

# **Australian Abrasive Minerals Pty Ltd**

## **Harts Range Spinifex Bore Project Annual Technical Report For the period 29<sup>th</sup> November, 2015 to 28<sup>th</sup> November, 2016 ML28614**



First Load from ML28614, 1<sup>st</sup> September, 2016

TARGET COMMODITY: GARNET

Map Sheet: Alice Springs, Alcoota,  
Riddoch,

1:250,000

1:100,000

PROJECT OPERATOR: Australian Abrasive Minerals Pty Ltd

Author: John Baxter

12<sup>th</sup> January, 2017

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## EXECUTIVE SUMMARY/ABSTRACT

The Harts Range Garnet Project on ML28614 is located along the valley of the Plenty River and covers approximately 4,815 hectares. ML28614 is in the centre of a tenement block including EL24360, EL30318 and EL28696. It has a garnet resource estimated to contain 23.1Mt of sand containing 1.2Mt of garnet in the measured category and 44.5Mt of sand containing 2.65Mt garnet in the Inferred category. ML28614 also contains a bore field which can supply process water at a rate of 1,210 m<sup>3</sup>/day (14 l/s). The garnet resource and the identified water source are the key factors underlying the future success of the project. Mining began in September 2016.

During the 2015-2016 exploration period Australian Abrasive Minerals Pty Ltd (AAM) have invested \$12.7m to:

- Complete construction of the separation plant
- Commence mining (see front cover)

This report outlines the work that has been undertaken to date.

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## INTRODUCTION

The Harts Range Garnet Project is located along the valley of the Plenty River and includes approximately 296km<sup>2</sup> or 76 blocks of Exploration Licences surrounding ML28614. To date more than \$10M has been spent on exploration on the ML to identify the resource. A garnet resource has been identified and estimated to contain 23.1Mt of sand containing 1.2Mt of garnet in the measured category and 44.5Mt of sand containing 2.65Mt garnet in the inferred category (Coxhell, 2014). Previous drilling for water has identified that the Mining Lease contains a bore field which can supply process water at a rate of 1,210 m<sup>3</sup>/day (14 l/s) (Rockwater,2007), in 2014-2015 further drilling has increased the yield of the borefield to 17.1l/s in the vicinity of the ML. A further 7l/s has been identified to the east of the ML in hole 3/2015 and 5/2015.

In this reporting period 29<sup>th</sup> November, 2015 to 28<sup>th</sup> November 2016 the main focus has been construction of the plant.

### Location

The Harts Range Spinifex Bore Garnet Project, located within the Northern Territory, is approximately 134km northeast of Alice Springs (Figure 1). The project is accessed via travelling north along the Stuart Highway for 68km then east along the Plenty Highway for a further 143km. The first 103km along the Plenty Highway is sealed after which the remainder of the access is unsealed; with loose gravels and corrugations regularly encountered. A newly constructed mine access road has been built from the Plenty Highway to the plant site starting 2km west of the Harts Range Police Station (Figure 2).

The Plenty Highway provides excellent access to the Mining Lease. The Mining Lease is surrounded by the Harts Range Garnet Project and all tenements are shown in Figure 3.

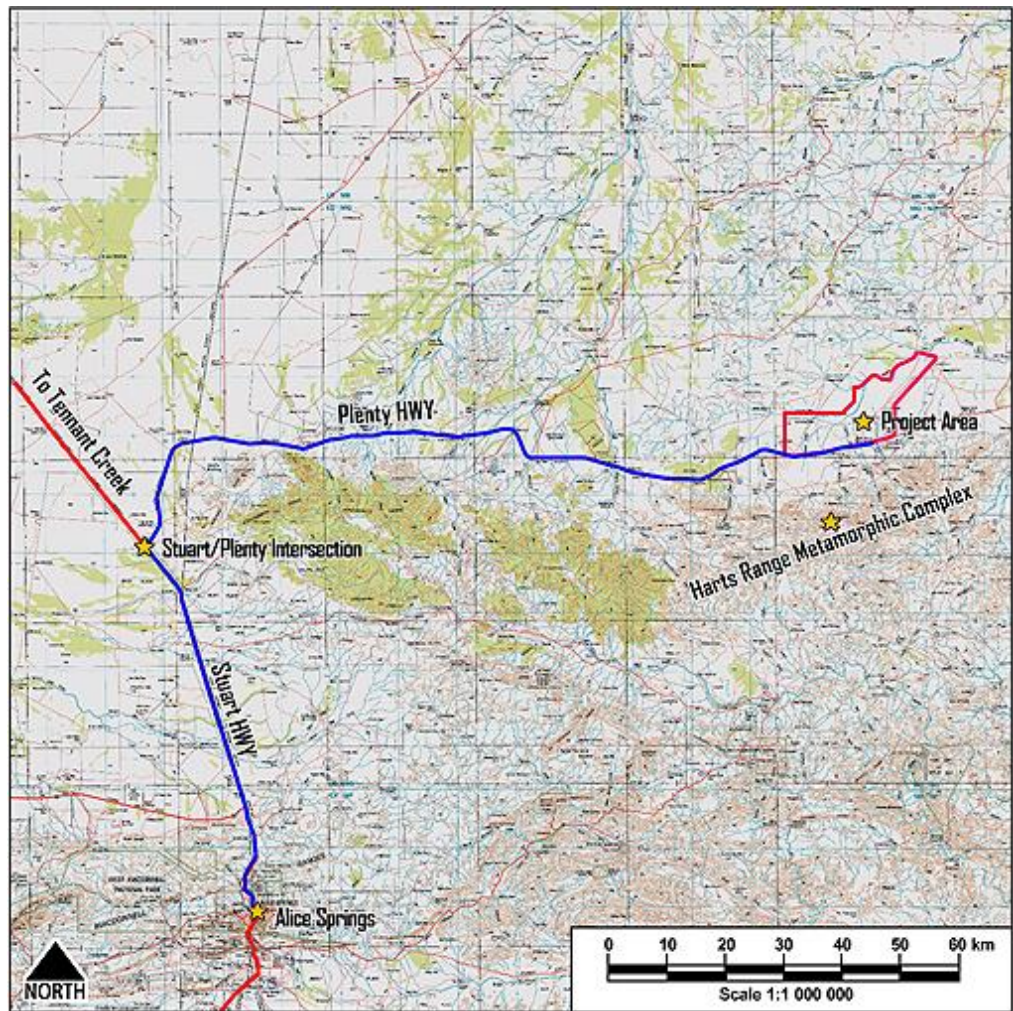
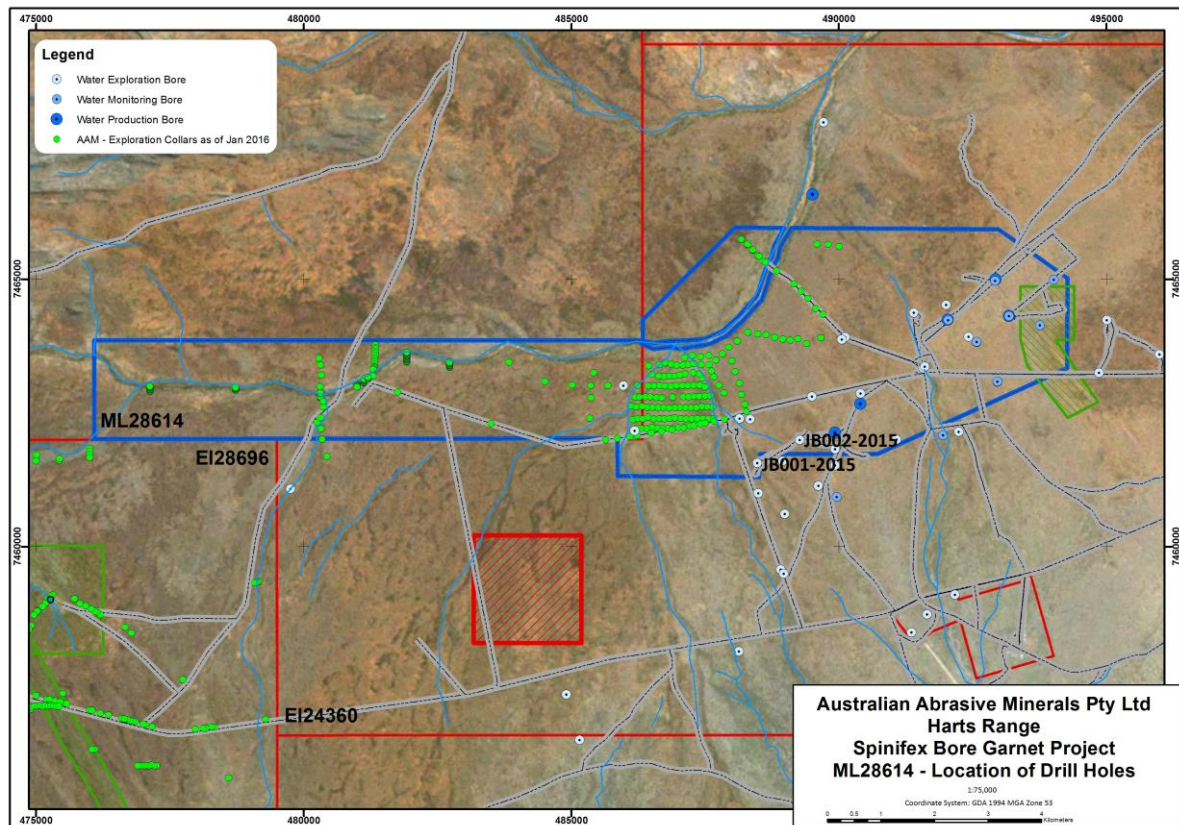


Figure 1 Location Plan for Harts Range Spinifex Bore Project 2014



**Figure 2 Locations of Australian Abrasive Minerals Pty Ltd Tenements, 2014**

## Previous Work and Acquisition

Australian Abrasive Minerals Pty Ltd ('AAM') acquired the Harts Range Spinifex Bore Garnet Project from Matilda Zircon Ltd in 2009. Matilda (previously Olympia Resources Ltd) had previously conducted extensive work on the Aturga Project about 15 km to the west of the Harts Range Spinifex Bore Garnet Project identifying a deposit with 27.5Mt of sand containing 2.4Mt of garnet in Measured and Indicated categories. Matilda had also conducted reconnaissance drilling in the vicinity of the Harts Range Spinifex Bore Garnet Project and reported 51.7Mt of sand containing 3.8Mt of garnet in the Inferred category (Baxter and Stewart, 2009).

## Australian Abrasive Minerals Activities

In 2010 Australian Abrasive Minerals undertook a comprehensive resource drilling programme over a portion of the Inferred resource area identified by Matilda and identified 23.1Mt of sand containing 1.2Mt of garnet in the Measured category and 30.6Mt of sand containing 1.6Mt garnet in the Inferred category (Coxhell, 2010).

In 2012 Australian Abrasive Minerals completed a feasibility study on the identified resource in an endeavour to secure finance for development of the deposit. In 2013 AAM undertook a short exploration drilling program with a view to extend the resource and to further understand the stratigraphy in the district. Heavy mineral analysis of this program was completed in 2014.

Subsequently the data was reviewed and an update of the resource estimate by Coxhell (2010) was made. This concluded that the Inferred resources have been increased to 44.5Mt of sand containing 2.65Mt of garnet (Coxhell, 2014).

In the period 2014 to 2016 AAM has constructed a wet plant on the ML and begun mining. The breakdown of expenditure in 2015-2016 is shown in Table 1.

**Table 1 Expenditure on ML28614**

	2015-16 (a)	2014-15	2013-14
Geological		27,877	24,925
Geochemical Activities			
Geophysics			
Drilling		62,241	32,118
Bulk Sampling			3,745
Rehabilitation			3,500
Pre-Feasibility/Construction	11,028,280	9,400,000	22,158
Office Studies			19,132
Overheads			6,000
Minesite Operating Costs	1,633,938		
<b>Total</b>	<b>12,662,218</b>	<b>9,490,118</b>	<b>111,578</b>

It is essential for the Harts Range Spinifex Bore Garnet Project that there is a supply of water for the life of the project. In 2013-2014 a detailed review of all data relating to stratigraphy in the district was completed with a proposal for further drilling. In 2014-2015 three bores (9/2015, 10/2015 and OLY4P) were drilled to test the potential extent of the deep aquifers and to improve the supply of water for the plant.

## **GEOLOGICAL SETTING –EXPLORATION RATIONALE**

### **Physiography**

The Harts Range Spinifex Bore Garnet Project covers the floodplain of the Plenty River predominantly over the Kanandra Land System. It includes alluvial plains of Stones, Eblana, Ulgama, Watson and Brett Creeks.

The Kanandra System is characterized by sparsely timbered, red sandy plains on the north side of the Harts Range. The system can contain low dunes that

particularly occur at the gradation to the Simpson land system which is characterized by large dunes.

The vegetation of the Kanandra system within the project area is dominated by scattered Ironwood trees (*Acacia estrophiolata*), tall shrubs of Witchetty Bush (*Acacia kempeana*), Cassia (*Senna artemisioides* subsp. *filifolia*), low shrubs such as Saltbushes (*Rhagodia* species) and grasses (*Aristida* species and *Eragrostis* species).

## **Geology and Mineralisation**

Garnet bearing sands in paleochannels have been identified along the Plenty River floodplain from Aturga Creek (west of the Project) to Entire Creek (east of the Project). Australian Abrasive Minerals focussed their exploration in the vicinity of the bore field identified around Spinifex Bore concentrating on the floodplains of the Plenty River and Stones, Ulgarna and Watson Creeks.

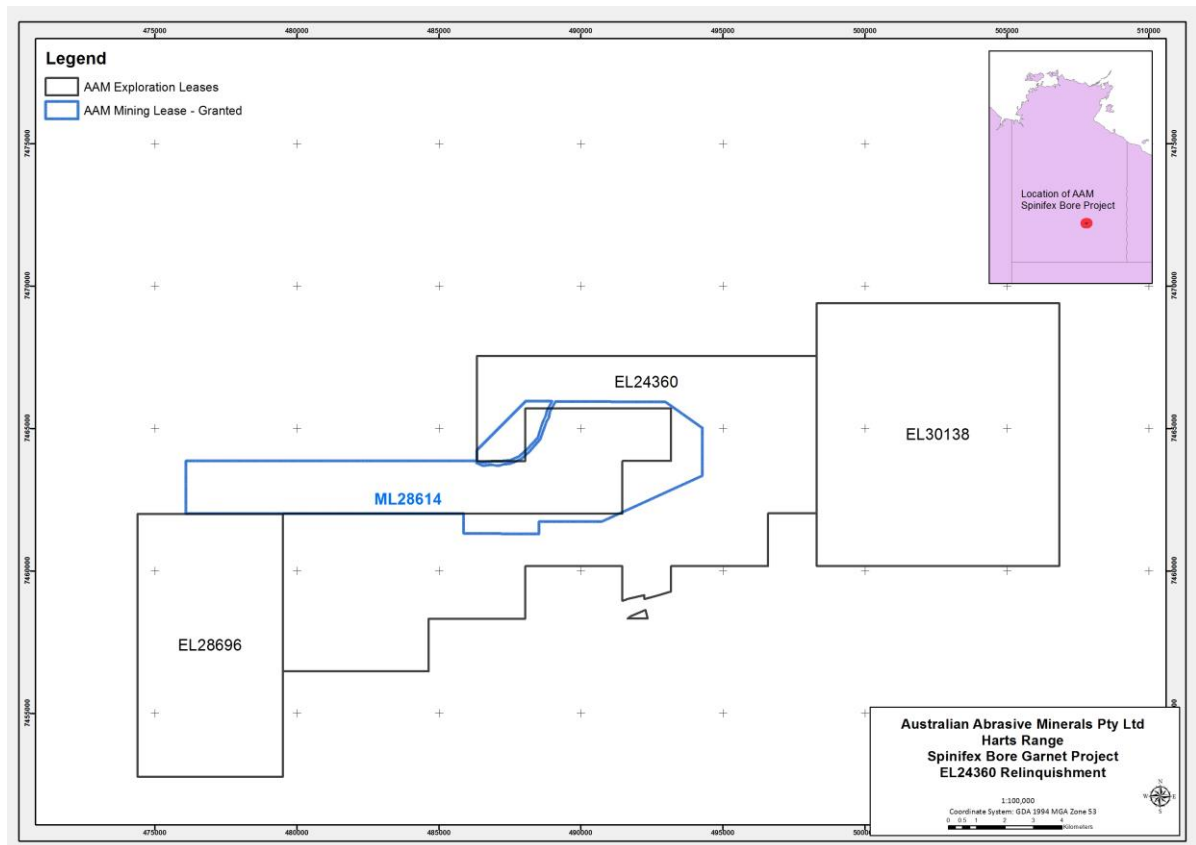
The stratigraphy of the region is now well known based on drilling and pitting, that has been conducted on the tenements over the past 10 years.

Previous drilling for water on EL24360 has identified that to the south of the project the sand is underlain by Tertiary sediments of the Waite Formation and Ambalindum Sandstone. It is in the Ambalindum Sandstone that the aquifer that will eventually supply the treatment plant for the Harts Range Spinifex Bore Garnet Project. It is clear from 1/2015 that some of the sandy lenses usually called Ambalindum Sandstone do not have connection and are likely to be of limited value as water supply aquifers.

## **Exploration Index Map**

In 2014-2015 two new holes were drilled within the boundaries of ML28614 to examine the stratigraphy and potential aquifers in the project area. The locations are shown on Figure 3. An earlier hole OLY4 was re-drilled to improve yield.





**Figure 3 Exploration Index Map**

**Hydro-geological Studies**

No further hydrogeological work was carried out in 2015-16

**Mineralogy and Metallurgy**

No mineralogy or metallurgy was conducted in 2015-2016

**Remote Sensing and Geophysics**

No remote sensing or geophysics was done during 2015-2016.

**Surface Geochemistry**

No soil or grab samples were taken during 2015-2016.

**Drilling**

No drilling was done during 2015-2016.

**Geotechnical Studies**

No geotechnical studies were completed in 2015-2016.

## **Resource estimation**

No further resource estimations were undertaken in 2015-2016.

## **Mine Development**

Construction of the plant at the Harts Range Garnet Project was completed during the period. To date \$9.4million has been expended on the construction.

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Report on  
Groundwater Exploration Programme  
April 2015  
for  
Australian Abrasive Minerals

## INTRODUCTION

The water-supply requirement for the Harts Range Spinifex Bore Garnet Project is 21 L/s for 20 years, the water to be used for ore processing.

Previous works have established a borefield (Spinifex Borefield) capable of supplying 14 L/s for at least 5 years, as indicated by computer modelling.

There is thus a need to prove an additional supply of 7 L/s, plus a standby allowance for pump and bore repair and maintenance; a minimum recommended standby allowance would be 5 L/s.

Groundwater exploration has been undertaken in September 2014 and April 2015, with the aim of locating additional production bore sites to supply the additional water-supply requirement.

Drilling in September 2014 (referred to as Phases 1 and 2A) was concentrated on a potential weathered and fractured rock aquifer to the north and northwest of the Spinifex Borefield, where shallow mineral exploration bores had encountered indications of groundwater. Four bores were drilled including one test-production bore. The test-production bore was evaluated by pumping tests, and shown to have a sustainable yield of only 0.9 L/s. None of the other three bores gave promising results. This potential resource was therefore adjudged unlikely to be useful to the AAM Garnet Project.

The five production bores forming the Spinifex Borefield were redeveloped by airlifting as part of the Phase 1 programme.

Attention was then directed to investigating possible extensions of the Spinifex Bore aquifer (referred to as Phase 2B). This campaign, carried out in April 2015, is described in this report.

Five bores were drilled over the period 25-29 April 2015, to investigate whether the Spinifex Bore aquifer extends eastwards and westwards beyond its currently proven extent. Three bores were drilled to the east, and two to the west, obtaining promising results in two of the eastern bores and in one of the western ones. The bores were drilled by Tomlin Drilling by the air-rotary method. The first bore was drilled using downhole hammer, which proved to be slow due to clay blocking the bit. Subsequent bores were drilled with a finger bit, which achieved much faster penetration. Foam was used to assist circulation from depths below 30-40m.

## DRILLING RESULTS

All five bores penetrated a similar sequence, as follows:

SILTY SAND : 6 – 15m thick

CALCRETE : 9 – 15m thick

CLAY : Grey and yellow, sandy – thicker sand beds towards base of sequence in Bores 1/2015, 3/2015 and 5/2015. Thickness of clay sequence 47 – 49m in western bores (1/2015 and 2/2015) and 90 – 103m in eastern bores (3/2015, 4/2015 and 5/2015).

BEDROCK : Quartz-biotite schist in Bores 1/2015 and 2/2015, weathered granite in Bores 3/2015, 4/2015 and 5/2015.

Airlift yields of 3.5 L/s were obtained from sand beds in the lower part of Bores 3/2015 and 5/2015 and of 6.5 L/s from a sand layer between 54 and 59m depth in Bore 1/2015. No significant thicknesses of sand, or airlift yields, were encountered in Bores 2/2015 or 4/2015. The aquifer intervals in Bore 5/2015 are interbeds of clayey sand in sandy clay, and accurate depths were difficult to determine because of poor sample return.

Bore 1/2015 was completed as a monitor bore by installing 50mm Class 18 PVC tubing.

The intention to complete Bore 5/2015 as a monitor bore was abandoned when the hole collapsed on withdrawal of the drilling rods. All bores except Bore 1/2015 were backfilled and abandoned.

The results are summarised in Table 1 below.

TABLE 1: BOREFIELD DETAILS

BORE NO.	DATE DRILLED	CO-ORDINATES		DEPTH DRILLED (m)	STATUS	CASING DEPTH (m)	AQUIFER DEPTH (m)	AIRLIFT YIELD (L/s)	SWL (mbns) <sup>1</sup>	BEDROCK DEPTH (m)
		NORTH	EAST							
1/2015	27-28/4/15	7461594	488490	66	Monitor bore	50mm PVC +0.45-60 Slotted 54-60	54 - 59	6.5	16.9	63
2/2015	28-29/4/15	7462006	489266	84	Backfilled	-	-	<0.5	-	70
3/2015	25/04/2015	7464262	495008	132	Backfilled	-	94.5 - 96.5 100.5 - 102	3.5	29.0	112
4/2015	26/04/2015	7463286	494854	144	Backfilled	-	-	<0.5	26.2	118
5/2015	27/04/2018	7463595	496004	138	Backfilled	-	(86 -129) INTERBEDS IN CLAYS	3.5	27.7	129

Note: 1. mbns – metres below natural surface

### GROUNDWATER CHEMISTRY

Samples were taken at the end of airlifting from bores 1/2015, 3/2015 and 5/2015, and analysed by ALS Environmental in Sydney. The analytical results are shown in Table 2 below.

TABLE 2: GROUNDWATER CHEMISTRY

PARAMETER	BORE 1/2015	BORE 3/2015	BORE 5/2015
pH	8.12	8.39	8.55
EC (microS/cm)	2680	2170	1210
Calcium (mg/L)	67	48	37
Magnesium (mg/L)	25	55	31
Sodium (mg/L)	455	330	164
Potassium (mg/L)	9	12	10
Bicarbonate (mg/L) <sup>1</sup>	41	106	100
Sulphate (mg/L)	387	275	136
Chloride (mg/L)	569	421	176
Nitrate (mg/L) <sup>2</sup>	0.2	11	19
Ferrous Iron (mg/L)	<0.05	0.2	<0.05
Fluoride (mg/L)	1.6	2.4	2.1
Sum of Ions (mg/L)	1,555	1,260	675

Notes: 1. Converted from bicarbonate alkalinity

2. Converted from nitrate as nitrogen.

The groundwater is of sodium-chloride-sulphate type, typical of the Spinifex Bore aquifer. The groundwater is slightly alkaline. The salinity from Bore 3/2015 is almost identical to the previously reported salinity of Spinifex Bore. Bore 1/2015 is slightly more brackish than Spinifex Bore, the groundwater from bore 5/2015 is fresh. Analysis results are appended to this report.

### DISCUSSION OF RESULTS

The Phase 2B drilling campaign has proved the presence of the Spinifex Bore aquifer 1500m further to the west (beyond OLY4) and 3000m further to the east (beyond OLY9) significantly increasing the known resources of the aquifer. The thickness of aquifer is shown on Figure 1.

Depth to bedrock is depicted on Figure 2. Although there is little correlation between aquifer thickness and depth to bedrock, this figure defines the potential limits of the Spinifex Bore aquifer.

Four additional exploration sites are identified on Figures 1 and 2, with the aim of locating additional production bore sites and of further defining the extent of the aquifer.

Two of the sites (7461500N, 489750E and 7461000N, 488500E) are on the western side, aimed at potentially thicker sections of the aquifer beyond OLY4. The other two (7465000N, 492250E and 7465000N, 495000E) are on the eastern side, to investigate the northern extent of deeper parts of the aquifer.

The best three sites should be re-drilled as test-production bores, in the hope of proving the additional long-term yield requirement of 7 L/s, plus allowance for standby capacity. One of these three sites will probably be Bore 1/2015.

#### CONCLUSIONS

The five exploration sites drilled in the Phase 2B campaign have proved further eastward and westward extensions of the Spinifex Bore aquifer.

The greater known extent of the aquifer shows potential for providing the additional long-term water requirement of 7 L/s, plus allowance for standby.

#### RECOMMENDATIONS

The following Phase 3 programme is recommended in order to establish the additional groundwater requirement for the Harts Range Spinifex Bore Garnet Project:

Drilling of four groundwater exploration bores at the following sites:

- 7461000N; 488500E (estimated depth 80 – 90m);
- 7461500N; 489750E (estimated depth 125 – 135m);
- 7465000N; 492250E (estimated depth 70 – 80m);
- 7465000N; 495000E (estimated depth 90-100m).

Conversion of the three most promising sites from Phases 2B and 3 into test-production bores (probably including Bore 1/2015).

Re-drill existing Bore OLY4 at larger diameter, to install 150mm diameter production casing and screen, to provide higher yield. The yield of this bore is currently limited by 100mm diameter casing.

Test-pumping of the new test-production bores, and re-drilled Bore OLY4, to establish their long-term sustainable yields.

Each bore to be tested by a four-step step-drawdown test, followed by a 24-hour constant discharge test.

John Barnett  
Hydrogeologist  
14 August 2015

#### BORE 1/2015 7461594N; 488490E

0 – 6m	SAND	Silty and slightly clayey, very fine to very coarse grained, poorly sorted, subangular to rounded, quartz, ferruginous grains, trace garnet. Calcareous cemented layers 2 - 6m.
6 – 16m	CALCRETE	Pink, sandy. Sand up to gravel size, subangular to rounded, poorly sorted, quartz, ferruginous grains, minor heavy minerals and garnet.
16 - 18m	CLAY	Brown, sandy, sand as above.
18 – 54m	CLAY	Pale grey and yellow, a few slightly sandy bands.
54 – 59m	SAND	Coarse to very coarse, mainly coarse-grained, well sorted, subrounded to rounded, quartz, trace heavy minerals.
59 – 63m	CLAY	Slightly shaley, grey, red and purple.
63 – 66m	QUARTZ-BIOTITE SCHIST	Slightly weathered (no garnets).

E.O.H (End of Hole): 66m



Airlifting 4 – 5 L/s at 60m, 6.5 L/s after 30 minutes at EOH.

SWL: 16.9m

Surface casing 6m x 155mm i.d. Steel +0.45m – 5.55m, 50mm ND PVC +0.45 – 60m, slotted 54-60m.

## BORE 2/2015

7462006N; 489266E

0 – 6m	SAND	Silty, very fine to very coarse grained, poorly sorted, subangular to rounded, slightly clayey. Quartz, minor ferruginous grains.
6 – 21m	CALCRETE	Sandy, pink and off-white. Sand fine to pebble size, pebbles up to 30mm, quartz and quartz-biotite schist. Sand quartz, minor ferruginous grains, heavy minerals and garnet, subangular to rounded, poorly sorted.
21 – 70m	CLAY	With sandy bands. Clay pale grey yellow and minor brown. Sand fine to gravel, mainly medium to coarse, moderately sorted, subrounded to rounded, quartz, trace heavy minerals.
70 – 79m	QUARTZ-BIOTITE SCHIST	Very soft, highly weathered.
79 – 84m	QUARTZ-BIOTITE SCHIST	Hard, very slightly weathered. Very minor garnets.

E.O.H (End of Hole): 84m

Seepage only, water level still recovering on leaving site (~30m)

**BORE 3/2015**  
7464262N; 495008E

0 – 6m	SAND	Silty, fine-grained, subangular to rounded, well-sorted, orange-brown, quartz, minor ferruginous grains, trace mica, clayey 5 – 6m.
6 – 9m	SAND	Orange-brown, fine to very coarse-grained, silty, very poorly sorted, partially cemented, calcareous. Angular to subrounded,
9 – 13m	CLAY	Orange-brown, minor sand 12 – 13m as for 6 – 9m.
13 – 22m	CALCRETE	Sandy. Generally soft, clayey, some hard bands, pale yellow 13 – 15m, white, minor pink 15-22m. Sand as for 6 – 9m, with trace garnet.
22 – 33m	CLAY	Slightly sandy, white and pink, trace calcrete. Sand as for 6 – 9m.
33 – 94.5	CLAY	Very minor sand. Clay pink, pale grey and yellow 33 – 40m, pale grey and yellow 40 – 94.5m. Sand fine to very coarse-grained, subrounded to rounded, clear quartz.
94.5 – 96.5m	SAND	Coarse to very coarse-grained, subangular to rounded, clear quartz.
96.5 – 100.5m	CLAY	White, thin beds of sand as above.
100.5 – 102m	SAND	Coarse to gravel size, otherwise as for 94.5 – 96.5m, minor heavy minerals.
102 – 112m	CLAY	White, minor thin sandy bands, as for 100.5 – 102m.

112 – 130m	QUARTZ and WHITE KAOLIN CLAY (Weathered Granite)	Angular clear quartz, gravel size, in matrix of clay.
130 – 132m	QUARTZ-BIOTITE SCHIST	Garnetiferous.

E.O.H (End of Hole): 132m

Airlifted end of hole, 10L in 2.5 seconds (with some foam and sand – say 3.5 L/s.

SWL: 29.0m

## BORE 4/2015

7463286N; 494854E

0 – 13m	SILTY SAND	Very fine to fine-grained, well sorted, quartz, minor ferruginous grains, orange brown. Some calcareous cemented layers 6 – 13m.
13 – 22m	CALCRETE	Pink and off-white, sandy, sand fine to coarse, subrounded to rounded, quartz, minor ferruginous grains, trace garnet. Moderately sorted.
22 – 24m	SAND	Very fine to coarse, mainly medium to coarse, moderately sorted, quartz, minor ferruginous grains, trace garnet. Some ferruginous cementing.
24 – 39m	CLAY	Yellow and pale grey. Slightly sandy, very fine to fine grained.
39 – 42m	SAND	Fine to very coarse, mainly medium to coarse, poorly sorted, subrounded to rounded, minor white clay.
42 – 118m	CLAY	With sandy interbeds. Clay yellow and pale grey, slightly sandy, a few thin (0.5 – 1m) beds of clayey sand 42 – 45m. Interbeds of slightly clayey SAND 85 – 87m, 90 – 91m, 96 - 97m, 102-104m and 114 – 115m. Sand fine to coarse, mainly medium-grained, well sorted, subangular to rounded quartz, minor black heavy minerals, trace mica.
118 – 138m	CLAY and SAND (Weathered and Lateritised Granite)	Clay red brown, pink and grey. Sand, fine to gravel, angular, quartz, some cemented by iron oxide.
138 – 144m	CLAY and SAND (Weathered Granite)	As above, but clay mainly white. Fresh muscovite flakes.

E.O.H (End of Hole): 144m

Airlifted end of hole <0.5 L/s  
SWL: 26.2m

**BORE 5/2015**  
7463595N; 496004E

0 – 15m	SAND	Silty, orange brown, very fine to fine-grained, well sorted, subrounded to rounded quartz, minor ferruginous grains, some calcareous-cemented bands 6 – 15m.
15 – 26m	CALCRETE	Sandy, pink 15 – 17m, yellow 17 – 26m. sand fine to pebble size, subangular to rounded, poorly sorted, quartz, minor ferruginous grains, trace garnet. Bands of quartz and quartz-mica schist pebbles up to 30mm, and with minor garnet.
26 – 86m	CLAY	Slightly sandy, yellow, pink and grey to 43m, generally pale grey and yellow below. Minor thin (0.5 – 1m) sandy bands; sand very fine to fine grained, subrounded to rounded, quartz, some ferruginous grains, trace garnet, heavy minerals. Clayey sand 78 – 80m, fine to very coarse-grained, partially iron-cemented.
86 – 129m	CLAYEY SAND and SANDY CLAY	Interbedded. Sand coarse to very coarse-grained, subangular to rounded, moderately sorted, quartz, trace mica, some ferruginous cement.
129 – 138m	CLAY and SAND (Weathered Granite)	Clay red-brown and pale grey. Sand coarse to very coarse-grained, mostly angular, a few mica flakes, some iron oxide cementing.

E.O.H (End of Hole): 138m  
Airlifted 3.5 L/s after 30 minutes.  
SWL 27.7m.

Intended to case as monitor bore, but collapsed to 48m when rods pulled.

## APPENDIX 2

### GROUND WATER REPORT 2

See .pdf file