



Karuah East Quarry

Monthly Environmental Monitoring Report

April 2017

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1. INTRODUCTION

This report has been completed to meet the requirements of Section 66(6) of the *Protection of the Environment Operations Act 1997* and the NSW Environmental Protection Authority's (EPA) Requirements for Publishing Pollution Monitoring Data (October 2013). This report summarises the required monitoring data under Environmental Protection Licence (EPL) 20611 for the Karuah East Quarry. This report also includes some monitoring requirements under Project Approval 09_0175.

A summary of the environmental data for April 2017 is covered in this report.

A summary of the licence information is provided in **Table 1** below.

Table 1 Licence Information

Environmental Protection Licence Number	20611
Licensee's Name	Karuah East Quarry Pty Ltd
Licensee's Address	Postal Address: PO Box 3284 Thornton NSW 2322 Quarry Location: Lot 13 DP1024564 Pacific Highway Karuah NSW 2324
Link to full Licence on the EPA Website	EPL 20611

2. DUST MONITORING

There are no specific dust criteria listed in the EPL, but the dust criteria (Tables 2-4) are listed in Schedule 3 Condition 13 of Project Approval 09_0175.

Table 2 PA 09_0175 Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	⁴Criterion
Total suspended particulates (TSP)	Annual	¹ 90 µg/m ³
Particulate matter < 10 µm (PM10)	Annual	¹ 30 µg/m ³

Table 3 PA 09_0175 Short term impact assessment criteria for particulate matter

Pollutant	Averaging period	⁴Criterion
Particulate matter < 10 µm (PM10)	Daily	¹ 50 µg/m ³

Table 4 PA 09_0175 Long term impact assessment criteria for Deposited Dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
³ Deposited dust	Annual	² 2 g/m ² /month	¹ 4 g/m ² /month

Notes to Tables 2-4:

¹ Total impact (ie incremental increase in concentrations due to the project plus background concentrations due

to all other sources).

² Incremental impact (ie incremental increase in concentrations due to the project on its own).

³ **Deposited dust** is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.

⁴ Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire, incidents, illegal activities or any other activity agreed by the Secretary in consultation with EPA.

Dust deposition and TSP/PM₁₀ monitoring is undertaken at Karuah East Quarry at the locations listed in **Table 5**.

Table 5 Air Quality Monitoring Locations for Karuah East Quarry

Site ID	Location	Address	GPS Coordinates
DDG 1	South-East of Karuah East Quarry	5760 Pacific Hwy, Karuah NSW 2324	32°38'04"S 151°59'58"E
DDG 2	South-East of Karuah East Quarry	5770 Pacific Hwy, Karuah NSW 2324	32°38'02"S 152°00'09"E
DDG 3	East of Karuah East Quarry	DP 1024341, Karuah	32°37'57"S 151°59'41"E
DDG 4	West of Karuah East Quarry	21 Halloran Rd, North Arm Cove NSW 2324	32° 37' 30.87"S 152°01'10.18"E
DDG 5	West of Karuah East Quarry	Lot 21/DP 1024341 Karuah NSW 2324	32° 37' 55.33"S 152°00'2.74"E
HVAS (TSP/PM10)	South-East of Karuah East Quarry	5770 Pacific Hwy, Karuah NSW 2324	32°38'03"S 152°00'09"E

2.1 Dust Deposition Results

Dust deposition results for April 2017 and the year to date are shown in **Table 6**.

Table 6 Insoluble Solids (g/m²/month) for the Year to Date

Date	DDG 1	DDG 2	DDG 3	DDG 4	DDG 5
7/9/2015 to 8/10/2015	0.8	0.4	0.3	0.3	-
8/10/2015 to 6/11/2015	1.3	1.2	0.6	0.5	-
6/11/2015 to 8/12/2015	2.1	0.8	0.8	4.1	-
8/12/2015 to 8/1/2016	6.4	0.9	0.6	1.2	-
8/1/2016 to 8/2/2016	1.4	0.9	1.1	1.2	-
8/2/2016 to 3/3/2016	4.0	0.7	0.6	0.9	-
3/3/2016 to 4/4/2016	3.1	0.3	1.0	2.0	-
4/4/2016 to 6/5/2016	1.5	1.1	0.4	3.2	-
6/5/2016 to 3/6/2016	1.0	0.9	0.7	0.4	-
3/6/2016 to 4/7/2016	0.4	1.6	0.5	0.3	-
4/7/2016 to 1/8/2016	1.4	0.7	0.3	0.5	-
1/8/2016 to 31/8/2016	2.7	3.0	0.8	0.7	-
31/8/2016 to 28/9/2016	2.1	1.6	0.8	0.8	0.9
28/9/2016 to 26/10/2016	0.8	0.6	0.8	0.5	0.7
26/10/2016 to 23/11/2016	0.7	1.0	1.3	2.3	1.9
23/11/2016 to 21/12/2016	1.3	0.5	0.9	1.0	4.2

21/12/2016 to 18/01/2017	0.4	0.8	0.7	2.5	3.1
18/01/2017 to 16/02/2017	1.3	0.9	1.2	1.2	1.9
16/02/2017 to 20/03/2017	0.4	1.4	0.5	3.8	1.3
20/03/2017 to 21/04/2017	0.6	0.7	0.5	0.8	1.3
¹ Rolling Annual Average	1.0	0.9	0.8	1.6	1.9

Note ¹: Rolling Annual Average from the EPL 20611 anniversary date of 26 August.

2.2 High Volume Air Sampling Results

The monthly results for TSP and PM10 are shown in **Table 7**.

Table 7 High Volume Air Sampling ($\mu\text{g}/\text{m}^3$) results

Date	HVAS TSP ($\mu\text{g}/\text{m}^3$)	HVAS PM10 ($\mu\text{g}/\text{m}^3$)
29/04/2016	23	18
05/05/2016	20	18
11/05/2016	17	8
17/05/2016	25	19
23/05/2016	35	20
29/05/2016	11	5
04/06/2016	9	8
10/06/2016	11	4
16/06/2016	10	8
22/06/2016	11	4
28/06/2016	11	6
04/07/2016	20	5
10/07/2016	10	6
16/07/2016	10	8
22/07/2016	14	7
28/07/2016	9	5
03/08/2016	27	14
09/08/2016	11	6
15/08/2016	18	12
21/08/2016	10	5
27/08/2016	9	4
02/09/2016	11	7
08/09/2016	15	8
14/09/2016	11	6
20/09/2016	16	9
26/09/2016	<i>Breakdown</i>	<i>Breakdown</i>
02/10/2016	18	7
08/10/2016	35	21
14/10/2016	12	8
20/10/2016	19	11
26/10/2016	21	12
01/11/2016	19	9
07/11/2016	74	50
13/11/2016	27	14

19/11/2016	40	14
25/11/2016	28	13
01/12/2016	25	12
07/12/2016	16	14
13/12/2016	41	21
19/12/2016	41	23
25/12/2016	19	13
31/12/2016	34	22
06/01/2017	30	14
12/01/2017	42	24
18/01/2017	44	18
24/01/2017	40	21
30/01/2017	34	18
05/02/2017	40	24
11/02/2017	54	36
17/02/2017	41	20
23/02/2017	30	16
01/03/2017	13	11
07/03/2017	30	16
13/03/2017	30	18
19/03/2017	21	15
25/03/2017	25	17
31/03/2017	25	14
06/04/2017	12	7
12/04/2017	13	6
18/04/2017	17	11
24/04/2017	18	10
30/04/2017	18	10
¹ 24hr Max Criteria	N/A	50
Report Average	15.0	8.8
² Rolling Annual Average	26.8	15.4
¹ Annual Average Criteria	90	30

- Note:**
1. Maximum criteria as specified in PA 09_0175
 2. Rolling Annual Average from the EPL 20611 anniversary date of 26 August.

2.3 Dust Monitoring Results Summary

All monitoring results to the end of April 2017 indicate that the Dust Deposition (Insoluble Solids), TSP and PM10 levels recorded were below the project criterion.

3. BLAST MONITORING RESULTS

The conditions stipulated for blasting is referred to in Condition L5 and M7 of EPL 20611 and Schedule 3, Condition 8 of PA 09_0175. Blast monitoring is undertaken at every blast. **Table 8** summarises the blast monitoring criteria.

Table 8 Blasting criteria

Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance
Any residence on privately-owned land, or any public infrastructure	120	10	0%
	115	5	5% of the total number of blasts over a period of 12 months

Summary of the blasting results is shown in **Table 9**.

Table 9 Blast Monitoring Results

Date and time	Overpressure and vibration	Monitor 1 (Front Gate)	Monitor 2 (Nearest Residence)
19/04/2017	Overpressure dB(L)	111.5	102.7
12:50 PM	Vibration (mm/s)	1.54	0.68

As shown in Table 9, there was one blasting event on 19 April 2017. The monitoring results for this blast were below the EPL criteria for ground vibration and overpressure.

4. NOISE MONITORING

Schedule 3 Condition 3 of the Project Approval and Condition L4.1 of the EPL requires Karuah East Quarry to ensure noise generated by the development does not exceed criteria outlined in **Table 10**.

Table 10 Operational Noise Criteria (dB(A) LA_{eq}(15min))

Location	Criteria (¹ day)
Residence on Lot 11 DP 10244564	43
A	40
B	37
G	38
All other residence	35

Note ¹: A day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.

In accordance with Schedule 3 Condition 5 and Condition 7 of the Project Approval and the [Noise Management Plan \(SLR, 2015\)](#) a noise monitoring program has been implemented. Summary of this monitoring program is outlined in **Table 11**.

Table 11 Noise Monitoring Program

Construction Noise Monitoring			
Monitoring Method	¹ Location	Frequency	² Criteria (dB(A) LA _{eq} (15min))
Attended noise monitoring	F	At the commencement of new activities and a min of once per quarter.	54

Attended noise monitoring	G	At the commencement of new activities and a min of once per quarter.	44
Operational Noise Monitoring			
Monitoring Method	¹Location	Frequency	²Criteria
Attended noise monitoring	F, G	Quarterly	As per Table 10, 12 and 13 Noise MP (SLR, 2015)
Unattended noise monitoring	G	Quarterly	As per Table 10, 12 and 13 Noise MP (SLR, 2015)

Note:

1. Appendix 1 illustrates the monitoring locations.
2. Criteria is for daytime limits. Daytime is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and Public Holidays.

4.1 Operator Attended Monitoring Results

The results of the operator attended noise surveys are presented in **Table 12**. Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, adjacent quarry and Karuah East Quarry. The table provides the following information:

- a) Monitoring location and serial number of the noise logger;
- b) Date, start time, Wind velocity (m/s) and Temperature (°C) at the measurement location; and
- c) Typical maximum (LA_{max}) and contributed noise levels.

Quarry contributions listed in the tables are from Karuah East Quarry and are stated only when a contribution could be quantified.

Table 12 Operator Attended Noise Survey Results

Location	Date/Start Time/ Weather	Primary Noise Descriptor (dBA re 20 µPa)					Description of Noise Emissions and Typical Maximum Noise Levels (dBA)
		LA _{max}	LA ₁	LA ₁₀	LA ₉₀	LA _{eq}	
F Lot 50 DP 103	<i><u>Attended noise monitoring was not conducted during April 2017</u></i>						
G Lot 3 DP 1032636							

4.2 Unattended Continuous Monitoring Results

Table 13 Unattended Continuous Noise Monitoring Results

INP Period	Units	LA ₁	LA ₁₀	LA ₉₀	LA _{eq}
Location G					
Daytime during Operational Hours ¹	dBA	<i><u>Unattended noise monitoring was not conducted during April 2017</u></i>			
Daytime outside Operational Hours ²	dBA				
Evening ³	dBA				

Night ⁴	dBa	
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- Note:**
1. Daytime - 7.00 am to 5.00 pm Monday to Friday, 8.00 am to 12.00 pm Saturday, not operational on Sunday.
 2. Daytime - 5.00 pm to 6.00 pm Monday to Friday, 12.00 pm to 6.00 pm Saturday, 8.00 am to 6.00 pm Sunday.
 3. Evening - 6.00 pm to 10.00 pm.
 4. Night - 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday.

5. SURFACE WATER MONITORING

Condition M2 of the EPL outlines the requirement to monitor surface water discharges from Karuah East Quarry via the three licensed discharge points (LDP001, LDP002, LDP003). The *Statement of Commitments* (Appendix 6, PA 09_0175) requires additional surface water monitoring to be undertaken for the first twelve months of operations. This additional water monitoring requires monthly sampling to be undertaken at the three licensed discharge points and at four locations on Yalimbah and Bulga Creeks when in flow.

5.1 Discharge Monitoring Results

Table 14 summarises the discharge criteria as per EPL.

Table 14 Surface Water Discharge Monitoring Criteria

Sampling Points	Pollutant	Unit	EPL Limit
LDP001 (Dam 1)	pH	pH units	6.5 – 8.5
LDP002 (Dam 2)	TSS	mg/L	40
LDP003 (Dam 3)	Oil & Grease	mg/L	5 and/or none visible
	Turbidity	NTU	-

Table 15 Surface Water Discharge Monitoring Results

Sampling Point	Date	Time	pH (pH units)	TSS (mg/L)	Oil & Grease (mg/L)	Turbidity (NTU)
LDP001 (Dam 1)	<u>No discharge during April 2017</u>					
LDP002 (Dam 2)						
LDP003 (Dam 3)						

5.2 Monthly Monitoring Results

Surface water was sampled from Dam 1 (LDP1), Dam 3 (LDP3) and SW2 (Bulga Creek) in April 2017. The monitoring points were dry at SW1 (Bulga Creek), SW3 and SW4 (Yalimbah Creek). Light flow was recorded at SW2 during the month.

Summary of monthly monitoring results is shown in **Table 16** and **Table 17**.

Table 16 Surface Water Monthly Monitoring Results – Sediment Dams

Date	LDP001 (Dam 1)				LDP002 (Dam 2)				LDP003 (Dam 3)			
	pH (Lab)	TSS	Oil & Grease	EC	pH (Lab)	TSS	Oil & Grease	EC	pH (Lab)	TSS	Oil & Grease	EC
19/01/2016	-	-	-	-	-	-	-	-	-	-	-	-
25/07/2016	6.60	<5	<5	107	-	-	-	-	-	-	-	-
30/08/2016	6.07	<5	<5	74	-	-	-	-	-	-	-	-
19/10/2016	5.57	96	<5	317	-	-	-	-	-	-	-	-
29/11/2016	5.89	63	<5	305	5.39	72	<5	520	5.22	<5	34	260
19/12/2016	4.97	570	<5	335	4.75	119	<5	559	4.75	58	<5	284
22/02/2017	5.90	145	8	349	-	-	-	-	5.28	8	<5	323
01/03/2017	5.28	40	<5	533	-	-	-	-	5.32	883	<5	216
21/03/2017	5.97	383	18	612	-	-	-	-	4.78	890	16	286
21/04/2017	6.48	21	<5	586	-	-	-	-	7.09	54	8	431

Units: pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in $\mu\text{S}/\text{cm}$

Table 17 Surface Water Monthly Monitoring Results – Drainage Lines

Date	SW1 (Bulga Creek)				SW2 (Bulga Creek)				SW4 (Yalimbah Creek)			
	pH (Lab)	TSS	Oil & Grease	EC	pH (Lab)	TSS	Oil & Grease	EC	pH (Lab)	TSS	Oil & Grease	EC
19/01/2016	5.60	<5	9	204	4.66	<5	<5	173	5.70	13	<5	201
25/07/2016	-	-	-	-	5.97	7	<5	158	-	-	-	-
30/08/2016	-	-	-	-	5.70	<5	<5	207	-	-	-	-
19/10/2016	-	-	-	-	5.84	7	<5	172	-	-	-	-
29/11/2016	-	-	-	-	-	-	-	-	-	-	-	-
19/12/2016	-	-	-	-	-	-	-	-	-	-	-	-
21/03/2017	4.90	<5	<5	313	4.76	12	<5	309	-	-	-	-
31/03/2017	-	-	-	-	5.70	86	34	319	5.79	9	97	263
21/04/2017	-	-	-	-	5.76	12	<5	369	-	-	-	-

Units: pH in pH units, Total Suspended Solids (TSS) in mg/L, Oil & Grease in mg/L, Electrical Conductivity (EC) in $\mu\text{S}/\text{cm}$

5.3 Surface Water Results Summary

Water quality at Dam 1, Dam 3 and SW2 improved considerably in April 2017 compared to previous month. Total suspended solids and oil and grease were below or close to the EPL criterion for discharge. The pH value had increased in Dam 3 and for the first time, it was within the EPL criterion.

6. GROUNDWATER MONITORING

Groundwater monitoring is undertaken to meet the *EA Statement of Commitments* (Appendix 6, PA 09_0175) and Section 8.2 [Water Management Plan \(SLR, 2015\)](#). Groundwater levels are monitored quarterly and water quality biannually at four groundwater monitoring bores (piezometers). Details of this monitoring program is shown in **Table 18**. Refer to Appendix 1 for piezometer locations.

Table 18 Groundwater Monitoring Program

Piezometer	Location	Water Level monitoring frequency	Water Quality monitoring frequency
¹ BH205	Lot 13/DP1024564	Quarterly	Biannually
² BH207	Lot 13/DP1024564	Quarterly	Biannually
BH208	Lot 21/DP1024341	Quarterly	Biannually
BH303	Lot 21/DP1024341	Quarterly	Biannually

Note: 1. Piezometer BH205 was relocated approximately 30m to the west on 13 March 2017
2. Piezometer BH207 was relocated approximately 60m to the north on 26 September 2016.

6.1 Groundwater Levels

Table 19 Groundwater Levels

Date	Unit	² BH205	³ BH207	BH208	BH303
30/03/2016	¹ metres	22.83	12.38	19.54	29.93
04/10/2016	¹ metres	24.00	9.61	19.77	30.45
04/04/2017	¹ metres	25.30	9.39	19.99	30.66

Note: 1. Groundwater levels are measured in metres below ground level.
2. Piezometer BH205 was relocated approximately 30m to the west on 13 March 2017.
3. Piezometer BH207 was relocated approximately 60m to the north on 26 September 2016.

6.2 Groundwater Quality

The biannual groundwater quality monitoring was undertaken in April 2017.

Table 20 Groundwater Quality

ANALYSIS	UNITS	BH205	BH207	BH208	BH303
Date Sampled	-	04/04/2017	04/04/2017	04/04/2017	04/04/2017
pH Value (field)	pH unit	10.21	6.64	8.00	6.21
Conductivity (field)	µS/cm	1719	2648	2527	1439
Total Dissolved Solids	mg/L	1200	1700	1900	950
BTEX					
Benzene	mg/L	<0.001	<0.001	<0.001	<0.001
Toluene	mg/L	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	mg/L	<0.001	<0.001	<0.001	<0.001
m/p-xylene	mg/L	<0.002	<0.002	<0.002	<0.002
o-xylene	mg/L	<0.001	<0.001	<0.001	<0.001
Total Xylenes	mg/L	<0.003	<0.003	<0.003	<0.003
Total Recoverable Hydrocarbons – 1999 NEPM Fractions					
TRH C6-C9	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C10-C14	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C15-C28	mg/L	<0.1	<0.1	<0.1	0.6

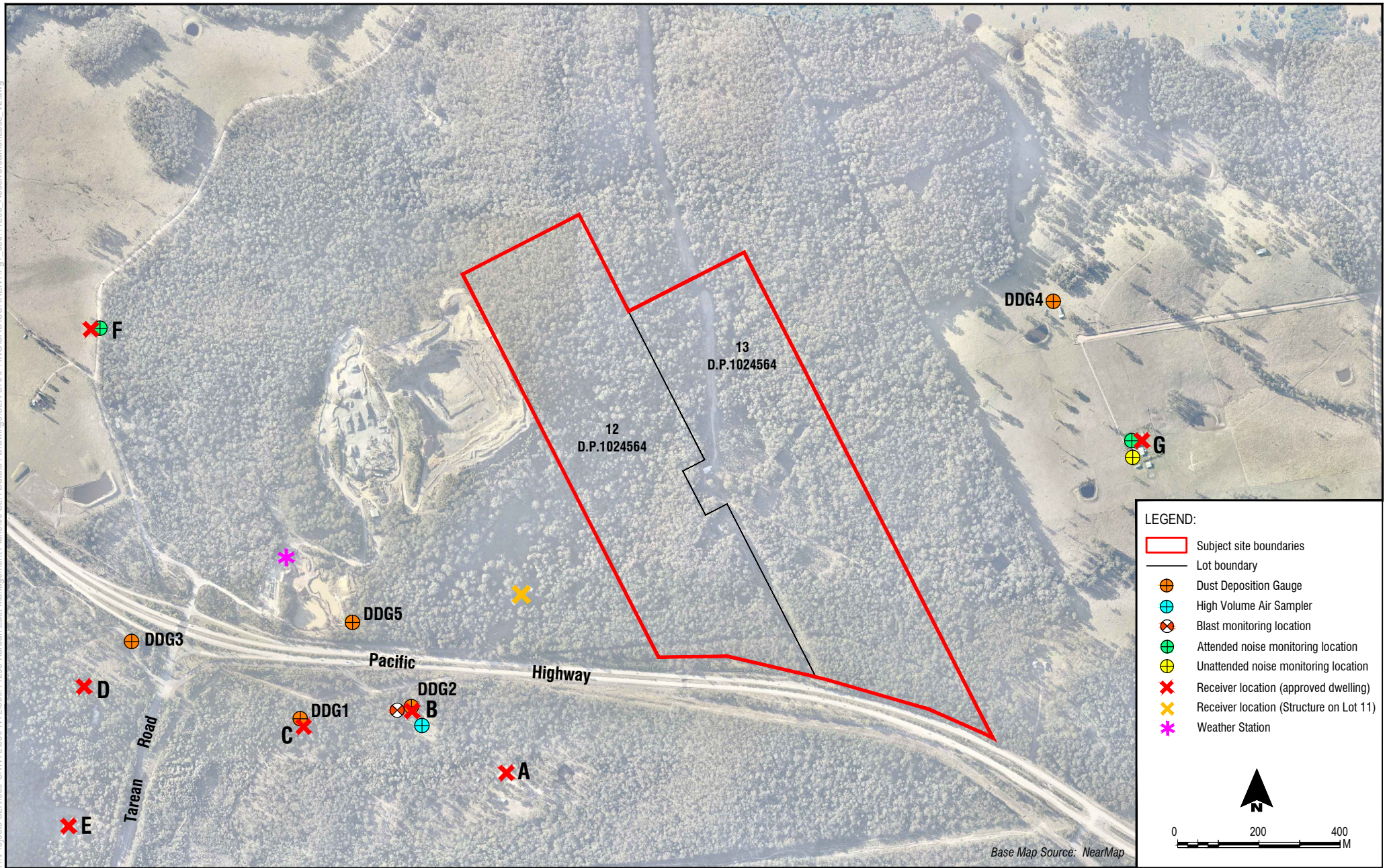
ANALYSIS	UNITS	BH205	BH207	BH208	BH303
TRH C29-C36	mg/L	<0.1	<0.1	<0.1	<0.1
TRH C10-C36 (Total)	mg/L	<0.1	<0.1	<0.1	0.6
Total Recoverable Hydrocarbons – 2013 NEPM Fractions					
Naphthalene ^{N02}	mg/L	<0.01	<0.01	<0.01	<0.01
TRH >C10-C16 less Naphthalene (F2) ^{N01}	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C6-C10	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C6-C10 less BTEX(F1) ^{N04}	mg/L	<0.02	<0.02	<0.02	<0.02
TRH C10-C16	mg/L	<0.05	<0.05	<0.05	<0.05
TRH C16-C34	mg/L	<0.1	<0.1	<0.1	0.7
TRH C34-C40	mg/L	<0.1	<0.1	<0.1	<0.1
Polynuclear Aromatic Hydrocarbons					
Naphthalene	mg/L	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	<0.001	<0.001	<0.001	<0.001
Acenaphthene	mg/L	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	<0.001	<0.001	<0.001	<0.001
Phenanthrene	mg/L	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Chrysene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(b&j)fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene	mg/L	<0.001	<0.001	<0.001	<0.001
Dibenzo(ah)anthracene	mg/L	<0.001	<0.001	<0.001	<0.001
Benzo(ghi)perylene	mg/L	<0.001	<0.001	<0.001	<0.001
Total PAH (18)	mg/L	<0.001	<0.001	<0.001	<0.001
OP Pesticides					
Dichlorvos	mg/L	<0.002	<0.002	<0.002	<0.002
Dimethoate	mg/L	<0.002	<0.002	<0.002	<0.002
Diazinon (Dimpylate)	mg/L	<0.002	<0.002	<0.002	<0.002
Fenitrothion	mg/L	<0.002	<0.002	<0.002	<0.002
Malathion	mg/L	<0.002	<0.002	<0.002	<0.002
Chlorpyrifos Ethyl	mg/L	<0.002	<0.002	<0.002	<0.002
Chlorpyrifos	mg/L	<0.02	<0.02	<0.02	<0.02
Ethyl Parathion	mg/L	<0.002	<0.002	<0.002	<0.002
Ethion	mg/L	<0.002	<0.002	<0.002	<0.002
Azinphos-methyl	mg/L	<0.002	<0.002	<0.002	<0.002
Dichlorvos	mg/L	<0.002	<0.002	<0.002	<0.002
Acid Herbicides					

ANALYSIS	UNITS	BH205	BH207	BH208	BH303
Dicamba	mg/L	<0.001	<0.001	<0.001	<0.001
MCPP (Mecoprop)	mg/L	<0.001	<0.001	<0.001	<0.001
MCPA	mg/L	<0.001	<0.001	<0.001	<0.001
Dichlorprop (2,4-DP)	mg/L	<0.001	<0.001	<0.001	<0.001
2,4-D	mg/L	<0.001	<0.001	<0.001	<0.001
2,4,5-TP (Silvex, Fenopop)	mg/L	<0.001	<0.001	<0.001	<0.001
2,4,5-T	mg/L	<0.001	<0.001	<0.001	<0.001
Dinoseb (Dinitrobutylphenol)	mg/L	<0.001	<0.001	<0.001	<0.001
Actril (Ioxynil)	mg/L	<0.001	<0.001	<0.001	<0.001
MCPB	mg/L	<0.001	<0.001	<0.001	<0.001
2,4-DB	mg/L	<0.001	<0.001	<0.001	<0.001
Anions					
Chloride	mg/L	440	800	710	430
Sulphate, SO ₄	mg/L	60	78	320	27
Nitrogen					
Nitrate & Nitrite (as N)	mg/L	0.08	<0.05	3.8	0.35
Total Alkalinity as CaCO ₃	mg/L	380	230	54	110
Total Kjeldahl Nitrogen	mg/L	<0.2	<0.2	0.6	<0.2
Total Nitrogen (calc)	mg/L	<0.2	<0.2	4.4	<0.2
Ammonia (as N)	mg/L	0.08	<0.01	0.02	0.02
Metals					
Calcium, Ca	mg/L	4.2	36	39	16
Magnesium, Mg	mg/L	0.8	48	45	22
Sodium, Na	mg/L	330	450	460	200
Potassium, K	mg/L	23	2.9	3.4	4.6
Arsenic, As	mg/L	0.006	<0.001	<0.001	0.003
Cadmium, Cd	mg/L	<0.002	<0.002	<0.002	<0.002
Chromium, Cr	mg/L	0.011	<0.001	<0.001	<0.001
Copper, Cu	mg/L	0.001	<0.001	<0.001	<0.001
Lead, Pb	mg/L	<0.001	<0.001	<0.001	<0.001
Nickel, Ni	mg/L	<0.001	0.002	0.011	0.002
Zinc, Zn	mg/L	<0.005	0.002	0.011	0.002
Manganese, Mn	mg/L	<0.005	0.31	0.014	1.4
Iron, Fe	mg/L	<0.05	<0.05	<0.05	2.7
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001

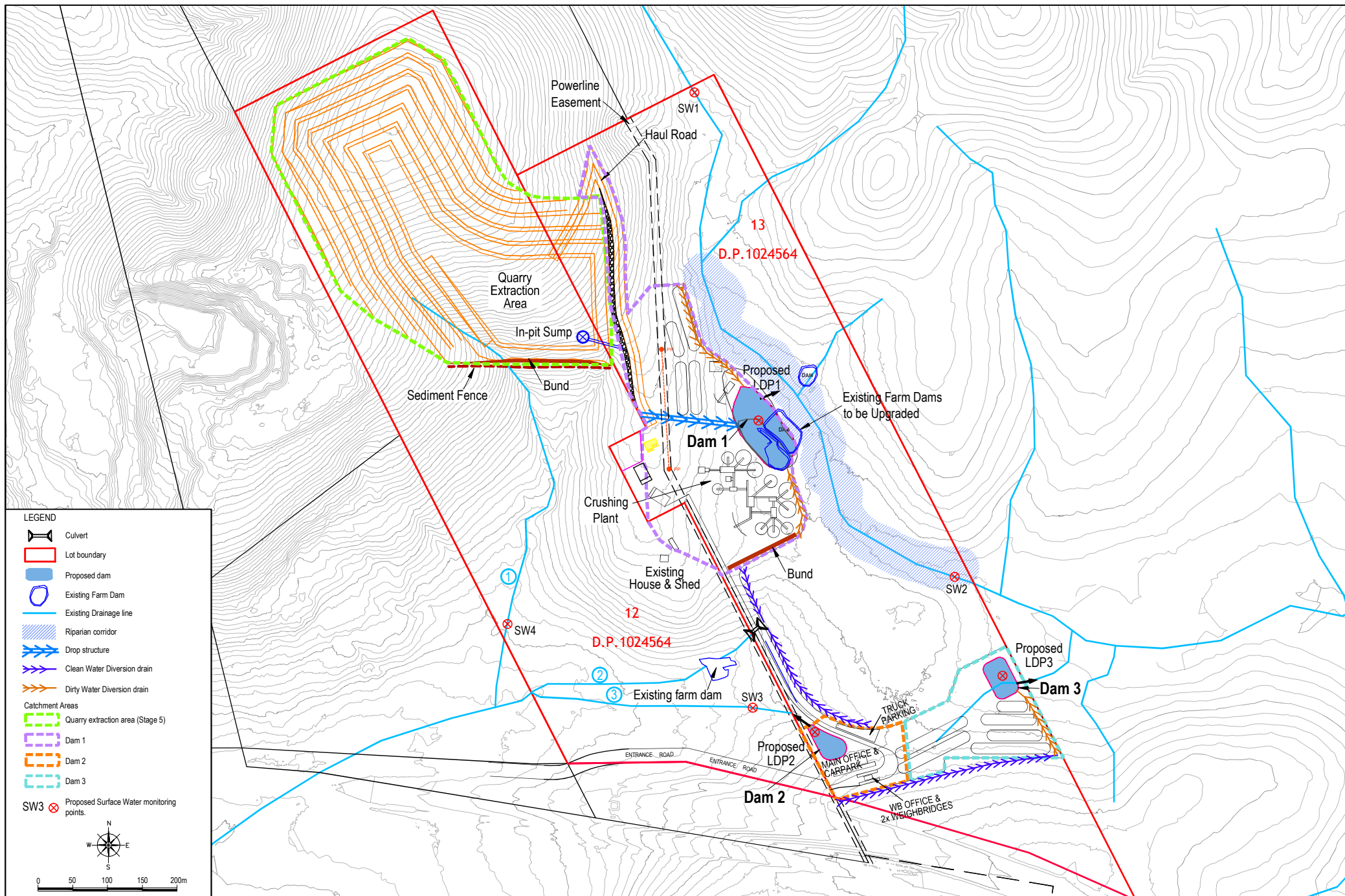
APPENDIX 1

Monitoring Locations

H:\Projects\SLR\630-SvNTL\630-NTL\630-11235 Karuah East Management Plans\06 SLR Data\01 Drawings\SLR DRAFTING\CAD\CURRENT\Fig1_630_11235 Receivers&MonLocs_V2.dwg



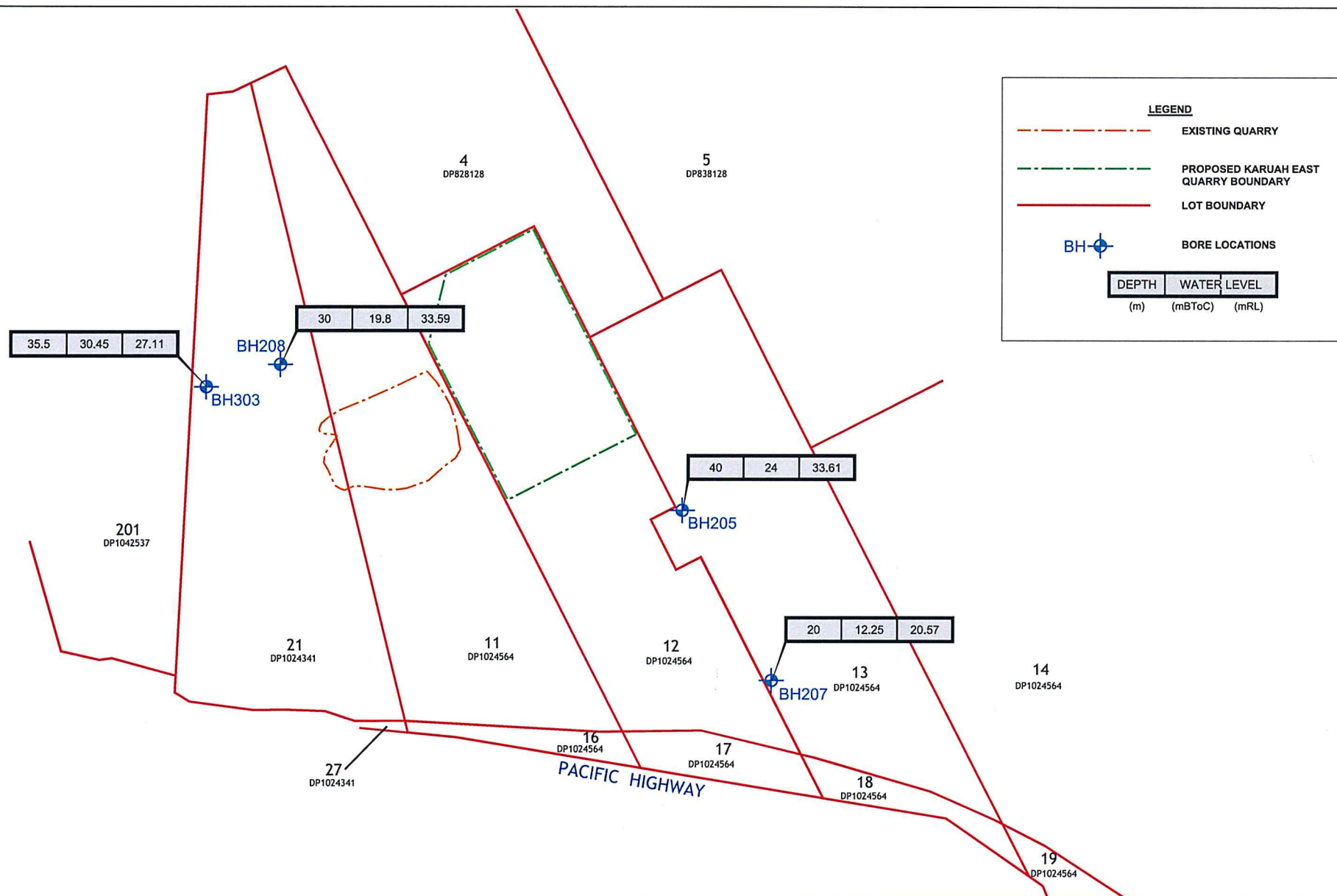
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To be printed A3

Proposed Surface Water Management Plan

FIGURE 4



drawn	LZ	 SPECIALISTS MANAGING THE EARTH	client:	KARUAH EAST QUARRY PTY LTD	
approved	MB		project:	PROPOSED KARUAH EAST HARD ROCK QUARRY GROUNDWATER STUDY	
date	18.08.11		title:	GROUNDWATER BORE LOCATIONS AND MONITORING DATA	
scale	1:12,000		project no:	GEOTWARA21232AA-AG	figure no: FIGURE 3.1
original size	A4				