



## **Three Kings Quarry**

### **Fill Management Plan - Annual Compliance Report**

**02 April 2012 – 31 May 2012**

**June 2012**

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# 1 Introduction

Winstone Aggregate was granted permit numbers 36221, 36222, 37770 and R/LUC/2009/743 by the Environment Court on 26 July 2011. These consents authorise the reclamation of the Three Kings Quarry. The consents were given effect on 02 April 2012.

The objective of the fill operation is to rehabilitate ground levels of the Three Kings Quarry and leave the site stable, safe and fit for subsequent use. The material used to fill the site must therefore be able to achieve the objective in a manner which has no more than minor adverse effects on people or the environment, during and after completion of filling.

In conjunction with the fill consents the Fill Management Plan sets out how the fill material quality is to be managed and includes the monitoring and reporting implemented to ensure ongoing compliance with the above mentioned consents. In accordance with Condition 27 of the consents the monitoring detailed in the Fill Management Plan is to be complied and reported annually.

Condition 27 reads:

*An Annual Compliance Report shall be submitted to the Manager by 30 June each year which provides an analysis of the results of data collected for the Fill Management Plan and an evaluation of the results in respect of compliance levels. The report shall be prepared by a suitably qualified person to a standard acceptable to the Manager and shall consider all data collected from the commencement date of the Resource Consent and up until 31 May prior to reporting. On the basis of this report the Consent Holder may submit recommended changes to the Fill Management Plan to the Manager for certification.*

This report is the first issue of the Fill Management Plan - Annual Compliance Report. The reporting period covers the first two months of operation being 02 April 2012 to 31 May 2012. The monitoring completed over this period is detailed in the following sections.

## 2 Summary of Fill

Fill operations currently run concurrently with quarry activities. Quarry and product distribution continue in the southern section of the site with filling focused in the northern corner of the site. The fill material imported to site has typically been the surplus soil from local development sites. The rate of importation of fill is dictated by the market and the factors that drive projects, their productivity and preferred tip site. Condition 50 puts a cap on the number of trucks that can enter the site per day as well as a requirement to keep a register of truck movements.

Condition 50 reads:

*In accordance with the details of the resource consent application, no more than 375 trucks shall enter the site per day. A register shall be kept on site which records all truck movements to and from the site, and shall include the category of vehicle, i.e. identification as a four, six or eight wheeler, articulated truck or truck and trailer heavy vehicles and a copy of it shall be submitted to the Manager on a quarterly basis to certify compliance with this condition.*

The following provides the details of this requirement.

## **2.1 Results**

Approximately 4000m<sup>3</sup> of fill material has been placed onsite between 02 April 2012 and 31 May 2012. The approximate volume tipped per day is provided as Appendix A. Over this period the material has been transported to site solely by 4 and 6 wheeler trucks. However transport of aggregate both to the site for distribution and from the site as sales continues.

Appendix B details the total number of trucks that entered site during each day of operation over the reporting period. The split of fill trucks to aggregate trucks entering site is also included. A tally of the classification of each fill truck to enter site is provided.

## **2.2 Analysis and Evaluation**

The truck movements over this reporting period were dominated by quarry related activities opposed to the importation of fill material. The fill related trucks made up an average of 20% a day of the total number of trucks to enter site in April 2012. For May 2012 this percentage increased to an average of 32%. The rate of fill activity is expected to remain in this order for the next several months. It is anticipated that towards the end of 2012 the rate of fill trucks will start to increase. Estimations of the volumes are difficult to determine at this stage. However, a limit of 375 movements into site per day has been committed to and this includes both fill and quarry related trucks.

Appendix B shows that the total number of trucks entering site per day has been less than the 375 allowed per day. As such the monitoring against Condition 50 is compliant over this reporting period. Furthermore, the measures in place to ensure this number is not exceeded are considered appropriate to manage this requirement over the next 12 months.

# **3 Weighted Rolling Mean Results**

The fill acceptance criteria are split into two threshold groups both of which must be met. These two groups are the Weighted Rolling Mean Criteria and the Maximum Criteria. These two groups are further divided into two categories: material being placed as deeper fill (greater than 2m from finished level) and that placed as shallow fill (less than 2m from finished level).

Condition 16 provides the specific limits of each criterion. However it is Conditions 19 and 20 which specify the required monitoring and compliance standards.

Condition 19 reads:

*The weighted rolling 12-month mean will be updated continuously as sample results are received. If the data reveals that the fill is above 85% of the weighted 12-month mean, the consent holder will report immediately to the Council and continue to report on a monthly basis while the data shows that the fill remains above 85% of the weighted 12-month mean. The consent holder shall take action to ensure that the fill reduces below 85% of the weighted 12-month mean as soon as possible. Once the fill reduces below 85% of the weighted 12-month mean, annual reporting to the Council shall resume.*

Condition 20 reads:

*Within the first 12 months of the filling operation the monthly weighted rolling mean shall be no greater than the weighted rolling 12-month mean in Table 1.*

### **3.1 Results**

The results of both the monthly and 12 month weighted rolling means are provided in Appendix C for April 2012 and May 2012. The data is presented in four tables two for each of the months covered by this report. For each of the months there is one table which presents the recorded values of the monthly weighted rolling mean while the other table details the values of the 12 month weighted rolling mean. For ease of comparison the Weighted Rolling Mean Criteria and Maximum Criteria for the deeper fill (as stated in the consent under Condition 16) are included within each table. Furthermore, a percentage of the actual value compared to the Weighted Rolling Mean Criteria is provided for each table.

### **3.2 Analysis and Evaluation**

All fill associated with this monitoring period is classified as deeper fill as defined in Condition 16. The approximate 4000m<sup>3</sup> tipped during the first two months of fill operations has been dominated by small development sites from the surrounding area. As such the weighted rolling mean values over this reporting period are largely a consequence of the analytical testing detailed in the following section.

Regardless, the results show compliance with the values stated in Condition 16 as well as the further refinements to the criteria detailed in Conditions 19 and 20. All the actual values are less than half of the Weighted Rolling Mean Criteria with some considerably below the compliance thresholds.

Careful management of the material accepted against the Weighted Rolling Mean Criteria will see to the ongoing compliance with these requirements over the next 12 months.

## 4 Analytical Testing Results

Fill being transported to the Three Kings site is classified as either pre-approved material or non-pre-approved material. In general terms, pre-approved material is that which comes from a site providing more than 200m<sup>3</sup>, or is a known ex-horticultural site, or is on the Ministry for the Environment Hazardous Activities and Industries List or is from the Auckland City District Plan Central Area Section. Such sources are subject to soil testing and analysis which demonstrates compliance with the consents criteria prior to the disposal of material onsite. The soil testing provided for pre-approved sites as part of the pre-approval process are uploaded into the weighted rolling mean to ensure compliance prior to the material being approved. Non-pre-approved material is that which has not been subject to pre-approval as less than 200m<sup>3</sup> of material is to be placed on site from a single source and the source does not fall under any of the other categories provided above.

Each load is inspected prior to the material being placed onsite. The inspection procedure varies depending on if the load is classified as pre-approved or non-pre-approved. For pre-approved material, once signed into site the load is inspected by a trained staff member at the Testing Station. A visual and olfactory inspection is completed prior to the material being authorised to tip the load. The assessments done on non-pre-approved material is to undertake a visual and olfactory inspection in addition to taking and screening a sample of the load with an x-ray fluorescence unit to check for the presence of elevated levels of specific metals.

Furthermore, additional analytical testing applies to all fill material classified as non-pre-approved. Condition 15 specifies this additional testing requirement.

Condition 15 reads:

*If the fill has not previously been tested to at least the same extent by the fill generator as detailed in Condition 14 then the consent holder shall undertake analytical testing of imported fill for the chemical parameters set out in Table 1 at a rate of not less than 1 in every 150 incoming trucks or every 1400 tonnes (whichever comes first).*

### 4.1 Results

The inspection of each load (as detailed above) is completed by a member of staff trained specifically in this task. The details of the inspection are placed in an electronic register prior to the truck being allowed to tip the load off. This register flags when an analytical test is required on a non-pre-approved load. When this occurs the load is quarantined, sampled and sent away for testing. The register is audited weekly by the onsite Environmental Coordinator for completeness and accuracy.

Over the reporting period, four loads have been sampled and sent for analytical testing as detailed in Condition 15 above. The results of three of the test have been received and are provided in Appendix D. As of 31 May 2012 the results of the fourth sample was not yet

available. Once the results are received they are uploaded into the weighted rolling mean values detailed in Appendix C.

## 4.2 Analysis and Evaluation

All fill associated with this monitoring period is classified as deeper fill as it has been deposited greater than two meters from finished level. The approximate 4000m<sup>3</sup> tipped during the first two months of fill operations has been dominated by small development sites from the surrounding area. The three sets of results that are available for this reporting period are compliant with both the Weighted Rolling Mean Criteria as well as the Maximum Criteria.

The procedures and monitoring in place helps to prevent the placement of non-complaint fill. However, this additional analytical testing is a secondary defense. The Fill Management Plan clearly layouts the steps to be followed as well as the reporting requirements in the case of an issue with the analytical results of a quarantined load in the next 12 months. This system ensures the effects of such an incident are appropriately managed.

## 5 Groundwater Monitoring

Several conditions within the consents detail the groundwater monitoring requirements in relation to fill activities. The most relevant conditions are Conditions 30, 31 and 75.

Condition 30 reads:

*The consent holder shall install a continuous electrical conductivity and pH meter at the dewatering well head and report the results to the Council as part of the Annual Compliance Report. The independent expert who is appointed to undertake audit sampling in accordance with condition 25 shall review the conductivity and pH results to identify and report on any undesirable trends.*

Condition 31 reads:

*Groundwater monitoring shall be carried out at both the dewatering well and monitoring well BH7 at 109 Landscape Road (i.e. the existing borehole in the network that is used for monitoring groundwater behaviour for Auckland Regional Council dewatering permit 12977) in the following way:*

- a) For the first two years after the commencement of the consent, the ssamples shall be analysed for the chemical constituents listed in Table 3 Condition 32 at quarterly intervals, commencing within three months of the commencement of consent.*

- b) If after the first two years after the commencement of consent no groundwater trigger level has been exceeded then the samples shall be analysed for the chemical constituents listed in Table 3 Condition 32 at six monthly intervals for the remainder of the term of the consent.*

Condition 75 reads:

*Groundwater pumped from the site shall be monitored for suspended solids and turbidity, as part of the contaminant monitoring regime of the associated discharge permit. The concentration of suspended solids in the groundwater being discharged from the site shall not exceed 30 mg/l, and turbidity shall not exceed 30NTU. The results of this sampling shall be provided to the Council on a quarterly basis. Provided that if the groundwater is ever to be used as potable water, that portion being used as potable water shall be subject to a limit of 5mg/l TSS and a turbidity of no more than 5 NTU.*

The triggers related to Condition 31 are stated in Condition 32 of the consents. For ease of comparison they are also been included within the results that follow.

## **5.1 Results**

### **5.1.1 Continuous Monitoring - Dewatering Well Head**

The results of the continuous monitoring at the Dewatering Well Head of the electrical conductivity and pH are provided in two graphs attached as Appendix E. These results have been presented as an average per day. The results have been averaged as the data is recorded every five minutes creating a huge data set. This data set was most clearly presented as an average value. However, the full data set is available in electronic copy by request.

### **5.1.2 Quarterly Monitoring - Dewatering Well Head and Borehole 7**

The full suite of sampling and analysis of the Dewatering Well Head and Borehole 7 has been undertaken on three occasions since late 2011. The results of this sampling are provided in Appendix F. An additional sample was taken from Borehole 7 in April 2012 which was tested for zinc only as there was a trigger in the March 2012 results for this parameter.

### **5.1.3 Quarterly Monitoring – Dewatering Well Head**

The monitoring for both suspended solids and turbidity is completed as part of the sampling detailed in the previous section. The results of these two parameters are included in Appendix F.



## 5.2 Analysis and Evaluation

### 5.2.1 Continuous Monitoring - Dewatering Well Head

The results for the first two months of monitoring were somewhat variable for both the electrical conductivity and pH. The set up of the sampling system as well as the replacement of one of the sensors (under warranty) has led to more consistent results which are more in line with original expectations. The electrical conductivity in the last half of the reporting period has been reporting in the order of  $297\mu\text{S}/\text{cm}$ . As for pH, in the last half of the reporting period, it continued to fluctuate but only varied between the range 7 to 8.5 (pH units). This range is detailed as the trigger limits for this parameter in Condition 32 of the consents. The pH at this location is also monitored quarterly as part of the monitoring detailed in the following section.

It is difficult to make any fixed conclusions from the data to date. It is anticipated that the results will become more consistent as the instruments settle. However, ongoing monitoring of the results over the next 12 months is required to confirm this is the case. Furthermore, as the data set increases any trends of significance will become much more apparent.

It is anticipated that the additional assessment of this continuous monitoring (as required by Condition 30) will be completed as part of the Council's review of this report.

### 5.2.2 Quarterly Monitoring - Dewatering Well Head and Borehole 7

There were two triggers in the three samples taken since the issuing of fill consents. The first trigger was for zinc in Borehole 7 in December 2011. In the event of a trigger, Condition 36 of the consents states that the monitoring well is to be re-sampled and analysed as soon as practicable possible. To gather more background data prior to the commencement of filling both sampling locations were re-sampled in January for the full suite of parameters. The results of this second analysis were below the trigger limit for zinc and are largely compliant for all other parameters. As can be seen by the data there were a number of issues receiving accurate, timely and useable data for the first two lots of sampling. A new provider was engaged for the third set of sample analysis and will be used going forward.

It is in this third set of sampling that the second trigger was recorded. This was again for zinc in Borehole 7. As required by Condition 36 the borehole was re-sampled and analysed for zinc. Since the result of this re-sampling was below the trigger Condition 36 of the consents states that no further action was required. Furthermore, Borehole 7 currently has no direct groundwater link to the site. As such the results related to the monitoring of Borehole 7 are considered ambient / background water quality and the triggers are not considered related to the onsite activities.

The only outstanding item, in regards to groundwater monitoring, is that the trigger for Hexachlorobutadiene which is  $0.00035\text{g}/\text{m}^3$ . This trigger is slightly above the standard level of laboratory detection of  $<0.0005\text{g}/\text{m}^3$  for this parameter. Provided the results continue to be reported as less than detection this is not considered of any consequence

especially as the Ministry of Health (2005) Drinking Water Standards (revised 2008) Maximum Acceptable Value (MAV) is 0.007g/m<sup>3</sup>. The MAV is above the laboratory level of detection. As such a trigger for this parameter would be raised prior to or if the MAV is approached.

It is noted that each of the samples (apart from the re-sampling in April 2012 for zinc only) were completed prior to the commencement of filling on 02 April 2012. As such this data provides some background knowledge into the levels of the parameters tested for.

### 5.2.3 Quarterly Monitoring – Dewatering Well Head

In regards to the first sample taken in December 2011, the result for turbidity has not been provided as a reporting error at the laboratory meant that the sample was not analysed as required. However, all other results for both suspended solids and turbidity are well below the trigger limits for this reporting period.

### 5.2.4 Groundwater Monitoring Summary

At this very early stage of fill operations the monitoring results are of a small sample sizes. As such, it is difficult to determine if any undesirable trends or otherwise is present. As the size of this data set increases, issues (if present) will likely become apparent. Provided the monitoring, as required by the consent, continues over the next 12 months a much more thorough assessment will be possible and required.

However, the monitoring as required by the consents has been completed. Therefore it is deemed that the requirements for this reporting period have been met and are complaint.

## 6 Air Quality Monitoring

Condition 46 requires the installation of a BAM monitor at the southern boundary of site prior to the commencement of filling. This unit is in addition to the three air monitors already operational onsite as required by the existing consents related to quarry activities. Two of these existing monitors are set up at the office blocks; these units are a BAM monitor and a HiVol unit. A HiVol unit is also located along the northern boundary. In addition to these monitors a metrological station is located on the office block which records average rainfall and average wind speed and direction.

The results of the existing air quality monitoring are provided to Council quarterly. The additional BAM data has been added to this reporting regime. The fill consents specifically details ongoing quarterly submission of such monitoring records to Council is to be continued. This is detailed in Condition 59(g).

## 6.1 Results

The results of the monitoring since the commencement of fill operations on 02 April 2012 are provided in two tables attached as Appendix G. One table details the results for April 2012 while the other details those for May 2012.

## 6.2 Analysis and Evaluation

The additional BAM monitor is housed within the small port-a-com unit located on the southern boundary of the site. This unit was installed prior to 02 April 2012 which was the date fill activities commenced. The monitor installed was a unit previously used on another site. During a routine check of the monitor it was noted that there was a serious malfunction with the unit. As such, a new unit was purchased and installed. However, as a result of the malfunction, the data held on the old monitor was unable to be recovered. The Council compliance officer for the fill consents was notified of these details on 02 May 2012. Results from the new BAM monitor are available from 26 April 2012 and have been included along with the other air quality monitoring results as Appendix G.

Furthermore, data was not available from the southern boundary BAM on 21 and 22 May 2012 due to a power outage. However, the results available for the month of May 2012 indicate that had the monitor run the results would have been within the consented limits.

The available results for the southern boundary BAM are all below the trigger limit of 80mg/m<sup>3</sup> per 24 hour average and are at the expected levels. Ongoing dust prevention measure will ensure ongoing compliance in this regard over the next 12-months.

## 7 Compaction Requirements

Condition 9 clearly states the obligation in regards to compaction requirements.

Condition 9 reads:

*The controlled fill in the upper 5m layer shall be engineered to a compaction and stability standard in accordance with NZS 4431:1989 (Code of practice for Earth Fill for Residential Development) that enables future residential use of the finished landform no longer than 5 years after cessation of filling. This condition may be reviewed where a proposed Plan Change or review (or any resource consent addressing the use of the site as a whole) indicates that future uses will demand a lesser standard of compaction. The consent holder shall provide an annual report to the Manager, or his or her nominee, which contains sufficient detail to confirm the engineering standards required to meet NZS 4431:1989 have been achieved for the fill.*

## 7.1 Results

The first two months of operations has seen a relatively minute volume (approximate 4000m<sup>3</sup>) of material tipped onsite. Geotechnical advice has been sought for guidance into the appropriate placement of fill at this very early stage of the works. Such input will continue to be sought as filling progresses.

The fill is well below the upper 5m layer threshold. Therefore no further details on compaction standard are available or required at this time. There is no area in the next 12 months expected to be within this upper five meter threshold.

Furthermore, based on the volume of fill and the current operations it was determined that vibration monitoring was not required at this stage of works. In addition, is not anticipated that vibration monitoring will be required over the next 12 months. However if operations change over this period the need for vibration monitoring will be re-assessed and undertaken as required to ensure ongoing compliance with clause 8.8.1 of the Auckland City Operative District Plan.

## 8 Noise Monitoring

Any activity on site associated with fill operations is not to exceed the noise limits specified in the consent. Furthermore, monitoring is to be undertaken to show compliance. The monitoring requirements are detailed in Conditions 52 and 53.

Condition 52 reads:

*Within 3 months of the commencement of the fill activity the consent holder shall submit to Manager a report demonstrating that the activity meets the noise standards outlined in this condition.*

Condition 53 reads:

*The consent holder shall undertake further monitoring confirming compliance with the noise limits when the majority of the fill operation is occurring above RL 70m and following this at a 6 monthly interval.*

### 8.1 Results

The noise monitoring required as per Condition 52 was not undertaken during this reporting period. A noise consultancy has been engaged to undertake this monitoring and subsequent reporting. This monitoring is programmed to be undertaken in June 2012. Upon receipt of the results a copy will be forward to Council.

As for Condition 53 fill levels are expected to be well below RL 70m over the next 12 months. Therefore no further action is required in this regard at this time.

## **9 Conclusion**

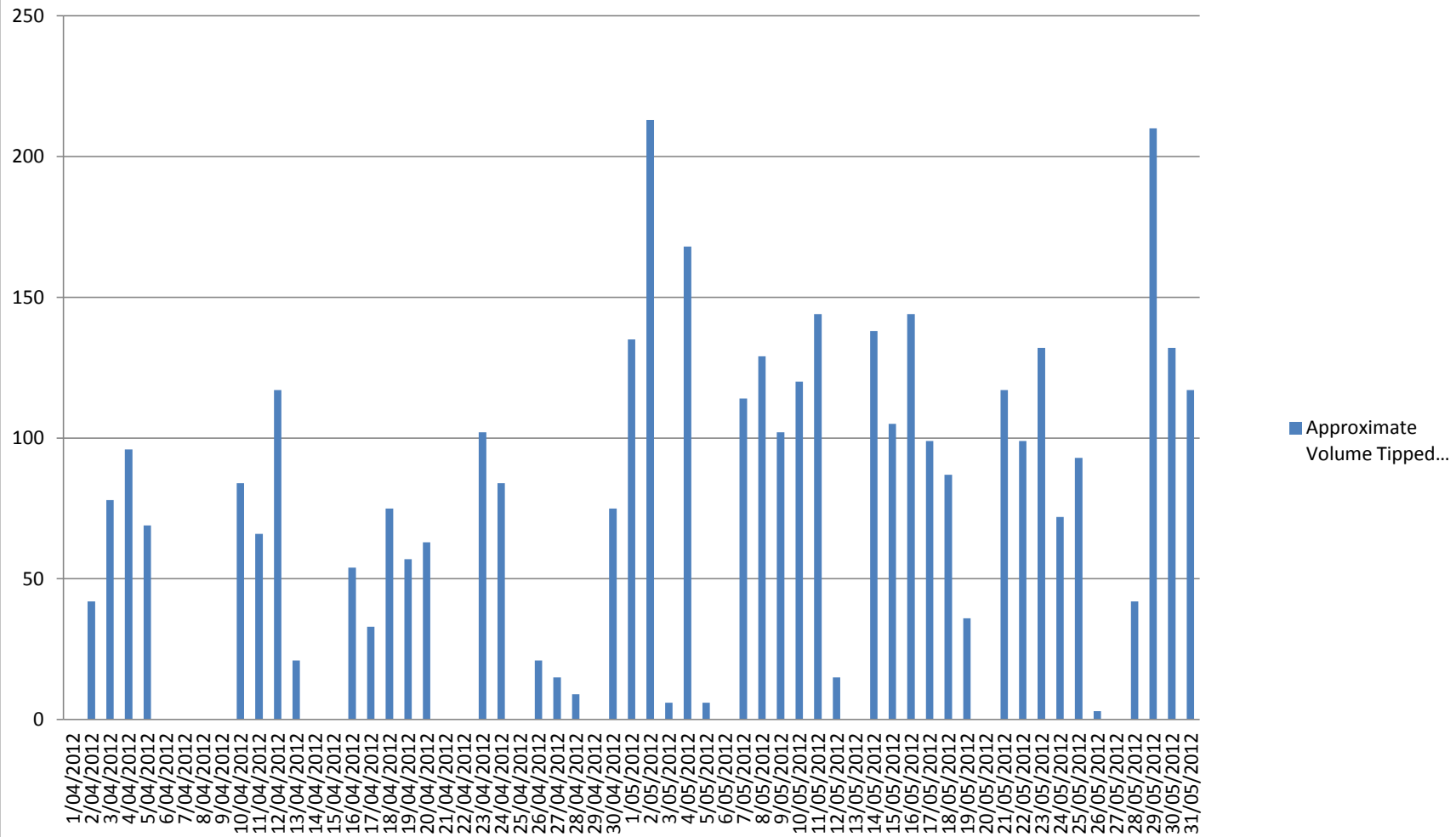
This first issue of the Fill Management Plan - Annual Compliance Report covering the period 02 April 2012 to 31 May 2012 has been prepared in accordance with permit numbers 36221, 36222, 37770 and R/LUC/2009/743 which authorise the rehabilitation of the Three Kings Quarry. At this very early stage of fill operations the monitoring results are limited and the ability to draw conclusions is restricted. However the data present provides a solid basis and baseline for the ongoing monitoring requirements of the next 12 months to be assessed.

Lastly, at this stage, no changes are recommended to the current Fill Management Plan (Revision 4 dated April 2012).

## **APPENDIX A**

Approximate Volume Tipped per Day

Approximate Volume Tipped per Day (m³)



## **APPENDIX B**

Total Number of Trucks per Day



## Truck Movements - April 2012

Day	4 Wheeler	6 Wheeler	Aggregate	Total
1/04/2012				
2/04/2012	0	7	42	49
3/04/2012	4	12	57	73
4/04/2012	4	14	54	72
5/04/2012	1	11	25	37
6/04/2012				
7/04/2012				
8/04/2012				
9/04/2012				
10/04/2012	2	13	43	58
11/04/2012	0	11	54	65
12/04/2012	1	19	47	67
13/04/2012	1	3	35	39
14/04/2012	0	0	12	12
15/04/2012				
16/04/2012	6	6	62	74
17/04/2012	5	3	37	45
18/04/2012	3	11	52	66
19/04/2012	7	6	57	70
20/04/2012	1	10	46	57
21/04/2012	0	0	5	5
22/04/2012				
23/04/2012	0	17	25	42
24/04/2012	6	11	45	62
25/04/2012				
26/04/2012	5	1	56	62
27/04/2012	5	0	43	48
28/04/2012	3	0	12	15
29/04/2012				
30/04/2012	7	9	26	42

Site closed.

## Truck Movements - May 2012

Day	4 Wheeler	6 Wheeler	Aggregate	Total
1/05/2012	3	21	59	83
2/05/2012	3	35	68	106
3/05/2012	8	35	59	102
4/05/2012	2	27	76	105
5/05/2012	2	0	18	20
6/05/2012				
7/05/2012	8	15	65	88
8/05/2012	3	20	39	62
9/05/2012	14	10	27	51
10/05/2012	14	13	64	91
11/05/2012	8	20	47	75
12/05/2012	1	2	12	15
13/05/2012				
14/05/2012	2	22	50	74
15/05/2012	3	17	25	45
16/05/2012	2	23	33	58
17/05/2012	1	16	57	74
18/05/2012	7	11	40	58
19/05/2012	2	5	19	26
20/05/2012				
21/05/2012	3	18	35	56
22/05/2012	1	16	73	90
23/05/2012	1	21	54	76
24/05/2012	2	11	34	47
25/05/2012	5	13	46	64
26/05/2012	1	0	13	14
27/05/2012				
28/05/2012	8	3	15	26
29/05/2012	14	28	30	72
30/05/2012	14	15	46	75
31/05/2012	9	15	35	59

Site closed.

## **APPENDIX C**

### Weighted Rolling Mean Values

## Weighted Rolling Mean Summary Results for April 2012.

**Table 1.** The following table shows the values and criteria for the monthly weighted rolling mean at 30 April 2012.

Monthly Values	Rolling Average (mg/kg)	Weighted Rolling Criteria (mg/kg)	Maximum Criteria (mg/kg)	% Actual Value to Weighted Criteria
Arsenic	2.98	12	100	24.8
Boron	7.16	130	260	5.5
Cadmium	0.08	0.65	7.5	12.3
Chromium	22.94	125	400	18.4
Copper	14.43	90	325	16.0
Mercury	0.1	0.45	0.75	22.2
Nickel	14.86	105	320	14.2
Lead	21.58	65	250	33.2
Zinc	53.81	400	1160	13.5
Benzo(a)pyrene Equivalence	0.4	1	2.15	40.0
Cyanide	0.07	1	25	7.0
Total DDT	0.02	0.7	12	2.9
Aldrin	0	0.7	12	0.0
Dieldrin	0	0.7	6	0.0
C7-C9	6.69	20	300	33.5
C10-C14	10.03	50	300	20.1
C15-C36	16.68	500	5600	3.3
Benzene	0.01	0.4	1	2.5
TEX Total	0.09	3	20	3.0

**Table 2.** The following table shows the values and criteria for the 12-month weighted rolling mean for the period of April 2012 as this marks the commencement of fill operations.

12-Month Values	Rolling Average (mg/kg)	Weighted Rolling Criteria (mg/kg)	Maximum Criteria (mg/kg)	% Actual Value to Weighted Criteria
Arsenic	2.98	12	100	24.8
Boron	7.16	130	260	5.5
Cadmium	0.08	0.65	7.5	12.3
Chromium	22.94	125	400	18.4
Copper	14.43	90	325	16.0
Mercury	0.1	0.45	0.75	22.2
Nickel	14.86	105	320	14.2
Lead	21.58	65	250	33.2
Zinc	53.81	400	1160	13.5
Benzo(a)pyrene Equivalence	0.4	1	2.15	40.0
Cyanide	0.07	1	25	7.0
Total DDT	0.02	0.7	12	2.9
Aldrin	0	0.7	12	0.0
Dieldrin	0	0.7	6	0.0
C7-C9	6.69	20	300	33.5
C10-C14	10.03	50	300	20.1
C15-C36	16.68	500	5600	3.3
Benzene	0.01	0.4	1	2.5
TEX Total	0.09	3	20	3.0

## Weighted Rolling Mean Summary Results for May 2012.

**Table 3.** The following table shows the values and criteria for the monthly weighted rolling mean at 31 May 2012.

Monthly Values	Rolling Average (mg/kg)	Weighted Rolling Criteria (mg/kg)	Maximum Criteria (mg/kg)	% Actual Value to Weighted Criteria
Arsenic	4.88	12	100	40.7
Boron	12.31	130	260	9.5
Cadmium	0.06	0.65	7.5	9.2
Chromium	49.29	125	400	39.4
Copper	22.44	90	325	24.9
Mercury	0.07	0.45	0.75	15.6
Nickel	14.96	105	320	14.2
Lead	14.76	65	250	22.7
Zinc	21.9	400	1160	5.5
Benzo(a)pyrene Equivalence	0.15	1	2.15	15.0
Cyanide	0.06	1	25	6.0
Total DDT	0.04	0.7	12	5.7
Aldrin	0	0.7	12	0.0
Dieldrin	0	0.7	6	0.0
C7-C9	5.54	20	300	27.7
C10-C14	12.31	50	300	24.6
C15-C36	24.87	500	5600	5.0
Benzene	0.03	0.4	1	7.5
TEX Total	0.15	3	20	5.0

**Table 4.** The following table shows the values and criteria for the 12-month weighted rolling mean for the period April to May 2012.

12-Month Values	Rolling Average (mg/kg)	Weighted Rolling Criteria (mg/kg)	Maximum Criteria (mg/kg)	% Actual Value to Weighted Criteria
Arsenic	3.26	12	100	27.2
Boron	8.7	130	260	6.7
Cadmium	0.06	0.65	7.5	9.2
Chromium	30.58	125	400	24.5
Copper	19.9	90	325	22.1
Mercury	0.07	0.45	0.75	15.6
Nickel	23.09	105	320	22.0
Lead	16.15	65	250	24.8
Zinc	44.94	400	1160	11.2
Benzo(a)pyrene Equivalence	0.18	1	2.15	18.0
Cyanide	0.06	1	25	6.0
Total DDT	0.02	0.7	12	2.9
Aldrin	0	0.7	12	0.0
Dieldrin	0	0.7	6	0.0
C7-C9	5.5	20	300	27.5
C10-C14	10.01	50	300	20.0
C15-C36	18.48	500	5600	3.7
Benzene	0.02	0.4	1	5.0
TEX Total	0.1	3	20	3.3

## **APPENDIX D**

### **Summary of Analytical Test Results**

## Analytical Test Results

### Results:

Parameters (mg/kg)	Weighted Rolling 12-Month Mean >2m Deep (mg/kg)	Maximum Value >2m Deep (mg/kg)	Test Load # 3KTL-0001	Test Load # 3KTL-0002	Test Load # 3KTL-0003	Test Load # 3KTL-0004
Arsenic	12	100	4	2	5	Awaiting Results
Boron	130	260	20	20	20	Awaiting Results
Cadmium	0.65	7.5	0.11	0.1	0.1	Awaiting Results
Chromium	125	400	34	34	40	Awaiting Results
Copper	90	325	22	31	18	Awaiting Results
Lead	65	250	26	13.2	10	Awaiting Results
Mercury	0.45	0.75	0.1	0.1	0.1	Awaiting Results
Nickel	105	320	23	48	12	Awaiting Results
Zinc	400	1160	86	58	17	Awaiting Results
Cyanide	1	25	0.1	0.1	0.1	Awaiting Results
C <sup>7</sup> -C <sup>9</sup>	20	300	9	9	9	Awaiting Results
C <sup>10</sup> -C <sup>14</sup>	50	300	20	20	20	Awaiting Results
C <sup>15</sup> -C <sup>36</sup>	500	5600	40	40	40	Awaiting Results
DDT	0.7	12	0.06	0.06	0.07	Awaiting Results
Aldrin	0.7	12	0.01	0.01	0.011	Awaiting Results
Dieldrin	0.7	6	0.01	0.01	0.011	Awaiting Results
BaP (eq)	1	2.15	0.42	0.002	0.002	Awaiting Results
Benzene	0.4	1	0.06	0.05	0.05	Awaiting Results
TEX (Total)	3	20	0.12	0.1	0.1	Awaiting Results

### Details:

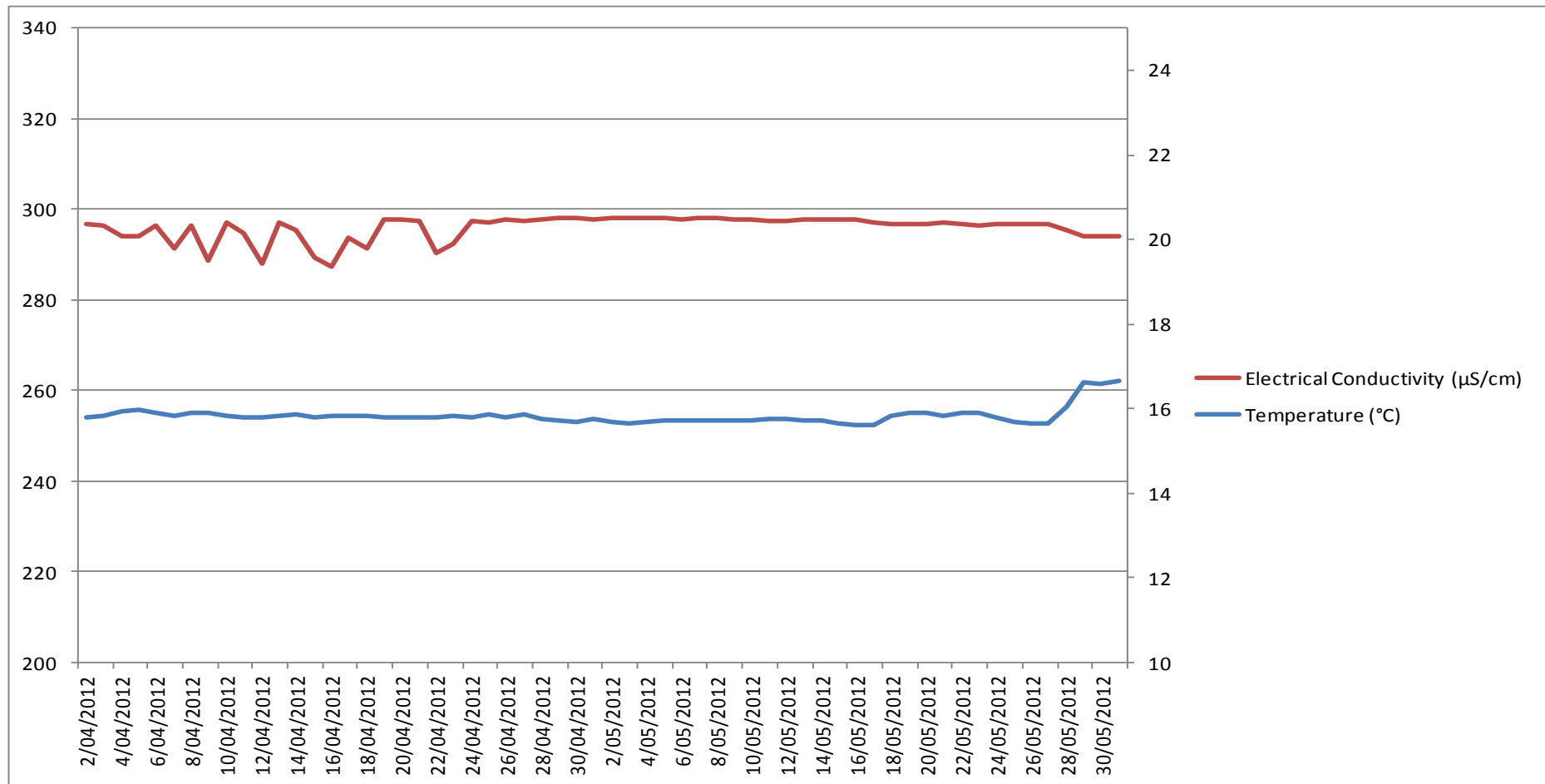
Test Load #:	Date Sampled:	Date Results Received:	Street Address:	Suburb:	Job #:	Compliant
3KTL-0001	23/04/2012	2/05/2012	Ngapipi Rd	St Helliers	9400006	Yes
3KTL-0002	8/05/2012	17/05/2012	Mahoe St	Remuera	9400037	Yes
3KTL-0003	18/05/2012	25/05/2012	Ladies Mile	Ellerslie	9400057	Yes
3KTL-0004	29/05/2012	Awaiting Results	Dryden Rd	Grey Lynn	9400015	Awaiting Results

## **APPENDIX E**

### Summary of Continuous Monitoring Data

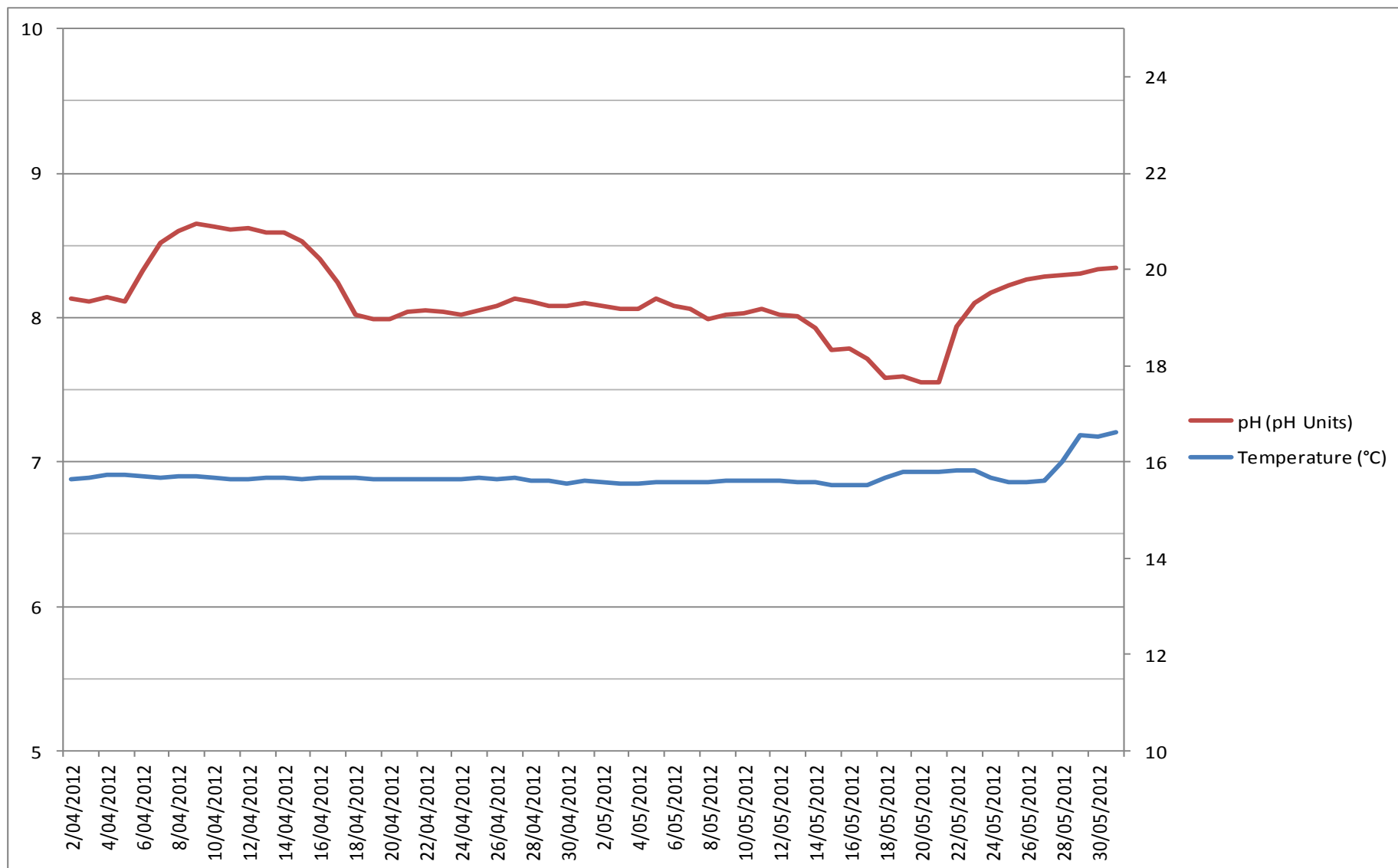


## Average Electrical Conductivity Record



**Figure 1.** This figure illustrates the average daily electrical conductivity of the water at the dewatering well head. This average is based on the readings taken at 5 second intervals. The average temperature has also been plotted as an additional reference.

## Average pH Record



**Figure 2.** This figure illustrates the average daily pH of the water at the dewatering well head. This average is based on the readings taken at 5 second intervals. The average temperature has also been plotted as an additional reference.

## **APPENDIX F**

### Groundwater Monitoring Data

### Three Kings Groundwater Chemistry Results

Note: all units are g/m<sup>3</sup> unless otherwise noted)

	Triggers Levels - Dewatering Well	Trigger Levels - Borehole 7	Lab Ref: 111221-131		Lab Ref: 120119-119		Lab No: 992783		Lab No: 998110	
			21/12/2011		19/01/2012		28/03/2012		13/04/2012 (re-test)	
			DW-002	BH7-002	DW-003	BH7-003	DW-004	BH7-004	DW-005	BH7-005
Arsenic	0.002	0.002	0.0014	0.00098	0.0016	0.001	0.0016	< 0.0010	no test	no test
Boron	0.07	0.07	0.038	0.041	0.044	0.049	0.054	0.056	no test	no test
Cadmium	0.00009	0.00009	<0.00005	<0.00005	<0.00005	<0.00005	< 0.00005	< 0.00005	no test	no test
Chromium	0.0011	0.0011	0.00042	0.00032	0.00046	0.0003	< 0.0005	0.001	no test	no test
Copper	0.003	0.003	0.0013	<0.0002	0.001	<0.0002	0.0023	< 0.0005	no test	no test
Mercury	0.0004	0.0004	<0.00005	<0.00005	<0.00005	<0.00005	< 0.00008	< 0.00008	no test	no test
Nickel	0.003	0.003	0.00019	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Lead	0.0007	0.0007	<0.0001	<0.0001	<0.0001	<0.0001	0.00023	< 0.00010	no test	no test
Zinc	0.008	0.008	0.0045	0.014	0.0024	0.003	0.0065	0.0092	no test	0.0038
Benzo-a-pyrene (equivalents)	0.00035	0.00035	<0.0001	<0.0001	<0.0001	<0.01	< 0.00005	< 0.00005	no test	no test
DDT (equivalents)	0.0005	0.0005	no data	no data	<0.00004	<0.00004	< 0.00006	< 0.00006	no test	no test
Aldrin	0.00002	0.00002	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000005	< 0.000005	no test	no test
Dieldrin	0.00002	0.00002	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000005	< 0.000005	no test	no test
Benzene (TPH (total) surrogate)	0.005	0.005	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Cyanide	0.04	0.04	<0.01	<0.01	<0.01	<0.01	< 0.0010	0.0029	no test	no test
Bromodichloromethane	0.03	0.03	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Bromoform	0.05	0.05	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Carbon tetrachloride	0.0025	0.0025	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Chloroform	0.1	0.1	<0.0001	0.0015	<0.0001	0.0011	< 0.0005	0.0009	no test	no test
Di(2-ethylhexyl)adipate	0.05	0.05	<0.002	<0.002	<0.002	<0.2	< 0.0010	< 0.0010	no test	no test
Di(2-ethylhexyl)phthalate	0.0045	0.0045	<0.002	<0.002	<0.002	<0.2	< 0.003	< 0.003	no test	no test
1,2-dibromo-3-chloropropane	0.0005	0.0005	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Dibromochloromethane	0.075	0.075	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,2-dibromomethane	0.0002	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,2-dichlorobenzene	0.75	0.75	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,4-dichlorobenzene	0.2	0.2	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,2-dichloropropane	0.025	0.025	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,3-dichloropropene	0.01	0.01	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
cis-1-3-dichloropropene	0.01	0.01	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
trans-1-3-dichloropropene	0.01	0.01	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Endosulfan 1	0.01	0.01	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000010	< 0.000010	no test	no test
Endosulfan 2	0.01	0.01	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000010	< 0.000010	no test	no test
Endrin	0.0005	0.0005	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000005	< 0.000005	no test	no test
Ethylbenzene	0.15	0.15	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Fluoranthene	0.002	0.002	<0.0001	<0.0001	<0.0001	<0.01	< 0.000008	< 0.000008	no test	no test
Heptachlor	0.00002	0.00002	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000005	< 0.000005	no test	no test
Heptachlor epoxide	0.00002	0.00002	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000005	< 0.000005	no test	no test
Hexachlorobenzene	0.00005	0.00005	<0.0005	<0.0005	<0.0005	<0.05	< 0.00004	< 0.00004	no test	no test
Hexachlorobutadiene	0.00035	0.00035	<0.0005	<0.0005	<0.0005	<0.05	< 0.0005	< 0.0005	no test	no test
Lindane	0.001	0.001	<0.00004	<0.00004	<0.00004	<0.00004	< 0.000010	< 0.000010	no test	no test
Pentachlorophenol	0.0045	0.0045	<0.001	<0.001	<0.001	<0.1	< 0.0003	< 0.0003	no test	no test
pH	<7 or >8.5	<7 or >8.5	8.1	8.2	7.7	8	7.8	7.8	no test	no test
Styrene	0.015	0.015	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Tetrachloroethene	0.025	0.025	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Toluene	0.4	0.4	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0010	< 0.0010	no test	no test
1,2,4-Trichlorobenzenes	0.015	0.015	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,2,3-Trichlorobenzenes	0.015	0.015	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
1,1,1-trichloroethane	1	1	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Trichloroethene	0.04	0.04	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
2,4,6-trichlorophenol	0.1	0.1	<0.004	<0.004	<0.004	<0.4	< 0.0010	< 0.0010	no test	no test
Vinyl chloride	0.00015	0.00015	<0.0001	<0.0001	<0.0001	<0.0001	< 0.00010	< 0.00010	no test	no test
ortho-xylene	0.3	0.3	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
meta&para-xylene	0.3	0.3	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0005	< 0.0005	no test	no test
Turbidity (units NTU)	30NTU	No test required	no data	not tested	<0.1	not tested	0.1	not tested	no test	no test
Conductivity (units mS/m)	No trigger	No test required	30.3	not tested	6.9	not tested	29.4	not tested	no test	no test
Suspended Solids	30	No test required	1.5	not tested	<1.0	not tested	<3	not tested	no test	no test

#### Legend:

	WaterCare level of detection is above trigger limit
	Hills and WaterCare level of detection is above trigger limit
	Lab issue where dilution was required resulting in higher result reported. See note attached note.
	Lab issue where results were never received from WaterCare
	Result above trigger limit

## **APPENDIX G**

### **Air Monitoring Results**

### Three Kings Quarry Summary monitoring results for the period April 2012

Date	Day	daily average WS (m/sec)	daily average WD ( degrees )	Daily Rain (mm)	Site TSP Office (µg/m³)	BAM Office (µg/m³)	Site TSP North Boundary (µg/m³)	BAM South Boundary (µg/m³)
1/04/2012	Sun	2.657	112.556	0.200	16.6	32.2	14.8	
2/04/2012	Mon	3.237	127.729	0.800		30.5		
3/04/2012	Tue	4.075	141.049	0.000	38.6	18.8	59	
4/04/2012	Wed	3.749	151.094	0.000		10.7		
5/04/2012	Thu	2.928	137.944	0.000	23.3	16.9	33.4	
6/04/2012	Fri	2.018	134.368	0.000		12.6		
7/04/2012	Sat	1.453	152.063	0.000		13.6		
8/04/2012	Sun	3.200	194.097	0.000		6.9		
9/04/2012	Mon	3.090	202.566	0.000		12.1		
10/04/2012	Tue	1.334	211.535	0.000	no data	15.2	27.6	
11/04/2012	Wed	2.719	148.913	13.000		6.5		
12/04/2012	Thu	4.274	208.771	0.200	38	17.2	25.7	
13/04/2012	Fri	4.616	209.226	0.000		22.6		
14/04/2012	Sat	2.832	188.951	1.400		20.5		
15/04/2012	Sun	1.282	148.604	0.000		21.8		
16/04/2012	Mon	1.573	198.201	0.000	60.7	24.7	28.2	
17/04/2012	Tue	1.738	189.083	0.000		19.4		
18/04/2012	Wed	1.937	167.684	0.000	35.6	19.6	24.4	
19/04/2012	Thu	1.790	165.184	0.000		4.6		
20/04/2012	Fri	1.374	165.844	0.000		4.4		
21/04/2012	Sat	1.153	149.566	0.000	21.1	5.5	16.6	
22/04/2012	Sun	1.188	120.628	0.000		16.5		
23/04/2012	Mon	1.542	119.243	0.000		12.9		
24/04/2012	Tue	1.436	109.559	0.000		10.5		
25/04/2012	Wed	1.596	109.806	0.000	14.46	15.5	7.64	
26/04/2012	Thu	1.909	111.375	0.000		20.2		13.0
27/04/2012	Fri	3.739	184.080	9.200	29.34	17.4	19.77	15.4
28/04/2012	Sat	3.250	230.139	0.800		17.2		19.8
29/04/2012	Sun	1.713	251.373	0.400		14.3		13.7
30/04/2012	Mon	2.980	228.413	0.800		15.7		22.8

### Three Kings Quarry Summary monitoring results for the period May 2012

Date	Day	daily average WS (m/sec)	daily average WD ( degrees )	Daily Rain (mm)	Site TSP Office (µg/m³)	BAM Office (µg/m³)	Site TSP North Boundary (µg/m³)	BAM South Boundary (µg/m³)
1/05/2012	Tue	3.360	203.038	0.000	40	18.1		20.2
2/05/2012	Wed	2.610	174.726	0.000		14.2		9.0
3/05/2012	Thu	1.739	158.094	0.000	29	14.1	36	11.9
4/05/2012	Fri	1.108	145.677	0.000		18.7		15.7
5/05/2012	Sat	1.068	131.361	0.000		14.6		13.2
6/05/2012	Sun	1.606	129.927	0.000	16	9.6		10.9
7/05/2012	Mon	2.071	118.122	0.000		11.2		10.0
8/05/2012	Tue	2.426	123.566	26.400	20	16.4	20	12.5
9/05/2012	Wed	1.444	135.962	21.400		15.9		13.2
10/05/2012	Thu	1.973	157.997	0.200		12.5		7.6
11/05/2012	Fri	4.106	207.354	0.200		12.7		11.3
12/05/2012	Sat	2.989	206.278	0.400	22	16.4		14.0
13/05/2012	Sun	2.531	231.587	0.200		15.6		12.9
14/05/2012	Mon	3.608	147.444	9.800		12.0		9.8
15/05/2012	Tue	2.838	234.215	15.400		14.6		11.5
16/05/2012	Wed	3.471	224.438	9.800	19	11.8	20	12.7
17/05/2012	Thu	3.954	211.708	1.400		19.1		19.6
18/05/2012	Fri	4.072	225.795	0.200		17.6		17.6
19/05/2012	Sat	3.039	223.674	2.600	23	14.9		16.3
20/05/2012	Sun	2.181	234.635	0.000		18.2		19.2
21/05/2012	Mon	1.139	229.722	0.000		30.8		no data
22/05/2012	Tue	0.968	152.163	0.000		19.6		no data
23/05/2012	Wed	1.079	155.309	0.000		21.3		28.0
24/05/2012	Thu	1.774	224.344	0.000		17.2		16.3
25/05/2012	Fri	2.368	236.181	0.000		16.0		13.8
26/05/2012	Sat	1.017	147.628	0.000		18.1		13.5
27/05/2012	Sun	3.561	106.962	1.200		12.4		10.3
28/05/2012	Mon	2.099	175.108	11.200		13.7		9.7
29/05/2012	Tue	3.479	182.225	0.200		14.7		16.6
30/05/2012	Wed	1.474	200.726	0.200		15.9		14.9
31/05/2012	Thu	3.143	192.340	0.600		19.9		17.9