of sources and receivers:



Receiver lines are S-N and Source lines are W-E on Coolibah.  
Receiver lines are W-E and Source lines are S-N on Delaware and Beanbush.

## CDP fold map using all offsets:



## Acquisition Details:



### Delaware 3D:

Delaware3D_Final_ObsLogs - Excel										
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW										
<div><div>Clipboard</div><div>Font</div><div>Alignment</div><div>Number</div><div>Styles</div><div>Cells</div></div>										
N10										
	A	B	C	D	E	F	G	H	I	J
1	Seismic Crew A2									
2	Client: Santos		Prospect: Delaware 3D							
3	Field Instrument: Sercel 428		Sample Rate: 2 mS				Record Length: 4 Seconds			
4	Field Filter: 0.8 Nyquist Linear Phase		.8nyq @ 2mS=200hz				Pre-Amp Gain: 400 mv			
5	Noise Editing: Div (OFF)		Correlation: After Stack				Auxillaries: TB, 100Hz, Pilot, DPG Ref, Auto-Correl.			
6	Vibrator: AHV IV		Vib Control: VE 464				Sweep Length: 1 x 12 sec			
7	Vib Array: 2 Vib ,12.5m pad spacing		Centered on peg,				1 x standing sweep, 70% Force			
8	Mono Sweep: 6 - 90 Hertz		0.25 Start and End Tapers				Linear Gain			
9	Roll In/Out: Yes		Active Spread: 5408 Channels :				26 Lines by 208 Channels			
10	Geophone Array: 6 phones bunched centred on peg					Station Interval: 40m.				

### Beanbush 3D:

FINAL_OBSERVER_LOG - Excel										
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW										
<div>Clipboard Font Alignment Number Styles Cells</div>										
O10										
	A	B	C	D	E	F	G	H	I	J
1	Seismic Crew A2									
2	Client: Santos			Prospect: BEANBUSH 3D						
3	Field Instrument: Sercel 428			Sample Rate: 2 mS			Record Length: 4 Seconds			
4	Field Filter: 0.8 Nyquist Linear Phase			.8nyq @ 2mS=200hz			Pre-Amp Gain: 400 mv			
5	Noise Editing: Div (OFF)			Correlation: After Stack			Auxillaries: TB, 100Hz, Pilot, DPG Ref, Auto-Correl.			
6	Vibrator: AHV IV			Vib Control: VE 464			Sweep Length: 1 x 12 sec			
7	Vib Array: 2 Vib ,12.5m pad spacing			Centered on peg,			1 x standing sweep, 70% Force			
8	Mono Sweep: 6 - 90 Hertz			0.25 Start and End Tapers			Linear Gain			
9	Roll In/Out: Yes			Active Spread: 5408 Channels :			26 Lines by 208 Channels			
10	Geophone Array: 6 phones bunched centred on peg					Station Interval: 40m.				

# Coolibah 3D:

	<b>Project Client Instruction: PEL101 2013 - 3D Seismic</b> <b>Drillsearch Australia</b> <b>Issue 01– Feb 01 2013</b>	
<b>SPREAD</b>		
Spread type	Single sensor 3D - Symmetric Split-Spread	
Acquisition method	MSS	
Number of active receiver lines	24	
Number of active stations per receiver line	672	
Total number of active channel per shot	16128	
Receiver line orientation	South-North (0 degrees)	
Source line orientation	West-East (90 degrees)	
Distance between source lines	350 m	
Distance between receiver lines	350 m	
Source station interval	12.5 m	
Maximum inline offset	4193.75m	
Maximum crossline offset	4193.75m	
Maximum offset	5931 m	
Number of VPs per salvo	28	
VP salvo length per swath	350 m	
Theoretical VP per sq km	228.6	
Inline roll	Continuous acquisition entire receiver patch	
Crossline roll	Roll 1 receiver line after each swath	
Nominal fold	144 (in 6.25 m bin)	
<b>RECEIVERS - SINGLE SENSORS</b>		
Type	Spike	
Model	Schlumberger Geophone Accelerometer (GAC) Digital Sensor	
Response	-3dB @ 1.8 Hz, Acceleration domain	
Geometry of pattern	Point sensor - Single GAC per station	
Receiver station layout	Straight line, 12.5 m interval between single sensors	



RECORDING INSTRUMENTS	
Type	WesternGeco UniQ Compact 2.2.38-6.21DVD 12331
Record length, uncorrelated	12 sec (8 sec sweep length + 4 sec listening time)
Recording sample interval	2 ms
Polarity	SEG
Filter, low cut	-3dB @ 1 Hz, 18 dB/Octave
Filter, high cut	200 Hz (0.8 Nyquist), 339dB/octave
Gain	High
Field processing	Uncorrelated data acquisition. Offline correlation using Omega™ software
Record length, correlated	4 sec
Recording format	Uncorrelated records - SEG-D Rev. 2
Auxiliary channels	Vibrator group CoG, Non-SEG polarity digital pilot, Cross-correlated Non-SEG and SEG pilot, SEG polarity pilot
SOURCE	
Source type/Model	Vibroseis/WesternGeco M30-RTV, 75000 lbf theoretical peak-force
Number of vibrator fleets	4 active fleets + 1 spare fleet
Number of vibrators per fleet/source pattern	1
Sweep type	WesternGeco Maximum Displacement Sweep design
Drive Level (%)	75
Sweep length	8 sec
Start frequency	1.5 Hz
End frequency	100 Hz
Sweep start taper length	Maximum displacement design
Sweep end taper length	300 msec
Number of sweeps per pattern	1
Polarity	SEG

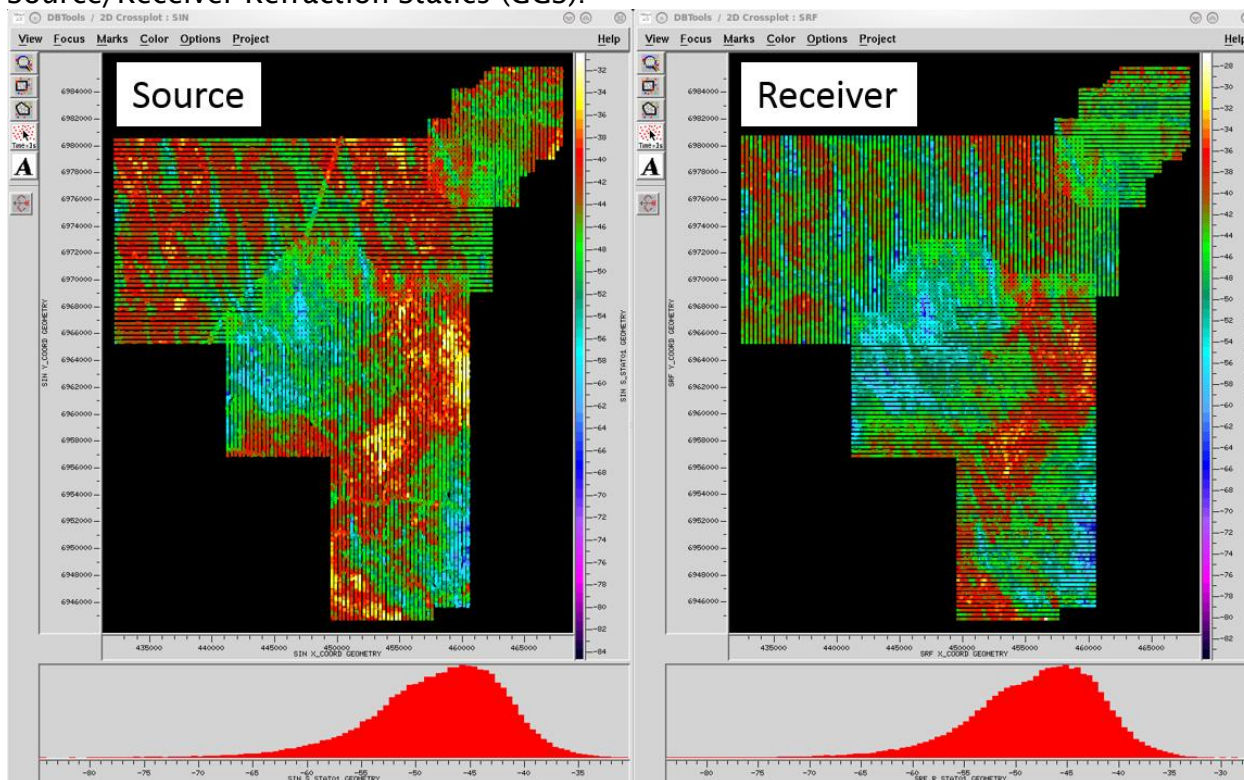
Geodetic parameters	
Group	Australian MGA Coordinate System
Coordinate System	Zone 54
Datum	GDA94
Units	METERS
Datum Description	GDA94
Datum Method	BURSA
Datum Ellipsoid	GRS80
Datum Ellipsoid SMA (m)	6378137
Datum Ellipsoid Rf	298.257222101
Transformation parameters	Coordinate frame to WGS84
DX (m)	0.05758
DY (m)	-0.00616
DZ (m):	-0.04919
RX (sec)	-0.029084
RY (sec)	-0.024818
RZ (sec)	-0.024448
Scale (ppm)	-0.0117904
Projection	Transverse Mercator
Projection Description	MGA Zone 54
Projection Latitude Origin (DD.ddd)	0
Projection Longitude Origin (DD.ddd)	141
Projection Easting Origin (m)	500000
Projection Northing Origin (m)	10000000
Projection Scale Factor	0.9996
Geoid	AUSGeoid09

### Processing Flow

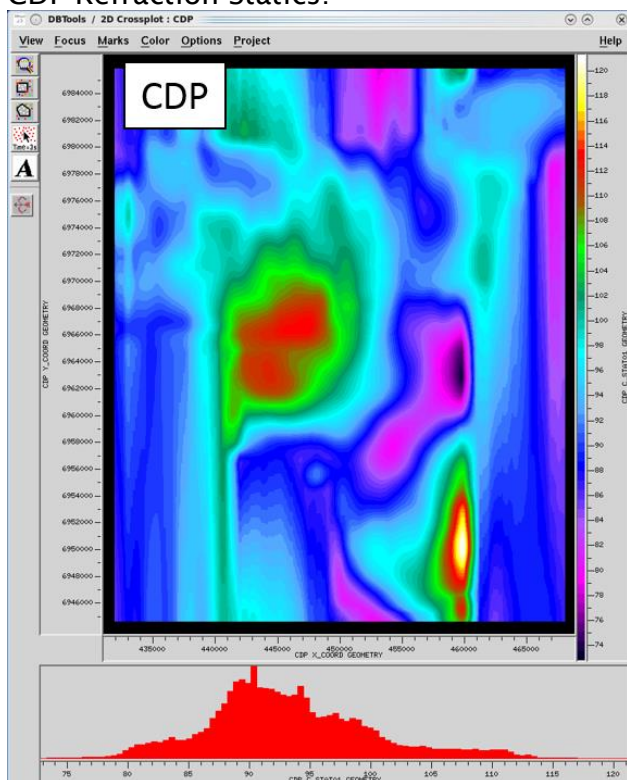
Received Individual Post-Decon datasets with Geometry from Global Geophysical Services. These data contained Refraction Statics, phase and bulk shift corrections, two passes of Residual Statics, individual survey SCamps, and initial VTI Velocity fields.
Merged the individual surveys received from GGS and applied Refraction Statics, the phase and bulk shift corrections, the two passes of Residual Statics, and the individual survey SCamps that were supplied by GGS.
Random Noise Attenuation – multiple passes
VTI Velocity Analysis
MASTT Residual Statics – 3 <sup>rd</sup> Pass
PSTM VTI Velocity Analysis
Surface-Consistent Amplitudes - Merged Pass
Coolibah Blueing
5D Regularization
Kirchhoff OVT VTI + HTI PSTM
VTI +HTI OVT PSTM Residual Azimuthal Velocity Analysis (AZIM™)
Time Variant Trim Statics
Mute Analysis, Stack, Angle Stacks
VTI+HTI Post Stack Enhancement
NEOS Well tie and Phase Analysis – report supplied
Angle Stacks
NEOS Azimuthal Wavelet-based AVO (AWAVO™)



## Source/Receiver Refraction Statics (GGS):

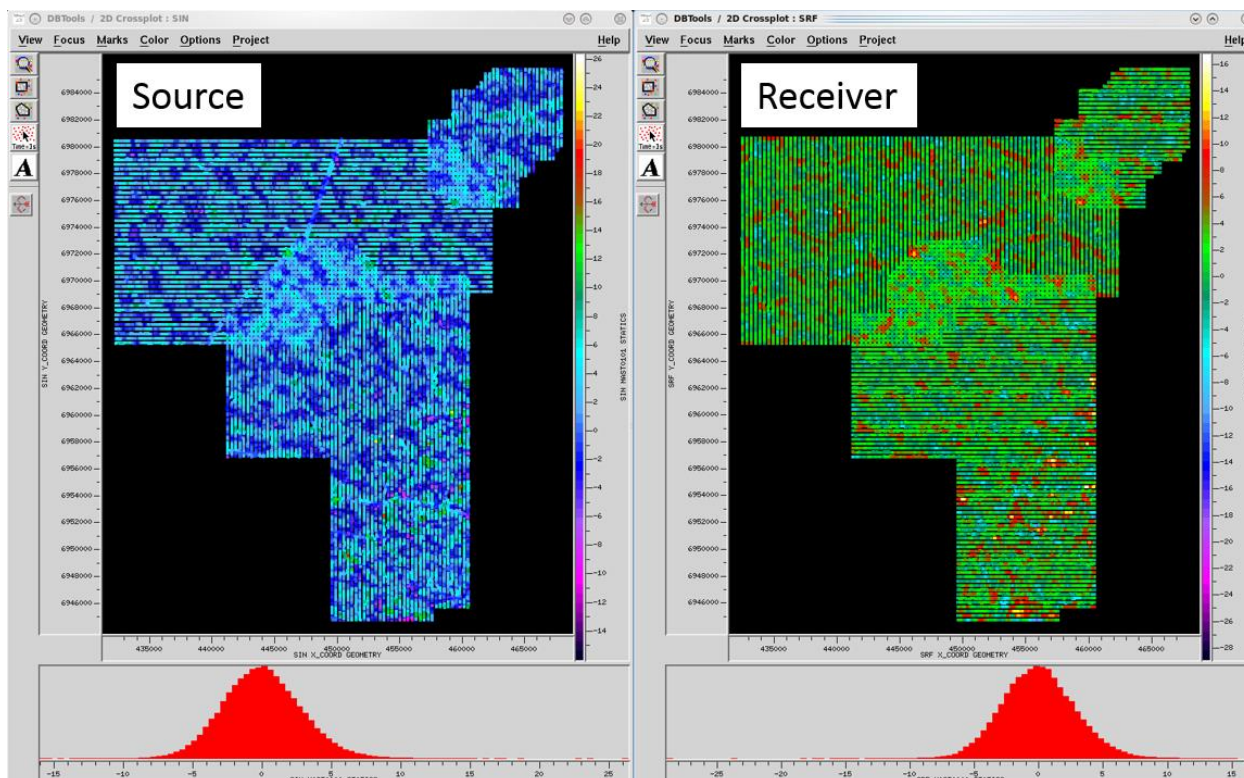


## CDP Refraction Statics:

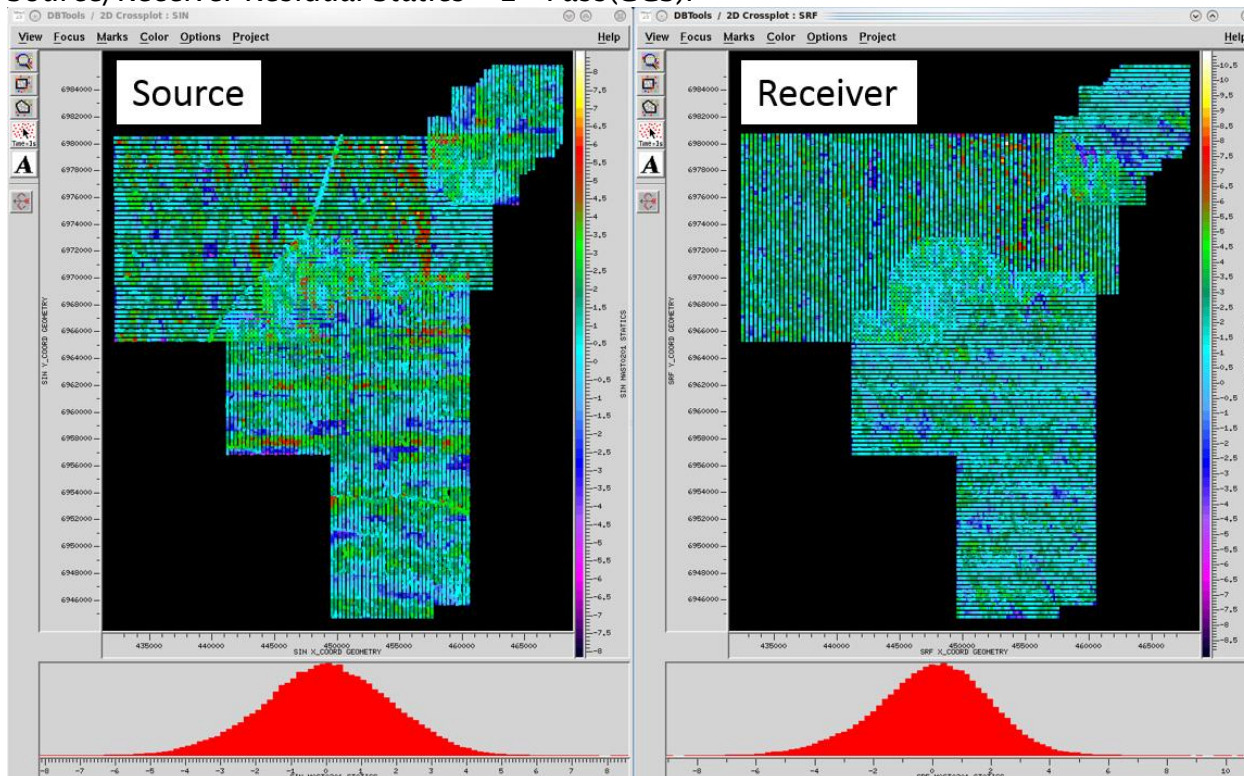




## Source/Receiver Residual Statics – 1<sup>st</sup> Pass (GGS):

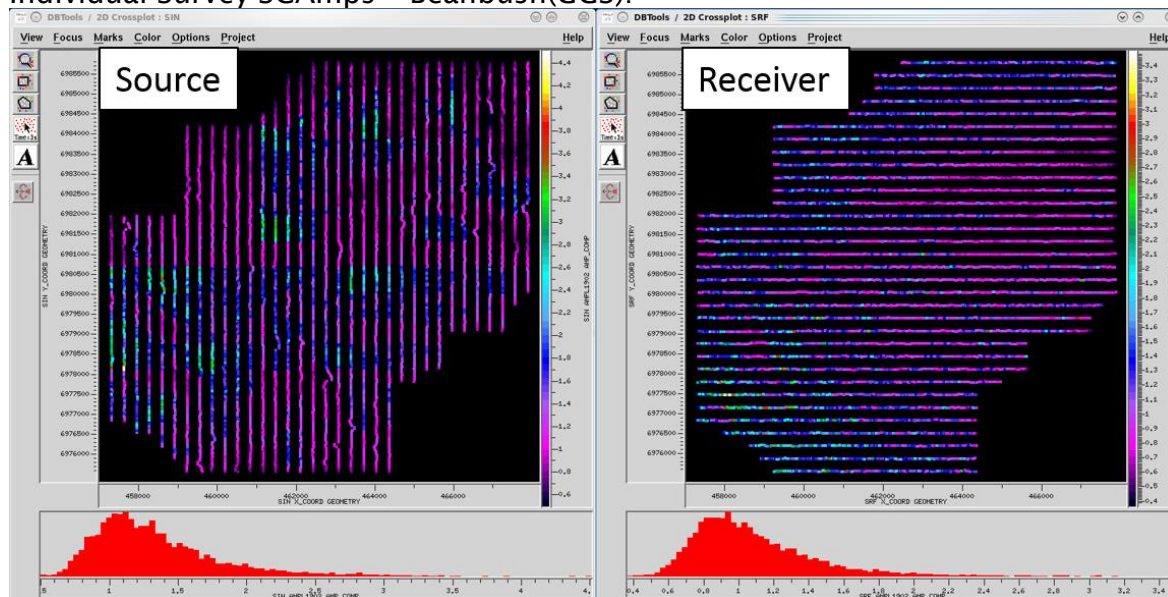


## Source/Receiver Residual Statics – 2<sup>nd</sup> Pass (GGS):

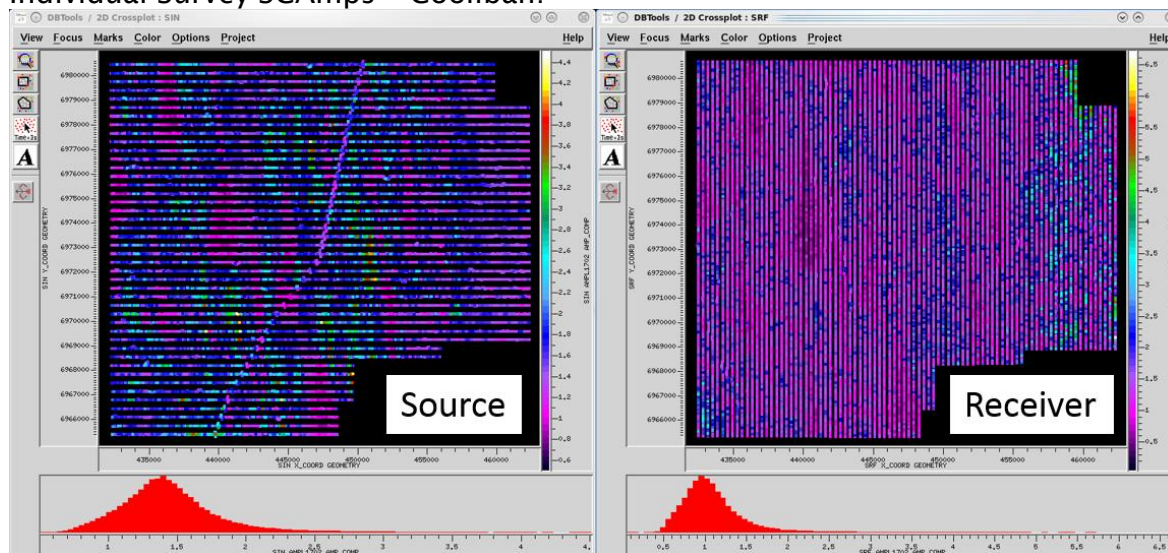




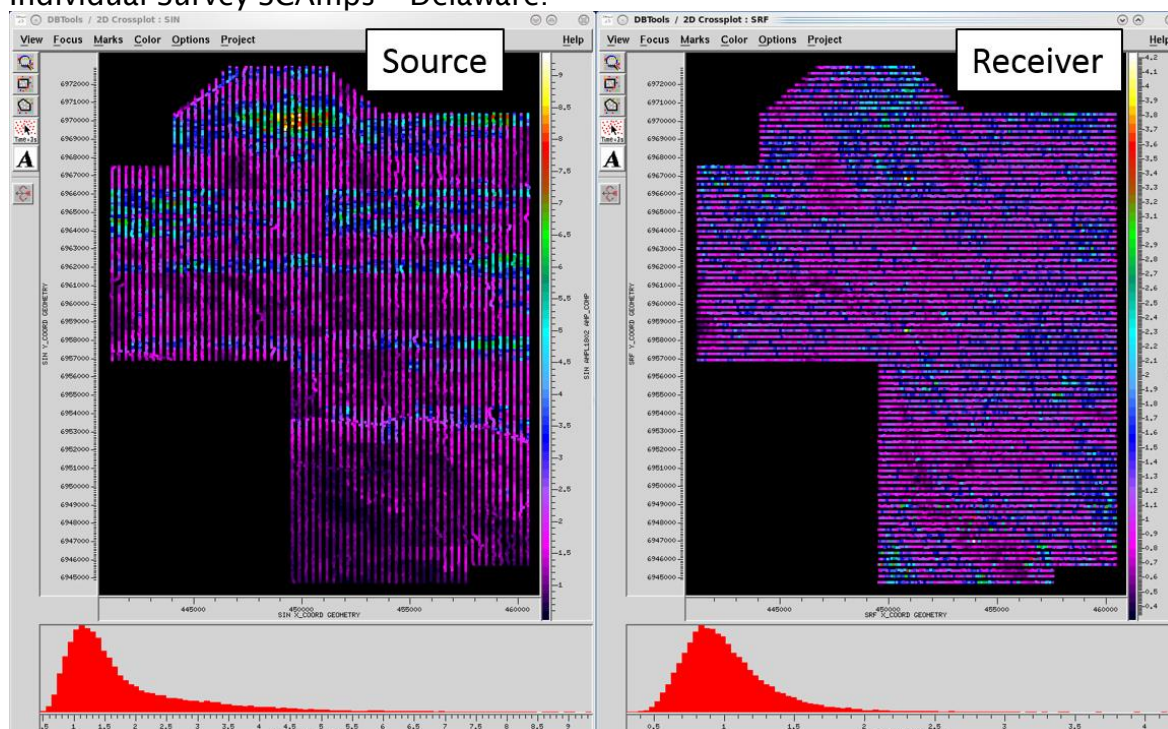
## Individual Survey SCamps – Beanbush(GGS):



## Individual Survey SCamps – Coolibah:



## Individual Survey SCamps – Delaware:



### Random Noise Attenuation – Multiple Passes

Ran a pass of Air Blast Attenuation on the merge as well as multiple passes of random noise attenuation. Random noise attenuation was completed using time-frequency domain noise removal (TFD) in the CDP domain. The three surveys, Beanbush, Coolibah and Delaware each had one pass which included respective survey overlap zones of adjacent surveys. Each survey also had a pass of de-noise alone without overlap zones.

See Power Point:

[101816\\_121316\\_RandomNoiseAttenuation.pptx](#)

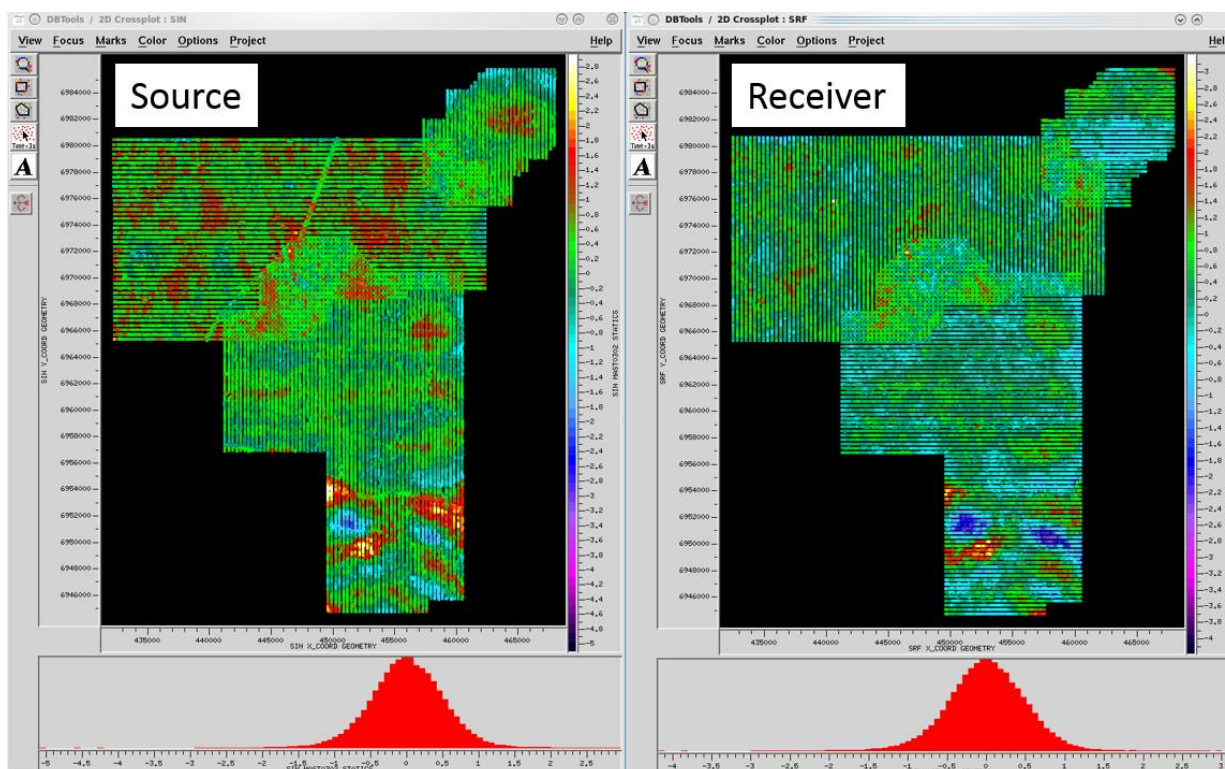
### Velocity Analysis

A pass of VTI Velocities were picked on a 250x250m grid using a 3x3 (IL by XL) supergathered input. We used AVO & Velocity Iteration (AVEL) to automatically pick velocities and a Guided Eta Autopicker to pick Eta. These velocities were then used as the input to the 3<sup>rd</sup> pass of MASTT Residual Statics.

### MASTT Residual Statics – 3<sup>rd</sup> Pass

The input to residual statics had the previous round of velocities applied and was flattened on the Cadna-Owie horizon. Statics were then calculated over a **window of 1000-2700ms** and a **shift limit of 24ms**.

Source/Receiver Residual Statics – 3<sup>rd</sup> Pass:





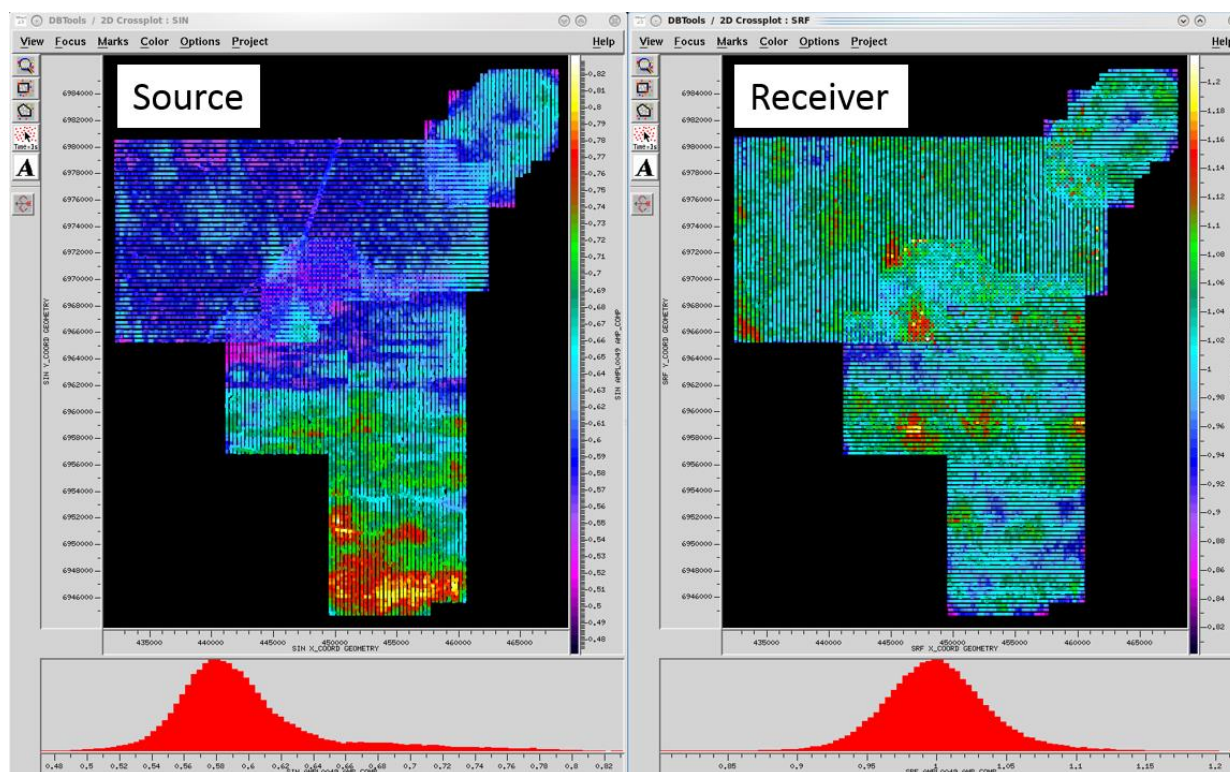
### ***PSTM Velocity Analysis, with VTI analysis***

Isotropic migration velocities were picked using AVEL and a Guided Eta Autopicker on a grid of 625x625m migrated CDP gathers after a preliminary isotropic PSTM migration was run. After velocities were picked on the 625x625m grid, a new isotropic PSTM was run and output CDP gathers on a 250x250m grid. Velocities were picked on this grid and then a new isotropic PSTM was run and output CDP gathers on a 100x100m grid. The final PSTM Velocities were then picked on this grid.

### ***Surface-Consistent Amplitudes – Merged Pass***

A final pass of SCamps was run on the Delaware Merge. The traces were filtered and offsets 500-3000m were used. The gate was 700ms above the Cadna-Owie and went down to the Toolachee. The measured amplitudes were decomposed into shot and receiver scalars.

Source/Receiver SCAMPS – Merged Pass:



### ***Coolibah Blueing***

Separated Coolibah from Delaware and Beanbush in order to use spectral blueing to tilt Coolibah's spectrum towards what Delaware's looks like. This improved the look of the stacks. Blueing design parameters were 2,4-80,120 Hz with a well Beta estimate of .45, data was then bandpass filtered back to 2,4-80,110 Hz.

### ***5D Regularization***

5D Regularization was run using **1.5 times** the source and receiver spacing for OVT bins. The offset bin centers were as follows:

OFF\_IL: -4560-4560(480)  
OFF\_XL: -4560-4560(480)

These OVT dimensions created INLINE and CROSSLINE tiles of 20x20=400 fold (maximum).

## PRE-STACK TIME MIGRATION

### *Kirchhoff OVT VTI + HTI PSTM*

5D interpolated traces were used as input to migration. Several migration iterations were conducted to complete the VTI+HTI migration. First, migrated super gathers were used as input to VTI scanning which calculated consistent velocity and eta fields. Second, VTI velocities were used in migration. Third, output OVT gathers were used to calculate smoothed HTI velocity fields with AZIM™ Velocity Analysis. Full VTI + HTI migration was run.

Kirchhoff OVT VTI+HTI Pre-Stack Time Migration was executed with these parameters:  
Offset Vector Tiles: 480X480 m each; 20 for both INLINE and CROSSLINE offsets.

Migration Parameters:

<b>Maximum offset</b>	<b>6500 meters</b>
<b>Dip limit</b>	<b>40-60°</b>
<b>Frequency limits</b>	<b>4 - 100 Hz</b>
<b>Maximum aperture</b>	<b>2000m</b>
<b>Anti-alias</b>	<b>37.5 INLINES X 37.5 CROSSLINES (1.5xnominal acquisition grid)</b>
<b>Sample Rate</b>	<b>2ms</b>
<b>Trace Length</b>	<b>4.2 seconds</b>

Following the migration, the validity of each output trace was determined based on the proximity of input data. Migrated traces that failed this test were omitted from stacks and other delivered products.

### *VTI +HTI OVT PSTM Residual Azimuthal Velocity Analysis (AZIM™)*

AZIM™ Analysis was carried out on 3x3 binned OVT gathers, which were sampled every 9<sup>th</sup> CDP across the survey, or in other words, at every viable location. The analysis captures small time shifts on flattened gathers and then inverted for the azimuthal velocity corrections. Time shifts were measured on every 3x3 binned gather at every 20ms over a time window 0-4200ms. The inversion appended the HTI migration velocities to add the residual HTI correction. The sinusoidal QC displays for the azimuthal velocity corrections show gathers sorted azimuthally, binned every 20 degrees, and used 20-55 degree mutes to highlight the correction.

### ***Time Variant Trim Statics***

Pilot based Time Variant Trim Statics applied to CDPs post-AZIM RMO.  
Ran two passes of Time Variant Trim Statics:

1. The first pass of TVTS had two internal passes of trims. This first internal pass had a 400ms cross-correlation window that averaged the picks over 150ms and smoothed them in time with a maximum near static of 2ms and a far static of 8ms. The second internal pass had a 200ms cross-correlation window that averaged the picks over 100ms and smoothed them in time with a maximum near static of 2ms and a far static of 8ms. Both of these internal passes of trims were pilot-based and the pilot trace was calculated internally and varied with offset. The output statics were smoothed again in time and then applied to the traces.
2. The second pass of TVTS had only one internal pass of trims. It had a 200ms cross-correlation window that averaged the picks over 100ms and smoothed them in time with a maximum near and far static of 4ms. This pass of trims was also pilot-based, but instead of making an internal pilot trace I used a filtered near stack that was moved back to processing datum as the pilot trace. Again, the output statics were smoothed in time and then applied to the traces.

## **POST STACK PROCESSING**

### ***Mute, Stack, and Angle Stacks***

Full Stack Mute used and incidence angle mute of 30 degrees stove-piped at the near traces. A 500 ms median scalar with 10% overlap was applied before stack as requested by client. Stack fold scaling applied was 1.0 (straight averaging=1/N).

### ***Angle Stacks***

Three angles stacks were generated using incidence angle mutes 0-20 degrees, 20-40 degrees, and 40-50 degrees as requested by client.

### ***VTI+HTI Post Stack Enhancement***

#### **TGF™**

NEOS Tensor Guided Filter (TGF™) was applied pre-whitening.

TGF™ is a structure oriented noise suppression tool based on Dave Hale's 2009 paper titled "Structure-oriented Smoothing and Semblance" {Center for Wave Phenomena Report 635: Dave Hale "Structure-oriented Smoothing & Semblance" 2009}.

TGF™ is an anisotropic diffusion filter. The diffusion operator at each image point is parameterized using 3D structure-oriented semblance. This semblance is computed from structure tensors: for each point of a 3D data cube they are the smoothed outer products of image gradients. The eigenvalues of these tensors give us a measure of isotropy, linearity, and planarity for that specific sample, as well as the direction of the linear or planar features that we discovered.

Basically, the algorithm uses the structure oriented semblance to detect edges or event truncations such as faulting. The anisotropic diffusion filter smooths the coherent events it discovers with the 3D structure tensors.

### **Spectral whitening**

Spectral whitening was applied using corner frequencies 3,8-70,100 Hz across 6 panels.

#### Time Variant Bandpass Filter (BPF) (Ormsby)

Time-variant band was applied post-whitening.

Bandpass:

Time (ms)	Frequency (Hz)
1000	0,5-110,130
1250	0,5-90,110
1500	0,5-70,100
1750	0,5-65,90
2550	0,5-60,80

#### F-X Filter

A very mild Inline and Crossline F-X filter using 1% additive white noise was applied as a final clean-up.

#### ***NEOS Well Tie and Phase Rotation Analysis***

Final VTI+HTI OVT PSTM stack was tied to available well data. A phase rotation of +13 was calculated to get the best tie, this rotation is less than 20 degree significance threshold and was NOT recommended for application.



## DELIVERABLES

### Datum

Data were processed to sea-level datum. An additional +200 ms bulk shift was applied to preserve data that would fall above 0 m sea level.

### Polarity

All volumes are reverse SEG Normal polarity which is increase in impedance is represented as a negative sample or trough on displays.

### PSTM Stacks:

2017\_06\_20\_Santos\_DelMerge\_RAW\_PSTM\_STACK.sgy  
 2017\_06\_28\_Santos\_DelMerge\_ENHC\_PSTM\_STACK\_Final.sgy  
 2017\_06\_20\_Santos\_DelMerge\_RAW\_PSTM\_Angle\_0\_20\_STACK.sgy  
 2017\_06\_20\_Santos\_DelMerge\_RAW\_PSTM\_Angle\_20\_40\_STACK.sgy  
 2017\_06\_20\_Santos\_DelMerge\_RAW\_PSTM\_Angle\_40\_50\_STACK.sgy

### PSTM Velocities:

2017\_06\_16\_Santos\_DelMerge\_PSTM\_RMS\_ETA\_at\_FinalDtm.sgy  
 2017\_06\_16\_Santos\_DelMerge\_PSTM\_RMS\_ETA\_at\_FloatDtm.sgy  
 2017\_06\_16\_Santos\_DelMerge\_PSTM\_RMS\_Velocity\_at\_FinalDtm.sgy  
 2017\_06\_16\_Santos\_DelMerge\_PSTM\_RMS\_Velocity\_at\_FloatDtm.sgy

### Screen capture of trace header format in ProMAX:

#### Stacks/Attributes:

```
cdp,4I,,13/  
xline_no,4I,,17/  
csstat01,2I,,99/  
crstat01,2I,,101/  
first_lv,2I,,113/  
cs_mast,4R,IBM,185/  
cr_mast,4R,IBM,189/  
tot_stat,2I,,193/  
iline_no,4I,,197/  
xline_no,4I,,201/  
cdp_x,4R,IBM,205/  
cdp_y,4R,IBM,209/  
cdp_elev,4R,IBM,213/  
cs_elev,4R,IBM,225/  
cr_elev,4R,IBM,229/  
fml_stat,4R,IBM,233/
```

# PSTM RAW Stack EBCDIC header:

```

File
C1 CLIENT: SANTOS  VENDOR: NEOS  Date: June 20, 2017
C2 PROJECT DESCRIPTION: DELAWARE MERGE 3D, COOPER BASIN, AUSTRALIA
C3 SEG Y DATA FORMAT: IBM FLOATING PT.  XY UNITS: meters
C4 DATA DESC/TYPE: RAW PSTM FULL STACK
C5 SEISMIC DATUM: 0 meters  REPLACEMENT VELOCITY: 2000m/s
C6 PROJECTION: MGA (Map Grid of Australia)  ZONE: MGA54
C7 GEODEDIC DATUM: GDA94  UNIT: METERS
C8
C9 Processing Grid Includes Delaware, Coolibah and Beanbush
C10 CORNER  X  Y  INLINE  XLINE  CORNER  X  Y  INLINE  XLINE
C11 UL 431986.0  6985813.0  3671  7981  UR 467886.0  6985813.0  5107  7981
C12 LL 431986.0  6944813.0  3671  9621  LR 467886.0  6944813.0  5107  9621
C13 IL/XL RANGE: 3684-5107(1)/7981-9621(1)  IL/XL BIN SIZE: 25m/25m
C14 FIRST SAMPLE:-200ms  MAX TIME:4200ms  SAMP INT:2 ms  SAMPLES PER TRACE:2101
C15 POLARITY: STANDARD SEG  PHASE: NOT CALCULATED
C16
C17 HEADER NAME  POSITION  LENGTH  HEADER NAME  POSITION  LENGTH
C18 CDP 13 4I  INLINE 197 4I
C19 CROSSLINE 17 4I  CROSSLINE 201 4I
C20 CSSTAT01 99 2I  CDP_X 205 4R,IBM
C21 CRSTAT01 101 2I  CDP_Y 209 4R,IBM
C22 FIRST_LV (=-200) 113 2I  CDP_ELEV 213 4R,IBM
C23 CS_MAST 185 4R,IBM  CS_ELEV 225 4R,IBM
C24 CR_MAST 189 4R,IBM  CR_ELEV 229 4R,IBM
C25 TOT_STAT 193 2I  FINAL STATIC 233 4R,IBM
C26
C27
C28 PROCESSING FLOW:
C29 Refraction Statics, Time Function Gain (X2.0),
C30 Integrate Accelerometers (Coolibah), Coherent NA, Random NA,
C31 Residual Statics, SCDecon, Merged Delaware/Coolibah/Beanbush Surveys,
C32 Phase Matching, Residual Statics, Random NA, Individual Survey SCamps,
C33 Random NA, Merge SCamps, Coolibah Blueing, 5D regularization (merged)
C34 OVT VTI HTI PSTM, Residual AZIM (anisotropic RM0),
C35 Time Variant Trim Statics, 500ms Median Scaling (500ms smoothing
C36 applied to scalars), Stacking Mute, Stack (1.0 power scalar)
C37
C38
C39
C40 END EBCDIC

```

# PSTM OVT Enhanced Stack EBCDIC header:

```

File
C1 CLIENT: SANTOS  VENDOR: NEOS  Date: June 28, 2017
C2 PROJECT DESCRIPTION: DELAWARE MERGE 3D, COOPER BASIN, AUSTRALIA
C3 SEG Y DATA FORMAT: IBM FLOATING PT.  XY UNITS: meters
C4 DATA DESC/TYPE: ENHANCED PSTM FULL STACK new wht (FINAL)
C5 SEISMIC DATUM: 0 meters  REPLACEMENT VELOCITY: 2000m/s
C6 PROJECTION: MGA (Map Grid of Australia)  ZONE: MGA54
C7 GEODEDIC DATUM: GDA94  UNIT: METERS
C8
C9 Processing Grid Includes Delaware, Coolibah and Beanbush
C10 CORNER  X  Y  INLINE  XLINE  CORNER  X  Y  INLINE  XLINE
C11 UL  431986.0  6985813.0  3671  7981  UR  467886.0  6985813.0  5107  7981
C12 LL  431986.0  6944813.0  3671  9621  LR  467886.0  6944813.0  5107  9621
C13 IL/XL RANGE: 3684-5107(1)/7981-9621(1)  IL/XL BIN SIZE: 25m/25m
C14 FIRST SAMPLE:-200ms  MAX TIME:4200ms  SAMP INT:2 ms  SAMPLES PER TRACE:2101
C15 POLARITY: STANDARD SEG  PHASE: NOT CALCULATED
C16
C17 HEADER NAME  POSITION  LENGTH  HEADER NAME  POSITION  LENGTH
C18 CDP  13  4I  INLINE  197  4I
C19 CROSSLINE  17  4I  CROSSLINE  201  4I
C20 CSSTAT01  99  2I  CDP_X  205  4R,IBM
C21 CRSTAT01  101  2I  CDP_Y  209  4R,IBM
C22 FIRST_LV (=-200)  113  2I  CDP_ELEV  213  4R,IBM
C23 CS_MAST  185  4R,IBM  CS_ELEV  225  4R,IBM
C24 CR_MAST  189  4R,IBM  CR_ELEV  229  4R,IBM
C25 TOT_STAT  193  2I  FINAL STATIC  233  4R,IBM
C26
C27
C28 PROCESSING FLOW:
C29 Refraction Statics, Time Function Gain (X2.0),
C30 Integrate Accelerometers (Coolibah), Coherent NA, Random NA,
C31 Residual Statics, SCDacon, Merged Delaware/Coolibah/Beanbush Surveys,
C32 Phase Matching, Residual Statics, Random NA, Individual Survey SCamps,
C33 Random NA, Merge SCamps, Coolibah Blueing, 5D regularization (merged)
C34 OVT VTI HTI PSTM, Residual AZIM (anisotropic RMO),
C35 Time Variant Trim Statics, 500ms Median Scaling (500ms smoothing
C36 applied to scalars), Stacking Mute, Stack (1.0 power scalar),
C37 Spectral Whitening 3,8-70,100 Hz,NEOS Tensor Guided Filter
C38 TV Bandpass (0,5-110,130 @ 1000ms // 0,5-90,110 @ 1250ms // 0,5-70,100
C39 @ 1500ms // 0,5-65,90 @ 1750ms // 0,5-60,80 @ 2550ms), FX filter
C40 END EBCDIC

```

## PSTM Angle Stack EBCDIC header example:

```

File
C1 CLIENT: SANTOS VENDOR: NEOS Date: June 20, 2017
C2 PROJECT DESCRIPTION: DELAWARE MERGE 3D, COOPER BASIN, AUSTRALIA
C3 SEG Y DATA FORMAT: IBM FLOATING PT. XY UNITS: meters
C4 DATA DESC/TYPE: RAW PSTM ANGLE 40-50 STACK
C5 SEISMIC DATUM: 0 meters REPLACEMENT VELOCITY: 2000m/s
C6 PROJECTION: MGA (Map Grid of Australia) ZONE: MGA54
C7 GEODEDIC DATUM: GDA94 UNIT: METERS
C8
C9 Processing Grid Includes Delaware, Coolibah and Beanbush
C10 CORNER X Y INLINE XLINE CORNER X Y INLINE XLINE
C11 UL 431986.0 6985813.0 3671 7981 UR 467886.0 6985813.0 5107 7981
C12 LL 431986.0 6944813.0 3671 9621 LR 467886.0 6944813.0 5107 9621
C13 IL/XL RANGE: 3684-5107(1)/7981-9621(1) IL/XL BIN SIZE: 25m/25m
C14 FIRST SAMPLE:-200ms MAX TIME:4200ms SAMP INT:2 ms SAMPLES PER TRACE:2101
C15 POLARITY: STANDARD SEG PHASE: NOT CALCULATED
C16
C17 HEADER NAME POSITION LENGTH HEADER NAME POSITION LENGTH
C18 CDP 13 4I INLINE 197 4I
C19 CROSSLINE 17 4I CROSSLINE 201 4I
C20 CSSTAT01 99 2I CDP_X 205 4R,IBM
C21 CRSTAT01 101 2I CDP_Y 209 4R,IBM
C22 FIRST_LV (=-200) 113 2I CDP_ELEV 213 4R,IBM
C23 CS_MAST 185 4R,IBM CS_ELEV 225 4R,IBM
C24 CR_MAST 189 4R,IBM CR_ELEV 229 4R,IBM
C25 TOT_STAT 193 2I FINAL STATIC 233 4R,IBM
C26
C27
C28
C29
C30
C31 PROCESSING FLOW:
C32 Refraction Statics, Time Function Gain (X2.0),
C33 Integrate Accelerometers (Coolibah), Coherent NA, Random NA,
C34 Residual Statics, SCDecon, Merged Delaware/Coolibah/Beanbush Surveys,
C35 Phase Matching, Residual Statics, Random NA, Individual Survey SCamps,
C36 Random NA, Merge SCamps, Coolibah Blueing, 5D regularization (merged)
C37 OVT VTI HTI PSTM, Residual AZIM (anisotropic RMO),
C38 Time Variant Trim Statics, 40-50deg Stack Mute, Stack (1.0 power scalar)
C39
C40 END EBCDIC

```