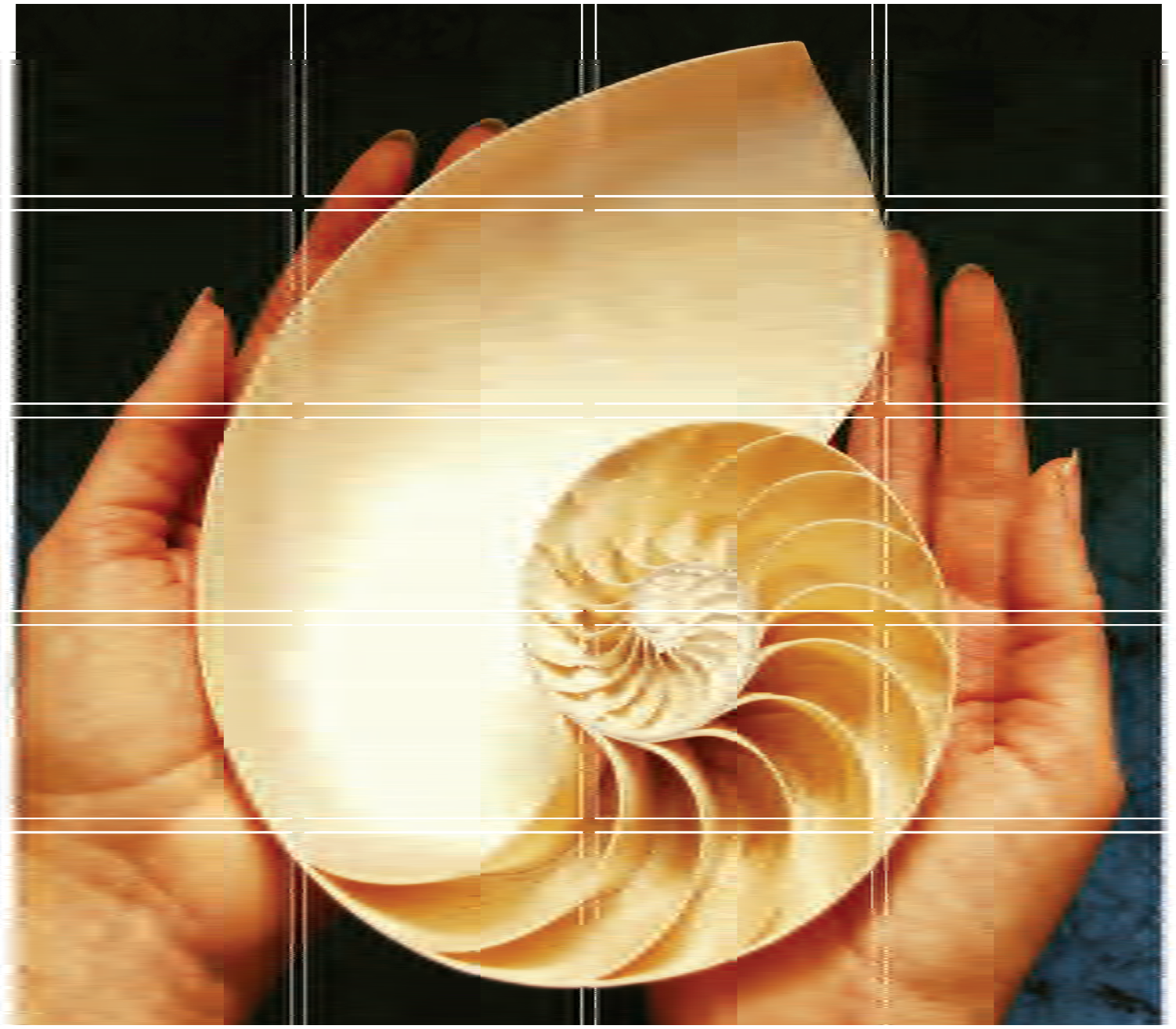


Environmental Health Assessment Report

Tara Complaint Investigation Report

Queensland Gas Company

January 2013

0181432R01

www.erm.com

Delivering sustainable solutions in a more competitive world

ERM

FINAL REPORT

Queensland Gas Company

ENVIRONMENTAL HEALTH ASSESSMENT REPORT

Tara Complaint Investigation Report

0181432R01

January 2013

Queensland Gas Company

Approved by:	*Ken Kiefer*
Position:	Project Manager
Signed:	
Date:	*8 January 2013*
Approved by:	*Greg Wheeler*
Position:	Partner Director
Signed:	
Date:	*8 January 2013*

Environmental Resources Management Australia Pty Ltd Quality System

Certified System
Quality
ISO 9001
SAI GLOBAL

Environmental Health Assessment Report

Tara Complaint Investigation Report

January 2013

Final

REF: 0181432R01

www.erm.com

This disclaimer, together with any limitations specified in the report, apply to use of this report. This report was prepared in accordance with the contracted scope of services for the specific purpose stated and subject to the applicable cost, time and other constraints. In preparing this report, ERM relied on: (a) client/third party information which was not verified by ERM except to the extent required by the scope of services, and ERM does not accept responsibility for omissions or inaccuracies in the client/third party information; and (b) information taken at or under the particular times and conditions specified, and ERM does not accept responsibility for any subsequent changes. This report has been prepared solely for use by, and is confidential to, the client and ERM accepts no responsibility for its use by other persons. This report is subject to copyright protection and the copyright owner reserves its rights. This report does not constitute legal advice.

CONTENTS

EXECUTIVE SUMMARY

1 INTRODUCTION

1.1 BACKGROUND 1
1.2 RISK ASSESSMENT OBJECTIVES 1

2 ISSUES IDENTIFICATION

2.1 BACKGROUND 2
2.2 ENVIRONMENTAL SETTING 2
2.2.1 STUDY AREA DESCRIPTION 2
2.2.2 HYDROLOGY 3
2.3 CSG SOURCES AND MIGRATION 3
2.3.1 CSG WATER 3
2.3.2 CSG AIR 4
2.3.3 SURFACE WATER MIGRATION PATHWAYS 5
2.3.4 AIR PATHWAYS 5

3 FIELDWORK

3.1 FIELD METHODOLOGY 7
3.2 WATER 7
3.3 SOIL 8
3.4 AIR 8

4 LABORATORY ANALYTICAL RESULTS

4.1 LABORATORY ANALYSIS WATER 9
4.1.1 WATER ION CHEMISTRY 9
4.2 LABORATORY ANALYSIS SOIL 10
4.3 LABORATORY ANALYSIS AIR 10

5 DATA EVALUATION

5.1 DATA QUALITY EVALUATION 11
5.1.1 DATA QUALITY OBJECTIVES 11
5.1.2 QUALITY CONTROL/QUALITY ASSURANCE SAMPLES 11
5.1.3 DATA QUALITY ASSESSMENT CRITERIA 13
5.1.4 DATA QUALITY ASSESSMENT SUMMARY 14

6 CONCEPTUAL SITE MODEL

6.1 SOURCE PATHWAY RECEPTOR LINKAGES (SPR LINKAGES) 16
6.1.1 SENSITIVE HUMAN RECEPTORS 16
6.1.2 SUMMARY OF COMPLETE SPR LINKAGES 16

CONTENTS

7	TIER 1 CHEMICAL SCREENING	
7.1	TIER 1 SCREENING CRITERIA	19
7.1.1	WATER	19
7.1.2	SOIL	20
7.1.3	AIR	20
7.2	TIER 1 SCREENING RESULTS	21
7.2.1	WATER	21
7.2.2	SOIL	22
7.2.3	AIR	22
8	CONCLUSIONS	

LIST OF FIGURES

FIGURE 1	STUDY AREA
FIGURE 2	CONCEPTUAL SITE MODEL

LIST OF TABLES

TABLE 1	SUMMARY OF WATER ANALYTICAL RESULTS
TABLE 2	SUMMARY OF SOIL ANALYTICAL RESULTS
TABLE 3	SUMMARY OF AIR ANALYTICAL RESULTS
TABLE 4	QUALITY CONTROL - FIELD DUPLICATES - WATER
TABLE 5	QUALITY CONTROL - FIELD DUPLICATES - SOIL

ANNEXURES

ANNEX A	REFERENCES
ANNEX B	SCOPE OF WORKS: WATER, AIR, AND SOIL MONITORING OF PRIVATE LAND IN KENYA BLOCK (QCOPS-OPS-USP-SOW-000020)
ANNEX C	LOT FIGURES
ANNEX D	SGS ANALYTICAL REPORTS
ANNEX E	SCHOELLER DIAGRAMS

EXECUTIVE SUMMARY

Queensland Gas Company (QGC) contracted Environmental Resources Management Australia Pty Ltd (ERM) to conduct an Environmental Health Assessment Report (EHAR) on the results of sampling conducted at nine (9) rural residential properties (Lots) within the Tara Estates and QGC's wells (hereafter collectively referred to as the 'study area'). Complaints from the Tara Estates triggered the need to complete an environmental investigation at their Lots. ERM's review was based on the results from the environmental investigations at the Lots and at QGC's wells in the study area.

The objective of this EHAR was to identify if the results reported from the environmental investigations indicate the potential for Coal Seam Gas (CSG) activities to produce emissions that may impact on the health of local residents.

Study Area

The environmental investigations were undertaken at nine (9) Lots, described as follows:

- *Lot 1* [redacted]
- *Lot 5* [redacted]
- *Lot 7* [redacted]
- *Lot 8* [redacted]
- *Lot 9* [redacted]
- *Lot 13* [redacted]
- *Lot 127* [redacted]
- *Lot 166* [redacted]
- *Lot 237* [redacted]

Twelve (12) CSG wells are located between 0.6 km and 17 km from the Lots and are used for the extraction of CSG and water from the Walloon coal seam.

Human Receptors and Exposure Pathways

The residential receptors in the study area were considered in the risk assessment. Releases of coal seam gas and coal seam water have not occurred. Accordingly, there are no complete SPR linkages between coal seam gas production in the study area and the Lots. However, the EHAR conservatively considered the following pathways potentially complete:

- *Direct contact with soil (incidental ingestion and dermal contact);*
- *Ingestion from the domestic use of water; and*
- *Inhalation of ambient air.*

Risk Characterisation Results

The screening of water, soil and air data identified several constituents which exceeded health based criteria, which indicates potential health risks, however, the presence of these constituents within the study area is not due to CSG activities and are from other sources.

Overall, the review of the reported investigation results from the study area does not indicate the presence of constituents related to CSG activities that may impact the health of residents.

1 INTRODUCTION

1.1 BACKGROUND

Queensland Gas Company (QGC) contracted Environmental Resources Management Australia Pty Ltd (ERM) to conduct an Environmental Health Assessment Report (EHAR) on the results of sampling conducted at nine (9) rural residential properties (Lots) within the Tara Estates and QGC's wells (hereafter collectively referred to as the 'study area') which requested environmental investigations at their Lots. Complaints from the Tara Estates triggered the need to complete an environmental investigation at their Lots. ERM's review was based on the results from the environmental investigations at the Lots and at QGC's wells in the study area.

The objective of this EHAR was to identify if the results reported from the sampling program indicate the potential for Coal Seam Gas (CSG) activities to produce emissions that may impact on the health of local residents.

1.2 RISK ASSESSMENT OBJECTIVES

The overall objective for environmental investigations with in the study area was to identify whether environmental media sampled (including water, soil, and air) indicate the potential for CSG activities conducted by QGC or other CSG proponents to produce emissions that may impact the health of local residents.

2 ISSUES IDENTIFICATION

2.1 BACKGROUND

The environmental investigation was undertaken at nine (9) Lots, described as follows:

- Lot 1 [redacted]
- Lot 5 [redacted]
- Lot 7 [redacted]
- Lot 8 [redacted]
- Lot 9 [redacted]
- Lot 13 [redacted]
- Lot 127 [redacted]
- Lot 166 [redacted]
- Lot 237 [redacted]

Twelve (12) CSG wells are located between 0.6 km and 17 km from the Lots and are used for the extraction of CSG and water from the Walloon coal seam (*Figure 1*).

2.2 ENVIRONMENTAL SETTING

2.2.1 Study Area Description

The Tara Estates study area, is located approximately 2.5 kilometres west of the town of Wieambilla and covers an area of approximately 19 hectares (ha). The study area location is illustrated in *Figure 1, Annex A*. The study area currently comprises nine (9) Lots, which are vegetated with dense scrub to open woodland. Buildings (located in small clearings on each Lot) generally include a house, numerous water tanks and small sheds. The majority of residents are utilising rain water for drinking which is stored in water tanks (generally poly tanks), captured from the main dwelling roof (generally tin). No groundwater is extracted for drinking water purposes. Other features include animal pens, dams, caravans and shipping containers. Dams are also utilised for bathing and irrigation purposes on some Lots, water is generally stored in Intermediate Bulk Containers (IBCs).

2.2.2 *Hydrology*

Surface Water

Wieambilla Creek flows from north to south, east of the study area. Jack Creek branches off Wieambilla Creek north of the study area and flows south-west to the west of all nine (9) Lots, with the exception of Lot 1 and Lot 9, which are located further west of Jack Creek.

Dams are present on Lot 5 (1 dam), Lot 8 (5 dams, 2 used for toilet flushing and irrigation), Lot 9 (1 dam and some ephemeral water bodies), Lot 13 (2 dams and an ephemeral water body), Lot 127 (1 dam), Lot 166 (1 dam, no longer used for drinking water) and Lot 237 (1 dam used for irrigation).

It is noted that Lot 237 floods following periods of heavy rainfall and drains to the north-east.

2.3 *CSG SOURCES AND MIGRATION*

2.3.1 *CSG Water*

QGC's petroleum leases that are nearest the study area are named Codie, Kate and Kenya. Codie wells are to the west (within the study area) and north-west (beyond the study area). Kate wells are to the east and north within the study area. Kenya wells are further to the north, beyond the study area.

CSG water composition data is available for 14 Codie wells which are of similar construction and location to other Codie, Kate and Kenya wells. The average chemical composition is shown in *Table 1*.

Table 1 ***Average Groundwater Composition for Codie Wells***

CSG Wells	TDS Average mg/L	Sodium Average mg/L	Chloride Average mg/L	Total Alkalinity (as CaCO3) Average mg/L	Average of pH
COD_WH002	2600	1053	365	1850	8.5
COD_WH003	2217	902	185	1783	8.4
COD_WH004	2100	940	196	5220	8.4
COD_WH005	2167	947	320	1633	8.3
COD_WH006	3229	1286	331	2343	8.5
COD_WH007	2300	1015	238	1850	8.4
COD_WH008	2643	1090	281	2043	8.6
COD_WH009	2250	1020	175	1900	8.5
COD_WH010	2550	1020	315	1900	8.6
COD_WH011	2125	818	220	1550	8.5
COD_WH012	2288	931	284	1713	8.5
COD_WH014	2260	928	290	1700	8.6
COD_WH015	2567	1027	430	1800	8.2
COD_WH017	2333	923	238	1789	8.6
AVERAGE	**2437**	**998**	**277**	**2080**	**8.5**

2.3.2 *CSG Air*

CSG air composition data is available for 14 Codie wells which are of similar construction and location to other Codie, Kate and Kenya wells. The average chemical composition is shown in *Table 2*.

Table 2 ***Average Gas Composition for Codie Wells***

CSG Wells	Average of Carbon Dioxide N Mol %	Average of Ethane N Mol %	Average of Methane N Mol %	Average of Nitrogen N Mol %
COD_WH002	0.11	0.017	97.9	1.97
COD_WH003	0.20	0.018	98.5	1.23
COD_WH004	0.21	0.018	98.3	1.50
COD_WH005	0.25	0.020	97.6	2.13
COD_WH006	0.38	0.020	98.7	0.93
COD_WH007	0.14	0.018	98.5	1.33
COD_WH008	0.17	0.019	98.6	1.17
COD_WH009	0.13	0.020	98.2	1.65
COD_WH010	0.12	0.018	98.5	1.36
COD_WH011	0.26	0.020	98.6	1.18
COD_WH012	0.22	0.020	98.2	1.55
COD_WH014	0.18	0.020	97.7	2.10
COD_WH015	0.30	0.020	97.1	2.63
COD_WH017	0.19	0.018	98.3	1.53
AVERAGE	**0.21**	**0.019**	**98.3**	**1.50**

In addition, a gas monitoring study has been undertaken by the Queensland Government Simtars, *Gas Monitoring at Tara Gas Field for Safety and Health Division, DEEDI Brisbane* report (7 May 2010), in response to concerns raised by Tara residents, with sampling completed between 30 and 31 March 2010. The investigation inspected and sampled a number of "Lauren" and "Codie" wells. The summary of the findings were as follows:

- No gas leaks were detected;
- No toxic gases or volatile organic compounds were found in ambient air downwind from the wells;
- Methane gas was *Not Detected* downwind of any of the seven well heads tested;
- Testing of the coal seam gas from Codie #6 showed a gas that was high in methane content and low in other volatile organic compounds;
- An air sample from over the over pressure vent sample on Codie #6 has elevated methane and was attributed to a venting safety relief valve on pipe work from the well head to a gas separator at the site. The venting is a normal function of this valve. When the measurement was taken a metre away from the vent, no methane was detected;

- Ambient air samples collected downwind from an operating well (Codie #6) showed no presence of coal seam gas components; and
- No public health standards were exceeded in any of the samples of ambient air.

2.3.3 Surface Water Migration Pathways

No releases of coal seam gas production water to surface water have occurred and therefore there are no pathways of potential impact from QGC infrastructure via surface water migration pathways.

2.3.4 Air Pathways

Meteorological data for the period 16-18 July 2012 supplied by QGC (*Annex D*) indicates that the prevalent wind directions are north-easterly to south-easterly. Wind speed was generally recorded at between 5-10 metres per second (m/s), but ranged from 0 to 22 m/s. Reference to the Bureau of Meteorology (BoM) website data confirms these wind directions.

Data gathered in the field by SGS Leeder (as per field methodology described in *Section 3.1* below) does not align with the QGC and BoM data. This is likely to be due to the effect of dense scrub / vegetation described at each of the Lots, which would have impacted upon wind movements in specific locations. As such, the field data collected by SGS Leeder is of limited use when considering wind patterns within the study area as a whole and potential air contamination sources, given they reflect specific conditions on each Lot based more on vegetation clearing.

3 FIELDWORK

Field activities were conducted between 11 and 19 July 2012. The field activities are summarised in *Table 3*, below.

Table 3 Fieldwork Activity Summary

Location	Fieldwork Dates	Fieldwork Activity Summary
Lot 1	12, 13 and 17 July 2012	• 4 soil samples (north, south, east [vegetable garden] and west); • 2 water samples (dam and water tank [drinking water]); and • 2 ambient air samples (near house and driveway).
Lot 5	11 and 12 July 2012	• 4 soil samples (playground, vegetable garden, dam overflow channel and dam spoil stockpile); • 2 water samples (dam and water tank [drinking water]); and • 1 ambient air sample (backyard).
Lot 7	11 and 12 July 2012	• 4 soil samples (dam, swamp, dam spoil and driveway); • 1 water sample (water tank [drinking water]); and • 2 ambient air samples (outdoor kitchen samples taken from the same location during different time periods).
Lot 8	12 July	• 4 soil samples (north [garden], south [near former chicken pen], west [fenced area around house] and west [black loam from end of block]); • 1 water sample (kitchen tap [drinking water]); and • 1 ambient air sample (front yard).
Lot 9	18 and 19 July 2012	• 4 soil samples (front gate, vegetable garden [2 samples] and drainage line); • 2 water samples (dam and water tank [drinking water]); and • 1 ambient air sample (crest of property).
Lot 13	13, 16 and 17 July 2012	• 4 soil samples (around house and from vegetable garden); • 1 water sample (water tank [drinking water]); and • 1 ambient air sample [redacted]
Lot 127	19 July 2012	• 4 soil samples (rear of Lot, area of cracked earth, drainage line and garden); • 1 water sample (water tank [drinking water]); and • 1 ambient air sample.
Lot 166	17, 18 and 19 July 2012	• 4 soil samples (north, south, east and west); • 2 water samples (dam and water tank [drinking water]); and • 2 ambient air samples (front of Lot and house).
Lot 237	12, 13, 16 and 17 July 2012	• 5 soil samples (vegetable garden, east, driveway, sample 4 and sample 5); • 3 water samples (dam, drinking water and water tank); and • 2 ambient air samples (daytime yard and overnight yard).

3.1 *FIELD METHODOLOGY*

Fieldwork included sampling and analysis of water, soil and air samples on each of the nine (9) Lots in accordance with QCGs Scope of Works: Water, Air, and Soil Monitoring of Private Land in Kenya Block QCOPS-OPS-USP-SOW-000020_0 (QGC Scope of Works). Details pertinent in QGCs Scope of Works for each sample matrix are described below. Field notes required in QCGs Scope of Works included the following:

- GPS location of monitoring points (Latitude/Longitude) reported in decimal degrees;
- Photographs of monitoring locations, conditions, equipment and other aspects pertinent to representation of the conditions of the monitoring Lot and equipment on the day of sampling;
- Meteorological conditions and observations at the time of sampling/monitoring including temperature, wind speed and direction, and barometric pressure;
- Observations of physical condition of tank and water delivery infrastructure (taps and plumbing) used in collection of water samples; and
- Field observations and notes pertinent to the monitoring program or likely to impact the quality or representativeness of results.

All samples were required to be stored and transported appropriately under Chain of Custody (COC) documentation, samples were to be transported to the laboratory as soon as possible and analysed within specified holding times to ensure validity of results.

3.2 *WATER*

QCG's Scope of Works required water samples to be collected from potable drinking water sources representative of quality and end use for each residence and to meet the requirements of DEHPs *'Monitoring and Sampling Manual 2009. Environmental Protection (Water) Policy 2009. Version 2, September 2010'.*

Leeder Consulting also collected water samples as per their internal specifications *LS-QCG-004 Sampling of Water from Ponds and Surface Water Sites,* which details Safety, Equipment, Contamination Prevention and Procedures.

3.3 SOIL

QCGs Scope of Works required soil samples to be collected to represent general soil conditions of each property and at depths considered to represent potential impacts on and the health of crops or plants growing on each property. Sampling was also required to follow *AS 4482 series – Guide to the investigation and sampling of sites with potentially contaminated soil.*

3.4 AIR

QCGs Scope of Works required air samples to be collected to obtain a representative sample of the condition on the day of sampling, but in line with the following points:

- Monitoring should be taken upwind of the residence, in order to be representative of any exposure at the residence from contaminants related to sources outside the property boundary;
- Where practicable, monitoring should be conducted downwind of any CSG infrastructure or operations within the property boundary of surrounding properties;
- Monitoring should be conducted over a suitable time period so as to provide a representative sample of any contaminate exposure;
- Monitoring must not be conducted near artificial contaminant sources which could adversely impact the results including LPG/natural gas appliances, vehicle exhausts, fires, organic solvents, etc; and
- Should long term monitoring be conducted using active/passive sampling equipment left on site, adequate controls and processes to eliminate or identify tampering of sampling equipment should be in place.

Monitoring of ambient air was also required in accordance with *AS 3580 series – Methods for Sampling and Analysis of Ambient Air.*

4 LABORATORY ANALYTICAL RESULTS

A summary of laboratory analytical results is presented in *Tables 1 - 3*. Analytical laboratory reports, chain of custody, and analysis request documentation are included in *Annex D*.

4.1 LABORATORY ANALYSIS WATER

Water samples were submitted to SGS Leeder (a NATA accredited laboratory) for analysis of:

- pH;
- Conductivity;
- Anions and cations;
- Organic carbon (dissolved and total);
- Biological oxygen demand;
- Nitrogen (Nitrate as N, Nitrite as N and Total Nitrogen);
- Total cyanide;
- Total and dissolved metals (suite of 21 metals – aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silica, silver, strontium, vanadium and zinc);
- Total petroleum hydrocarbons (TPH);
- Polycyclic aromatic hydrocarbons (PAH);
- Phenols;
- Benzene, toluene, ethylbenzene and xylenes (BTEX); and
- Coliforms.

4.1.1 Water Ion Chemistry

Ion profiles for the Lots are provided in Schoeller Diagrams (*Annex E*), which does not indicate similarity between the CSG water and the dam and poly tank water indicating that the reported concentrations are not linked to CSG water, rather localised environmental conditions.

The history of the storage tanks used for drinking water and dam water is also unknown.

4.2 LABORATORY ANALYSIS SOIL

Soil samples were submitted to SGS Leeder (a NATA accredited laboratory) for analysis of:

- pH;
- Moisture;
- Conductivity;
- Texture;
- Metals (suite of 12 – aluminium, boron, calcium, copper, iron, magnesium, manganese, molybdenum, potassium, sodium, sulphur and zinc);
- Exchangeable metals;
- Total nitrogen;
- Total phosphorus; and
- Total carbon.

4.3 LABORATORY ANALYSIS AIR

Air samples were submitted to SGS Leeder (a NATA accredited laboratory) for analysis of:

- Vacuum / pressure;
- Volatile organics;
- Total VOC as n-hexane;
- General gases (helium, hydrogen, methane, carbon dioxide, carbon monoxide and ethylene); and
- Sulphur gases.

5 DATA EVALUATION

The goal of data collection is to adequately characterise the nature and extent of potential contamination issues arising from an investigation area. Data collection is an important component of issue identification and the quality of a risk assessment is dependent on the quality of input data on which it is based.

A detailed assessment of the quality of the data used in this assessment and the preliminary evaluation of this data is outlined herein.

5.1 DATA QUALITY EVALUATION

5.1.1 Data Quality Objectives

The amount, nature and quality of the data used in this risk assessment have been determined by the data quality objectives (DQOs). Consideration of the DQOs has been given to ensure the reported data are sufficient to characterise water, soil and air impacts at sampling locations within the study area.

In establishing DQOs for this risk assessment the following general processes have been applied[1]:

- Issue identification – consideration of the setting of the study area and data required to assess plausible exposure pathways and receptors;
- Identification of information needed to adequately characterise the hazard and quantify exposures (including previous assessments, investigations, interviews, historical information, government/agency records);
- Definition of the spatial/temporal adequacy of the data; and
- Setting of acceptable limits for decision and data quality errors relative to consequences.

5.1.2 Quality Control/Quality Assurance Samples

Quality Control/Quality Assurance (QA/QC) samples are used to verify that sampling and analytical systems used in support of project activities are effective and the quality of the data generated is appropriate for making decisions. A review of the method for assessing QA/QC using field and laboratory QC samples is provided below.

---

[1] Adapted from the US EPA, Quality Assurance – QA/G-4, *Guidance for the Data Quality Objectives Process,* in accordance with consideration of Data Quality Objectives described in the *National Environmental Protection (Site Contamination) Measure, 1999* (NEPM).

Precision

Precision is a measure of the degree of agreement between replicate measurements of the same source or sample. Precision is expressed by RPD between replicate measurements. Replicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed using a subset of the measurements made.

The laboratory limits for precision, as measured by the RPD between analyses, are the laboratory control limits, based on historical data calculated, as specified in the analytical methods.

Precision is calculated using the following equation, where Xl and X2 are duplicate measurements:

$$RPD(\%) = \left[\frac{X_1 - X_2}{\left(\frac{X_1 + X_2}{2} \right)} \right] \times 100$$

Accuracy

Accuracy measures the level of bias that an analytical method or measurement exhibits. To measure accuracy, a standard, or reference material containing a known concentration, is analysed or measured and the result is compared to the known value. Several QC parameters are used to evaluate the accuracy of reported analytical results and are listed below.

- Holding times and sample temperatures;
- Laboratory control spike percent recovery;
- Laboratory matrix spike percent recovery (organics);
- Spike sample recovery (inorganics);
- Surrogate spike recovery; and
- Blank sample results.

Surrogate Recovery - Surrogate spike recovery is used to evaluate the accuracy of reported measurements. A surrogate standard is a distinct chemical that behaves similarly to the target chemical and is purposely added to the sample prior to cleanup and extraction. The surrogate spike recovery is used to assess recovery of the target chemical from the sample matrix. A known amount of a surrogate standard is added to the sample prior to cleanup. The amount of the surrogate detected in the analysis is compared to the amount added and the percent recovery is determined. Accuracy is calculated as follows:

$$\%R = \left[\frac{X - T}{K} \right] \times 100$$

where:

R = recovery

X = analytical result of spike sample

T = analytical result of the un-spiked aliquot

K = known addition of the spiked compound

Blanks - Accuracy is also evaluated by comparing results for the analysis of blank samples to results for investigative samples. Blanks are artificial samples designed to evaluate the nature and extent of contamination of environmental samples that may be introduced by field or laboratory procedures. Contaminant concentrations in blanks should be less than detection or reporting limits.

5.1.3 Data Quality Assessment Criteria

Analytical data used to form conclusions presented in this assessment were adopted from the SGS reports for each Lot provided in *Annex D*. As part of these investigations, the QA/QC data were evaluated to determine which met or exceeded acceptable specifications for the study area assessment. This data assessment process was undertaken to ensure that the sample data was of a suitable standard to be utilised for each report.

The quality of analytical data was considered based on the following:

1. Field Quality

- Collection and analysis of field duplicate samples at a rate greater than 1 in 20 primary samples. Relative percent differences (RPDs) of the primary and duplicate samples are required to be within the acceptable range of 50%;
- The inclusion of trip blanks and trip spikes in field sample storage and transportation. Subsequent analysis of trip blanks are required to be less than the laboratory limit of reporting (LOR) and trip spike recoveries are required to be within acceptable recovery criteria; and
- Preparation of field rinsate blanks. Subsequent analysis is required to be below the laboratory LOR.

2. Laboratory Quality

- Preparation of laboratory method blank samples, meeting the required frequency of 1 in 20 samples. Subsequent analysis is required to be below the laboratory LOR;

- Preparation of laboratory matrix spike samples, surrogates and laboratory control samples meeting the required frequency of 1 in 20 samples. Subsequent analysis is required to have a percent recovery within the established limits;
- Preparation of laboratory duplicate samples meeting the required frequency of 1 in 20 samples. Subsequent analysis is required to be within the acceptable RPD range of 70% to 130%; and
- Compliance of container requirements and holding times.

3. Adequacy of Investigation

- Sufficient samples collected to adequately characterise spatial and temporal heterogeneity in chemical concentrations at the site.

5.1.4 Data Quality Assessment Summary

The data review process involves the comparison of the reported chemical concentrations in water, soil, and air samples with conservative health risk screening criteria. The reported concentrations are provided in the laboratory report as *Annex D*. Laboratory analysis was completed by SGS Leeder (a NATA accredited laboratory) per the methods identified in the QGC Scope of Works.

Field QA/QC

Two field duplicate QA/QC water samples were taken per the 16 total water samples. Four field duplicate QA/QC soil samples were taken per the 36 total soil samples. The field duplicate sampling rate for soil and water meet the 1 per 20 samples criteria. No field duplicate air samples were taken.

Field duplicate RPDs were in the acceptable range in reference to AS4482.1-2005 or were not able to be calculated due to analyte concentrations recorded beneath the laboratory LOR, with the some exceptions between primary and duplicate water and soil samples, refer *Table 4 and Table 5, respectively.*

The discrepancy in the RPD noted between the water and soil duplicate pairs is most likely due to the low levels of the reported analytes. Even a minor alteration in concentration between samples can result in a high RPD value when the original concentration is low, or due to the heterogeneous nature of soils. As such, the calculated RPD values are not considered an indicator of poor integrity of results.

Two field blank samples were taken, one air and one water. No soil rinsate blank samples were taken. No analytes were reported above the LOR in the blank results.

Laboratory QA/QC

Laboratory QA/QC analyses (e.g. duplicates, blanks, spikes, and surrogate recoveries) are summarised below:

- All RPDs generated between duplicate laboratory samples were in the acceptable range according to AS4482.1-2005;
- No target analytes were reported in the analysis blanks; and
- All laboratory method blanks had reported concentrations within acceptable limits defined by the laboratory.

As such, the data is considered suitable for its intended use (to provide an assessment of potential contaminant sources that could be associated with Tara Residents' complaints).

6 CONCEPTUAL SITE MODEL

6.1 SOURCE PATHWAY RECEPTOR LINKAGES (SPR LINKAGES)

For exposure to the identified receptors to be considered possible, a mechanism ('pathway') must exist by which contamination from a given source can reach a given receptor. A complete 'source-pathway-receptor' exposure mechanism is referred to as a 'SPR linkage'.

The potential SPR linkages are evaluated for completeness based on the existence of:

- A source of chemical contamination;
- A mechanism for release of contaminants from identified sources (e.g. fugitive emissions from the gas infrastructure at the surface, including from the coal seam gas well head);
- A contaminant retention or transport medium (e.g. soil, air, groundwater etc.);
- Potential receptors of contamination (e.g. groundwater, surface water, people); and
- A mechanism for chemical intake by the receptors at the point of exposure (ingestion, dermal contact, inhalation or a combination thereof).

Whenever one or more of these elements are missing, the SPR linkage is incomplete and the potential risk to the identified receptor is considered unlikely.

6.1.1 *Sensitive Human Receptors*

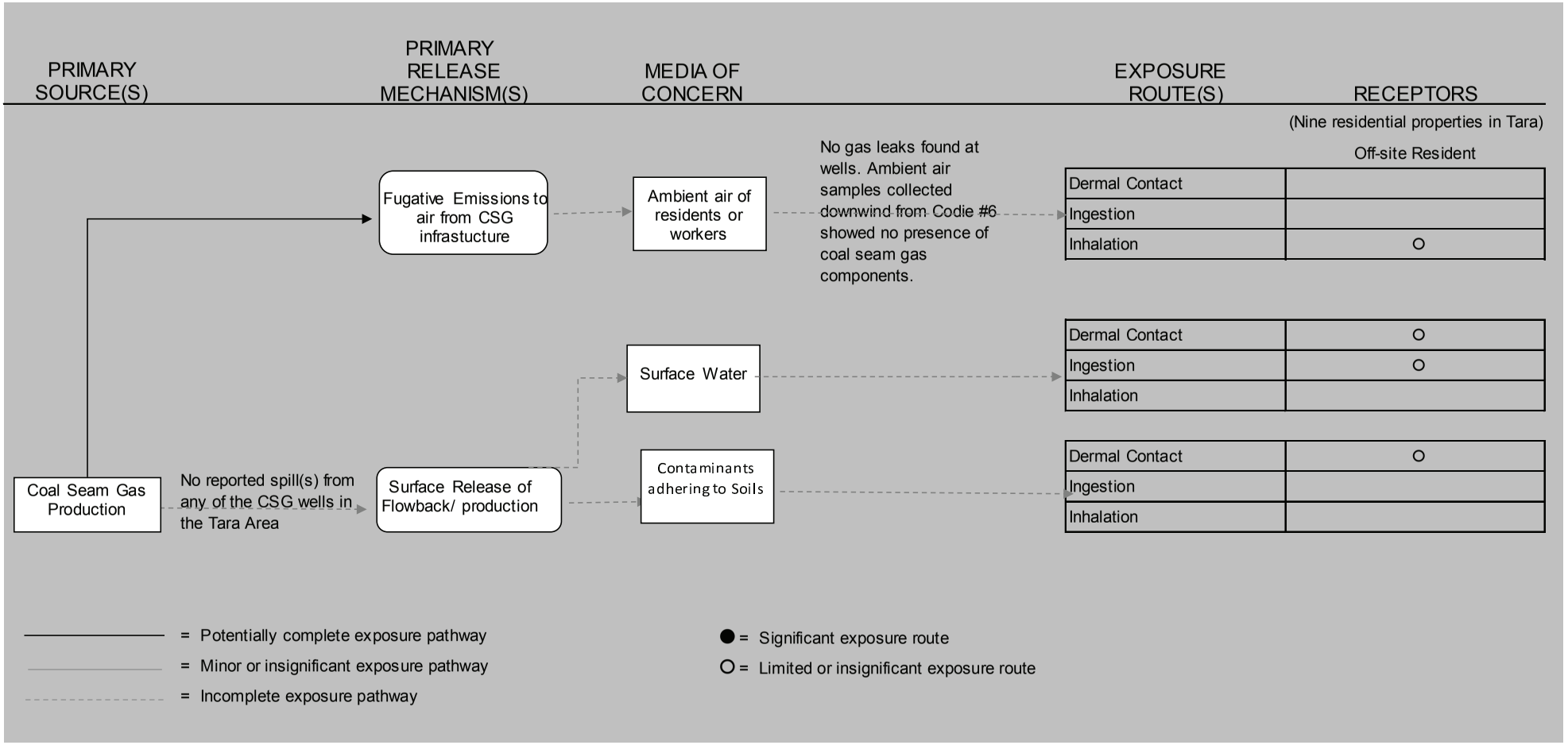
This assessment was to address concerns raised by residents of nine (9) Lots of in the study area. None of the CSG infrastructure lies within the direct vicinity of these residences.

6.1.2 *Summary of Complete SPR Linkages*

Surface releases of coal seam gas production water to surface water have not occurred. In addition, the Queensland Government's gas monitoring study found no gas leaks were detected and ambient air samples collected downwind from an operating well (Codie #6) showed no presence of coal seam gas components. Accordingly, the no complete SPR linkages between coal seam gas production in the study area and Lots exist.

The CSM and potentially complete SPR linkages for the study area are illustrated in *Figure 2* and summarised in *Table 4.*

Table 4 Summary of Exposure Pathways Considered for Human Receptors



7 TIER 1 CHEMICAL SCREENING

The Tier 1 risk assessment process involves comparison of the observed chemical concentrations in soil and groundwater at the study area with conservative 'Tier 1' screening criteria.

The aim of this process is to assess which contaminant concentrations are unlikely to cause a significant risk to human health.

Contaminants with concentrations above the Tier 1 screening criteria are then assessed further as part of the Tier 2 risk assessment.

The two fundamental inputs required to complete a Tier 1 risk assessment include:

- The definition of appropriate generic screening criteria for the identified SPR linkages (outlined in *Section 6*); and
- The appropriate delineation of potential contaminants of concern in water, soil and air to ensure that sampling is representative of concentrations found in the study area.

While complete human exposure pathways were not identified between coal seam gas sources and the residents, due to the lack of releases and the distance from the wells to the residents, the data were still included in the Tier 1 assessment of potential risks.

7.1 TIER 1 SCREENING CRITERIA

7.1.1 Water

The Tier 1 screening criteria applied to the groundwater data were the NHMRC (2004) *Australian Drinking Water Guidelines, National Health and Medical Research Council*.

These guidelines were developed to provide concentrations at which water is considered to be acceptable to drink without being toxic to human health. The NHMRC state that their guidelines define what is safe, good quality water at the point of use (at the tap), addressing both health and aesthetic quality aspects of supplying good quality drinking water.

Aesthetic guidelines were established to indicate the smallest concentration or amount that would be just detected by a trained group of people, would produce noticeable stains on laundry, cause corrosion or encrustation of pipes or fittings or would lead to the perception that water was not of good quality for drinking. These guideline values are usually lower than the health guideline values.

The approach used to derive the guideline values for risks to health is outlined in the NHMRC (2004) document (*Section 6.3.3*) and are considered over a lifetime of consumption, considering potential background exposure to chemicals.

This Tier 1 water screening is considered conservative, because there doesn't appear to be a complete SPR linkage for contaminants associated with coal seam gas productions and water.

7.1.2 Soil

The Tier 1 screening criteria applied to the soil data were the NEPM 'A' (NEPM 1999). These guidelines are the Health Investigation Levels (HIL) for residential land use. These values are listed in the *Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater, National Environmental Protection Measure*.

These criteria are designed to represent a level of acceptable concentrations for surface soils on a residential property. They consider the chronic toxic effects from exposure via inhalation, ingestion or dermal contact with contaminants in soils for a child and adult residents over the course of their life.

The exposure parameters and the toxicity data used to calculate these screening criteria are outlined within the NEPM *Schedule B(4*) *Guideline on Health Risk Assessment Methodology* (1999).

This Tier 1 soil screening is considered conservative, because there does not appear to be a complete SPR linkage for contaminants associated with coal seam gas productions and soil.

7.1.3 Air

The primary Tier 1 screening criteria applied to the air data was the National Environment Protection (NEPM; Air Toxics) Measure, (2004). The National Environment Protection (NEPM; Air Toxics) Measure (2004) were developed by the National Environment Protection Council and were based on exposure within a residential property over the course of a lifetime that would not induce toxic health effects in a resident. The health basis for these levels was from toxicological and epidemiological evidence of a level at which no health effects are observed or expected.

Where NEPM air criteria were not available the US EPA (2012) Regional Screening Levels (RSLs) for residential air were considered. The US EPA RSLs combines current human health toxicity values with standard exposure factors to estimate contaminant concentrations in air that are considered by the US EPA to be protective of human exposures (including sensitive groups such as children or the aged), over a lifetime. It was also recognised that often

it is difficult to determine a source of concentration in ambient air for more common compounds.

7.2 TIER 1 SCREENING RESULTS

The maximum analytical concentrations identified in water, soil and air and the appropriate Tier 1 screening criteria are summarised in *Tables 1-3* attached. The approach and outcomes of this Tier 1 screening assessment are summarised below.

7.2.1 Water

A summary of the constituents reported in air in exceedances of health and aesthetic criteria are summarised in *Table 5* and *Table 6*, respectively.

Table 5 Tier 1 Water Health Exceedances Summary

Location	Exceedances	Notes
Coal Seam Water	Fluoride	
Lot 1	E.coli	The presence of E.coli in drinking water is unlikely due to CSG activities.
Lot 5	None	
Lot 7	None	
Lot 8	None	
Lot 9	Cadmium ; E.coli	The presence of cadmium and E.coli in drinking water is not due to CSG activities and is from other sources.
Lot 13	E.coli	The presence of E.coli in drinking water is not due to CSG activities and is from other sources.
Lot 127	Cadmium; lead	The presence of cadmium and lead is not due to CSG activities and is from other sources.
Lot 166	E.coli	The presence of e.coli is not due to CSG activities and is from other sources.
Lot 237	E.coli	The presence e.coli is not due to CSG activities and is from other sources.

Table 6 ***Tier 1 Water Aesthetics Exceedances Summary***

Location	Exceedances	Notes
Coal Seam Water	pH, TDS, chloride, sodium	
Lot 1	TDS, aluminium, iron, silica, and silver	The presence of TDS, aluminium, iron, silica, and silver is not due to CSG activities and is from other sources.
Lot 5	pH	The irregular pH is not due to CSG activities and is from other sources.
Lot 7	pH	The irregular pH is not due to CSG activities and is from other sources.
Lot 8	None	
Lot 9	Aluminium	The presence of aluminium is not due to CSG activities and is from other sources.
Lot 13	pH	The irregular pH is not due to CSG activities and is from other sources.
Lot 127	Zinc	The presence of zinc is not due to CSG activities and is from other sources.
Lot 166	Aluminium, iron and pH	The presence of aluminium, iron, and irregular pH is not due to CSG activities and is from other sources.
Lot 237	TDS, aluminium, and iron	The presence of TDS, aluminium, and iron is not due to CSG activities and is from other sources.

7.2.2 Soil

No constituents were reported in soil above health risk criteria.

7.2.3 Air

A summary of the constituents reported in air in exceedance of criteria are summarised in *Table 7.*

Table 7 ***Tier Air Exceedances Summary***

Location	Exceedances	Notes
Coal Seam Gas	None	-
Lot 1	None	-
Lot 5	None	-
Lot 7	None	-
Lot 8	None	-
Lot 9	None	-
Lot 13	None	-
Lot 127	None	-
Lot 166	None	-

Location	Exceedances	Notes
Lot 237	Benzene	Benzene was reported in the overnight sample in air above health risk criteria. The average of the two samples was below the NEPM 2004; Air Toxics level. No other constituents were reported in air above health risk criteria. Benezene is not a compound that is found in CSG and this cannot be attributed to CSG activities but rather from a local source such as smoking, etc.

8 *CONCLUSIONS*

The conclusions of the EHAR are as follows:

The review of the reported investigation results from the study area does not indicate the presence of constituents related to CSG activities that may impact the health of residents.

Figures

Tables

Table 1 - Summary of Water Analytical Results
Environmental Health Assessment Report - 0181432

				Lot 1		Lot 5		Lot 7	Lot 8	Lot 9		Lot 13	Lot 127	Lot 166		Lot 237		
				M121364D	M121364D	M121364A	M121364A	M121364B	M121364C	M121364H	M121364H	M121364E	M121364I	M121364G	M121364G	M121364F	M121364F	M121364F
			Sample ID	Lot 1 DW	Lot 1 Dam	Lot 5 Dam	Lot 5 DW Kitchen Sink	Lot 7 DW	Lot 8 DW	Lot 9 DW	Lot 9 Dam	[redacted]DW	Lot 127 DW	Lot 166 Dam	Lot 166 DW	Lot 237 Dam	Lot 237 DW	Lot 237 Polytank
			Sample Date	17/07/2012	17/07/2012	11/07/2012	11/07/2012	11/07/2012	12/07/2012	19/07/2012	19/07/2012	17/07/2012	19/07/2012	18/07/2012	19/07/2012	17/07/2012	17/07/2012	17/07/2012
		Criteria																
Analyte	Unit	ADWG - Health	*ADWG - Asthetics*															
pH (pH Units)	pH	<4 or >11	*<6.5 or>8.5*	6.6	6.8	4.6	6	6.4	7.3	6.8	6.7	4.5	6.8	7.1	8.9	7.8	6.8	6.8
Conductivity (uS/cm)	µS/cm	N/A	*N/A*	30	130	260	20	50	5	20	100	20	20	85	65	350	10	20
Sodium	mg/L	N/A	*180*	8	25	25	0.2	5.8	0.05	0.26	15	<0.05	0.48	13	1	78	0.3	0.07
Potassium	mg/L	N/A	*N/A*	0.32	0.62	0.92	0.21	1	0.11	0.15	3.1	0.08	0.58	0.94	1.5	1.1	0.06	0.09
Calcium	mg/L	N/A	*N/A*	1.3	0.35	0.68	1.1	2.7	0.11	0.41	1.2	0.24	0.33	0.81	10	0.74	0.15	0.13
Magnesium	mg/L	N/A	*N/A*	0.13	2.8	4.7	0.33	1	<0.05	0.09	1.8	0.05	0.29	2.1	0.11	7.1	0.05	<0.05
Sodium Adsorption Ratio (no unit)	-	N/A	*N/A*	1.8	3.1	2.3	<0.1	0.8	<0.1	0.1	2	<0.1	0.1	1.7	0.1	6	0.2	<0.1
Chloride	mg/L	N/A	*250*	3	19	9	<1	5	<1	<1	24	<1	1	21	<1	69	<1	<1
Fluoride	mg/L	1.5	*N/A*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbonate (as CaCO3)	mg/L	N/A	*N/A*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate (as CaCO3)	mg/L	N/A	*N/A*	9	43	<1	5	18	<1	7	10	3	10	5	30	60	2	2
Hydroxide (as CaCO3)	mg/L	N/A	*N/A*	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Alkalinity (as CaCO3)	mg/L	N/A	*N/A*	9	43	<1	5	18	<1	7	10	3	10	5	30	60	2	2
Sulphate as SO4(2-)	mg/L	N/A	*N/A*	<1	<1	70	<1	2	1	2	6	2	2	2	2	62	1	1
Total Phosphorous	mg/L	N/A	*N/A*	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Total Dissolved Solids	mg/L	N/A	*600*	15	640	150	10	34	<1	10	68	8	11	470	38	1300	1300	5
Total Suspended Solids	mg/L	N/A	*N/A*	3	150	<1	<1	<1	<1	<1	24	<1	<1	52	1	100	<1	<1
Total Cations (meq/L)	mEq/L	N/A	*N/A*	0.43	1.4	1.6	0.097	0.5	0.013	0.043	0.92	0.051	0.077	0.78	0.6	4	0.027	0.015
Total Anions (meq/L)	mEq/L	N/A	*N/A*	0.25	1.4	1.7	0.1	0.53	0.064	0.17	1	0.092	0.29	0.72	0.64	4.4	0.066	0.067
Cation / Anion % RPD	%	N/A	*N/A*	NC	1.4	4.8	1.5	3.2	NC	NC	4.1	NC	NC	4	3.3	4.6	NC	NC
Total Organic Carbon	mg/L	N/A	*N/A*	1	9	4	1	1	<1	<1	19	<1	2	7.5	<0.5	13	<1	<1
Dissolved Organic Carbon	mg/L	N/A	*N/A*	<1	8	4	<1	1	<1	<1	15	<1	1	7	<1	12	<1	<1
Biological Oxygen Demand	mg/L	N/A	*N/A*	<2	9	<2	<2	<2	<2	<2	19	<2	<2	<2	<2	9	<2	<2
Nitrate as N	mg/L	50	*N/A*	0.11	0.02	<0.01	0.16	0.11	0.13	0.24	<0.01	0.6	0.13	1.4	0.38	0.02	0.23	0.56
Nitrite as N	mg/L	3	*N/A*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01
Total Nitrogen	mg/L	N/A	*N/A*	0.2	0.3	0.2	0.2	0.2	0.2	0.3	1.5	0.7	0.2	1.7	0.4	0.4	0.3	0.6
Total Cyanide	mg/L	0.08	*N/A*	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Aluminium	mg/L	N/A	*0.02*	0.01	1.4	9.3	<0.001	<0.001	<0.001	0.005	0.2	<0.001	0.007	0.92	0.008	2.6	0.009	0.009
Arsenic	mg/L	0.01	*N/A*	<0.001	0.003	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Barium	mg/L	2	*N/A*	0.006	0.022	0.086	0.015	0.009	0.001	0.006	0.016	0.005	0.003	0.033	0.032	0.1	0.004	0.002
Beryllium	mg/L	0.06	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001
Boron	mg/L	4	*N/A*	<0.001	0.022	0.02	0.007	0.013	0.003	<0.001	0.04	<0.001	0.006	0.012	0.002	0.025	<0.001	<0.001
Cadmium	mg/L	0.002	*N/A*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0021	0.0005	<0.0001	0.0024	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.05	*N/A*	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	N/A	*1*	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.005	<0.001	<0.001
Copper	mg/L	2	*0.3*	0.002	0.001	0.004	0.01	0.006	0.002	0.002	0.002	0.015	0.008	<0.001	<0.001	0.003	0.001	0.05
Iron	mg/L	N/A	*N/A*	0.011	1.3	0.038	<0.001	<0.001	<0.001	0.007	0.58	0.008	0.038	1.9	0.013	1.6	0.01	0.007
Lead	mg/L	0.01	*N/A*	0.001	0.003	0.002	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.01	0.002	0.001	0.005	0.001	0.002
Manganese	mg/L	0.5	*0.1*	0.007	0.035	0.062	0.009	0.001	0.008	0.005	0.019	0.004	0.011	0.021	0.002	0.036	<0.001	<0.001
Mercury	mg/L	0.001	*N/A*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.05	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.02	*N/A*	<0.001	0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.002	0.001	0.004
Selenium	mg/L	0.01	*N/A*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silica (SiO2)	mg/L	N/A	*N/A*	<0.1	13	2.7	0.2	3	0.2	0.2	2.4	<0.1	<0.1	4.2	<0.1	30	<0.1	<0.1
Silver	mg/L	0.1	*N/A*	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	mg/L	N/A	*N/A*	0.015	0.008	0.01	0.01	0.027	<0.001	0.004	0.012	0.002	0.003	0.015	0.04	0.012	0.001	0.002
Vanadium	mg/L	N/A	*N/A*	<0.001	0.009	<0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.006	<0.001	0.023	<0.001	<0.001
Zinc	mg/L	N/A	*3*	1.7	0.016	0.029	2.4	0.028	0.61	4.4	<0.001	0.28	3.2	<0.001	0.65	<0.001	0.52	0.18
Total Aluminium	mg/L	N/A	*N/A*	0.01	1.4	9.3	0.022	<0.001	<0.001	0.005	0.2	<0.001	0.007	0.94	0.006	2.7	0.011	0.01
Total Arsenic	mg/L	N/A	*N/A*	<0.001	0.003	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001
Total Barium	mg/L	N/A	*N/A*	0.006	0.022	0.086	0.015	0.01	0.001	0.006	0.017	0.005	0.003	0.033	0.031	0.1	0.004	0.002
Total Beryllium	mg/L	N/A	*N/A*	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001

				Lot 1		Lot 5		Lot 7	Lot 8	Lot 9		Lot 13	Lot 127	Lot 166		Lot 237		
				M121364D	M121364D	M121364A	M121364A	M121364B	M121364C	M121364H	M121364H	M121364E	M121364I	M121364G	M121364G	M121364F	M121364F	M121364F
			Sample ID	Lot 1 DW	Lot 1 Dam	Lot 5 Dam	Lot 5 DW Kitchen Sink	Lot 7 DW	Lot 8 DW	Lot 9 DW	Lot 9 Dam	[redacted]DW	Lot 127 DW	Lot 166 Dam	Lot 166 DW	Lot 237 Dam	Lot 237 DW	Lot 237 Polytank
		Criteria	Sample Date	17/07/2012	17/07/2012	11/07/2012	11/07/2012	11/07/2012	12/07/2012	19/07/2012	19/07/2012	17/07/2012	19/07/2012	18/07/2012	19/07/2012	17/07/2012	17/07/2012	17/07/2012
Total Boron	mg/L	N/A	N/A	0.005	0.022	0.021	0.007	0.015	0.003	<0.001	0.04	<0.001	0.006	0.013	0.004	0.025	<0.001	<0.001
Total Cadmium	mg/L	N/A	N/A	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0023	0.0005	<0.0005	0.0025	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Chromium	mg/L	N/A	N/A	0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001
Total Cobalt	mg/L	N/A	N/A	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.005	<0.001	<0.001
Total Copper	mg/L	N/A	N/A	0.002	0.001	0.004	0.01	0.011	0.005	0.003	0.002	0.015	0.009	<0.001	<0.001	0.003	0.001	0.051
Total Iron	mg/L	N/A	N/A	0.011	1.3	0.048	<0.001	<0.001	0.031	0.007	0.57	0.008	0.042	2.1	0.011	1.7	0.01	0.008
Total Lead	mg/L	N/A	N/A	0.001	0.003	0.002	0.001	<0.001	<0.001	0.001	0.001	0.001	0.01	0.002	0.001	0.006	0.001	0.002
Total Manganese	mg/L	N/A	N/A	0.007	0.04	0.062	0.009	0.001	0.009	0.007	0.019	0.004	0.011	0.021	0.002	0.034	0.005	0.004
Total Mercury	mg/L	N/A	N/A	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Molybdenum	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Nickel	mg/L	N/A	N/A	<0.001	0.001	0.011	0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.002	0.001	0.002	0.002	0.001	0.004
Total Selenium	mg/L	N/A	N/A	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Silica (SiO2)	mg/L	N/A	N/A	4	380	3.3	0.7	3.7	0.3	0.5	12	0.6	0.4	250	0.3	640	<0.1	0.8
Total Silver	mg/L	N/A	N/A	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Total Strontium	mg/L	N/A	N/A	0.015	0.008	0.012	0.012	0.029	<0.001	0.004	0.013	0.002	0.003	0.015	0.039	0.012	0.001	0.002
Total Vanadium	mg/L	N/A	N/A	<0.001	0.009	<0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.006	<0.001	0.023	<0.001	<0.001
Total Zinc	mg/L	N/A	N/A	1.8	0.016	0.03	2.4	0.035	0.7	4.8	<0.001	0.28	5.4	0.002	0.73	0.003	0.56	0.18
C6-C9	mg/L	N/A	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
C10-C14	mg/L	N/A	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
C15-C28	mg/L	N/A	N/A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C29-C36	mg/L	N/A	N/A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total C6-C36	mg/L	N/A	N/A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Anthracene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo (a) pyrene	mg/L	0.00001	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo (b) fluoranthene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo (ghi) perylene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzo (k) fluoranthene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chrysene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dibenz (ah) anthracene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
7,12-Dimethylbenz(a)anthracene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluorene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Indeno (1,2,3-cd) pyrene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
3-Methylcholanthrene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Naphthalene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phenanthrene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pyrene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Chloro-3-methylphenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Chlorophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
m&p-Cresol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
o-Cresol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dichlorophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,6-Dichlorophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dimethylphenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Methyl-4,6-dinitrophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4-Dinitrophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dinoseb	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hexachlorophene	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2-Nitrophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4-Nitrophenol	mg/L	N/A	N/A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

				Lot 1		Lot 5		Lot 7	Lot 8	Lot 9		Lot 13	Lot 127	Lot 166		Lot 237		
				M121364D	M121364D	M121364A	M121364A	M121364B	M121364C	M121364H	M121364H	M121364E	M121364I	M121364G	M121364G	M121364F	M121364F	M121364F
			Sample ID	Lot 1 DW	Lot 1 Dam	Lot 5 Dam	Lot 5 DW Kitchen Sink	Lot 7 DW	Lot 8 DW	Lot 9 DW	Lot 9 Dam	[redacted] DW	Lot 127 DW	Lot 166 Dam	Lot 166 DW	Lot 237 Dam	Lot 237 DW	Lot 237 Polytank
			Sample Date	17/07/2012	17/07/2012	11/07/2012	11/07/2012	11/07/2012	12/07/2012	19/07/2012	19/07/2012	17/07/2012	19/07/2012	18/07/2012	19/07/2012	17/07/2012	17/07/2012	17/07/2012
		Criteria																
Pentachlorophenol	mg/L	N/A	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phenol	mg/L	N/A	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,3,4,6-Tetrachlorophenol	mg/L	N/A	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4,5-Trichlorophenol	mg/L	N/A	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2,4,6-Trichlorophenol	mg/L	N/A	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Benzene	mg/L	0.001	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	mg/L	0.3	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	mg/L	0.8	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
m&p-Xylenes	mg/L	0.6	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
o-Xylene	mg/L	0.6	*N/A*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Coliforms	CFU/100 mL	N/A	*N/A*	4	3600	<1	11	>60	>80	27	69000	>60	>80	>2400	<1	>800	>80	17
Thermotolerant Coliforms	CFU/100 mL	N/A	*N/A*	2	3600	<1	<1	>15	>8	<1	15000	>23	<1	140	<1	20	<1	2
E.coli	CFU/100 mL	*Should not be detected*		*2*	*3600*	<1	<1	<1	<1	<1	*15000*	>8	<1	*84*	<1	*10*	<1	<1
Faecal Coliforms	CFU/100 mL	N/A	*N/A*	2	3600	<1	<1	>15	>8	<1	15000	>23	<1	140	<1	20	<1	2
Standard Plate Count (CFU/ML)	CFU/100 mL	N/A	*N/A*	>300	1700	>300	>300	>300	>300	>300	5100	>300	>300	1900	~23	540	>300	160

Comments

-' not applicable

NA - no screening criteria available in ADWG Health and Asthetics

NC - Not calculated and/or results below the PQL

			Lot 1				Lot 5				Lot 7				Lot 8				Lot 9			
			M121364D	M121364D	M121364D	M121364D	M121364A	M121364A	M121364A	M121364A	M121364B	M121364B	M121364B	M121364B	M121364C	M121364C	M121364C	M121364C	M121364H	M121364H	M121364H	M121364H
		Sample ID	Lot 1 South	Lot 1 East	Lot 1 West	Lot 1 North	Lot 5 SS1	Lot 5 SS2	Lot 5 SS3	Lot 5 SS4	Lot 7 Dam	Lot 7 Swamp	Lot 7 Spoil	Lot 7 Drive	Lot 8 SS1	Lot 8 SS2	Lot 8 SS3	Lot 8 SS4	Lot 9 Front Gate	Lot 9 Vege 1	Lot 9 Vege 2	Lot 9 Drainage
		Sample Date	13/07/2012	13/07/2012	13/07/2012	13/07/2012	11/07/2012	11/07/2012	11/07/2012	11/07/2012	11/07/2012	11/07/2012	11/07/2012	11/07/2012	12/07/2012	12/07/2012	12/07/2012	12/07/2012	19/07/2012	19/07/2012	19/07/2012	19/07/2012
Analyte	Unit	Criteria																				
		NEPM HIL A																				
pH	pH	N/A	5.4	5.8	5.5	5.2	6.2	5.9	6.4	6.3	5.9	6.4	5.9	6	5	5.6	5.9	5.7	6.4	5.9	6	5.9
Conductivity (1:5)	µS/cm	N/A	25	160	20	20	15	1800	65	160	190	30	95	15	40	170	25	20	30	220	150	55
Soil Moisture	% w/w	N/A	13	17	12	9.8	3.2	9.7	6	7.6	5.3	15	14	0.5	9.6	5.8	17	7.5	17	28	33	24
Colour	-	N/A	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Dark Brown	Light Brown	Light Brown	Orange/Red	Brown	Brown	Brown/Orange	Brown	Brown	Dark Brown	Orange/Cream	Red/Brown	Dark Brown	Dark Brown	Brown
Texture	-	N/A	Loamy	Loamy	Loamy	Loamy	Sandy Loam	Loamy	Loamy	Sandy Loam	Sandy Clay	Loamy Clay	Loamy Clay	Sand	Sandy Loam	Sandy Loam	Loam	Sandy	Sandy	Sandy Clay	Sandy Clay	Sandy Clay
Aluminium	mg/kg	N/A	2700	2800	6600	2100	1200	6000	2900	2200	2300	3100	8100	860	2100	2400	2600	1500	1100	4100	4300	8600
Boron	mg/kg	3000	<2	<2	<2	<2	<2	3	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	4	3	2
Calcium	mg/kg	N/A	110	1200	290	83	100	2900	170	120	<2	300	200	14	1200	3900	440	470	74	8600	3000	440
Copper	mg/kg	1000	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	2	16	<2	<2	<2	7	5	7
Iron	mg/kg	N/A	6300	5500	6600	4700	18000	16000	14000	16000	11000	8800	10000	6800	3500	6300	14000	19000	6900	17000	14000	25000
Magnesium	mg/kg	N/A	92	130	110	74	76	660	190	550	310	350	360	82	210	440	110	200	140	480	480	290
Manganese	mg/kg	1500	9	22	10	7	12	98	27	17	15	32	24	5	57	89	16	22	5	81	78	19
Molybdenum	mg/kg	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Potassium	mg/kg	N/A	92	130	110	100	54	370	110	81	88	140	190	54	350	370	110	250	73	720	750	480
Sodium	mg/kg	N/A	70	89	72	67	61	720	110	790	370	110	210	66	70	100	91	75	130	120	100	140
Sulphur	mg/kg	N/A	<10	<10	<10	<10	<10	590	<10	<10	<10	<10	<10	<10	<10	180	<10	<10	<10	190	<10	<10
Zinc	mg/kg	7000	<2	3	2	<2	15	13	16	3	3	<2	2	<2	32	89	15	20	<2	140	89	<2
Exch-Calcium	meq/100g	N/A	<2	2	<2	<2	<2	14	<2	<2	<2	<2	<2	<2	6	18	<2	2	<2	24	14	<2
Exch-Magnesium	meq/100g	N/A	<2	<2	<2	<2	<2	5	<2	5	<2	3	3	<2	2	9	<2	<2	<2	5	5	2
Exch-Potassium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	2	<2
Exch-Sodium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Exch-Sodium (%)	%	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cation Exchange Capacity	meq/100g	N/A	<2	4.5	<2	<2	<2	20.9	<2	5.7	<2	4.1	4.3	<2	8.9	27.3	2.2	3.4	2.2	30.4	21.2	4.5
Ca/Mg Ratio	-	N/A	NC	NC	NC	NC	NC	2.6	NC	NC	NC	NC	NC	NC	3.1	2	NC	NC	NC	5.3	2.9	NC
Exch-Aluminium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Nitrogen	mg/kg	N/A	1500	1300	1700	620	220	1200	640	350	23	880	730	73	2300	6100	1600	760	190	4600	3500	1500
Total Phosphorus	mg/kg	N/A	47	59	51	31	43	100	46	41	13	67	68	27	270	1300	66	70	23	1300	740	120
Total Carbon	mg/kg	N/A	24000	34000	25000	13000	6000	34000	12000	7800	<1000	14000	17000	<1000	56000	72000	32000	26000	2200	73000	65000	29000

			Lot 13				Lot 127				Lot 166				Lot 237				
			M121364E	M121364E	M121364E	M121364E	M121364I	M121364I	M121364I	M121364I	M121364G	M121364G	M121364G	M121364G	M121364F	M121364F	M121364F	M121364F	M121364F
		Sample ID	[redacted]SS1	SS2	SS3	Vege	Lot 127 Rear	Lot 127 Crack	Lot 127 Drainage	Lot 127 Garden	Lot 166 North	Lot 166 South	Lot 166 West	Lot 166 East	Lot 237 SS1	Lot 237 SS2	Lot 237 SS3	Lot 237 SS4	Lot 237 Driveway
		Sample Date	13/07/2012	13/07/2012	13/07/2012	13/07/2012	19/07/2012	19/07/2012	19/07/2012	19/07/2012	18/07/2012	18/07/2012	18/07/2012	18/07/2012	12/07/2012	12/07/2012	12/07/2012	12/07/2012	12/07/2012
Analyte	Unit	Criteria																	
		NEPM HIL A																	
pH	pH	N/A	5.5	4.9	4.8	6.1	5.6	6	6	5.8	6.7	6.1	6.4	6	6.1	6.6	6.3	6.6	6.4
Conductivity (1:5)	µS/cm	N/A	20	70	130	210	55	10	20	160	15	20	20	15	200	30	80	45	25
Soil Moisture	% w/w	N/A	11	6.3	5.5	17	23	20	19	13	3.8	5.6	7.5	7.4	9.1	7.4	3	12	4.5
Colour	-	N/A	Brown	Light Brown	Light Brown	Brown	Dark Brown	Dark Brown	Orange Brown	Brown	Brown	Brown	Brown	Brown	Red/Brown	Red/Brown	Light Brown	Red	Red
Texture	-	N/A	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy Clay	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy Loamy	Sandy	Sandy
Aluminium	mg/kg	N/A	6300	2600	2100	2200	6500	9100	3100	4900	2700	2700	2100	2000	2200	1200	1300	290	920
Boron	mg/kg	3000	<2	<2	<2	3	2	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2
Calcium	mg/kg	N/A	220	260	220	2500	2400	860	65	1100	110	120	91	250	6900	200	240	15	83
Copper	mg/kg	1000	2	<2	<2	6	8	3	<2	2	<2	<2	<2	<2	19	<2	<2	<2	<2
Iron	mg/kg	N/A	18000	14000	5500	18000	12000	25000	18000	16000	9200	3300	13000	18000	4200	6200	6700	5400	9400
Magnesium	mg/kg	N/A	180	130	120	390	530	290	260	700	140	240	180	140	1700	180	200	85	89
Manganese	mg/kg	1500	30	18	15	92	97	45	6	21	14	13	27	13	480	14	18	12	8
Molybdenum	mg/kg	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2
Potassium	mg/kg	N/A	210	130	87	270	270	340	100	300	140	150	95	96	350	100	71	39	83
Sodium	mg/kg	N/A	98	73	110	140	150	120	140	130	110	84	190	84	90	93	170	110	100
Sulphur	mg/kg	N/A	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	200	<10	<10	<10	<10
Zinc	mg/kg	7000	12	8	9	53	620	15	11	23	4	11	2	2	98	4	7	<2	<2
Exch-Calcium	meq/100g	N/A	<2	<2	<2	19	8	<2	<2	3	<2	<2	<2	<2	18	<2	<2	<2	<2
Exch-Magnesium	meq/100g	N/A	<2	<2	<2	2	5	<2	3	4	<2	2	<2	<2	4	2	2	<2	<2
Exch-Potassium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Exch-Sodium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Exch-Sodium (%)	%	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cation Exchange Capacity	meq/100g	N/A	<2	<2	2.4	22.2	13.3	<2	3.5	7.6	<2	3.4	<2	2.4	23.3	2.3	2.6	<2	<2
Ca/Mg Ratio	-	N/A	NC	NC	NC	7.7	1.7	NC	NC	0.7	NC	NC	NC	NC	4.4	NC	NC	NC	NC
Exch-Aluminium	meq/100g	N/A	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Nitrogen	mg/kg	N/A	910	1100	1100	1400	2800	1700	300	820	880	1300	720	690	2000	740	850	52	280
Total Phosphorus	mg/kg	N/A	88	76	42	280	250	120	29	82	39	47	53	59	1300	58	58	17	42
Total Carbon	mg/kg	N/A	17000	22000	35000	17000	62000	46000	2800	10000	16000	19000	18000	12000	34000	16000	17000	<1000	7100

Comments
-' not applicable
N/A - no screening criteria availabel in NEPM, SIL HIL A (residential)
NC - Not calculated and/or results below the PQL

				Lot 1		Lot 5	Lot 7		Lot 8	Lot 9	Lot 13	Lot 127	Lot 166		Lot 237	
				M121364D	M121364D	M121364A	M121364B	M121364B	M121364C	M121364H	M121364E	M121364I	M121364G	M121364G	M121364F	M121364F
			Sample ID	Lot 1 Near House	Lot 1 Driveway	Lot 5 Backyard	Lot 7 Outdoor Kitchen	Lot 7 Outdoor Kitchen PM	Lot 8 Front Yard	Lot 9 crest of Property	[redacted]	Lot 127	Lot 166 Front	Lot 166 House	Lot 237 yard	Lot 237 Yard
			Sample Date	12-13/07/2012	12-13/07/2012	11/07/2012	11/07/2012 0:00	11/07/2012 0:00	12-13/07/2012	19/07/2012	16/07/2012	19/07/2012	17/07/2012	17/07/2012 0:00	17/07/2012	17/07/2012 0:00
Analyte	Unit	Criteria														
		NEPM Air Toxics - Health (2011)	USEPA RSLS - Health (2012)													
Receipt Vacuum (PSIA)	-	*N/A*	N/A	14.4	14.4	10.1	12.3	13.7	14.4	12.1	14.9	11.4	14.1	14.9	14.7	14.6
Acrolein	µg/m³	*N/A*	0.021	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Acrylonitrile	µg/m³	*N/A*	0.036	<15	<15	<21	<18	<16	<15	<19	<15	<20	<16	<15	<16	<16
tert-Amyl Methyl Ether	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Benzene	µg/m³	*10.3*	0.31	<4.1	<4.1	<5.9	<4.9	<4.4	<4.2	<5.3	<4.3	<5.6	<4.5	<4.3	<4.3	25
Bromodichloromethane	µg/m³	*N/A*	0.066	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
Bromoform	µg/m³	*N/A*	2.2	<9.9	<9.9	<14	<12	<10	<10.0	<13	<10	<13	<11	<10	<10	<10
Bromomethane	µg/m³	*N/A*	5.2	<7.4	<7.4	<11	<8.8	<7.8	<7.5	<9.5	<7.7	<10	<8.1	<7.7	<7.8	<7.8
1,3-Butadiene	µg/m³	*N/A*	0.081	<2.5	<2.5	<3.6	<2.9	<2.6	<2.5	<3.2	<2.6	<3.4	<2.7	<2.6	<2.6	<2.6
2-Butanone (Methyl Ethyl Ketone)	µg/m³	*N/A*	N/A	<4.1	<4.1	<5.9	<4.9	<4.4	<4.2	<5.3	<4.3	<5.6	<4.5	<4.3	<4.3	<4.4
tert-Butyl Alcohol	µg/m³	*N/A*	N/A	<4.1	<4.1	<5.9	<4.9	<4.4	<4.2	<5.3	<4.3	<5.6	<4.5	<4.3	<4.3	<4.4
n-Butylbenzene	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
sec-Butylbenzene	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
tert-Butylbenzene	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Carbon Tetrachloride	µg/m³	*N/A*	0.41	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
Chlorobenzene	µg/m³	*N/A*	52	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Chloroethane	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Chloroform	µg/m³	*N/A*	0.11	<7.4	<7.4	<11	<8.8	<7.8	<7.5	<9.5	<7.7	<10	<8.1	<7.7	<7.8	<7.8
Chloromethane	µg/m³	*N/A*	94	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
2-Chloroprene	µg/m³	*N/A*	N/A	<9.1	<9.1	<13	<11	<9.6	<9.2	<12	<9.5	<12	<9.9	<9.5	<9.6	<9.6
3-Chloropropene	µg/m³	*N/A*	N/A	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
2-Chlorotoluene	µg/m³	*N/A*	N/A	<7.4	<7.4	<11	<8.8	<7.8	<7.5	<9.5	<7.7	<10	<8.1	<7.7	<7.8	<7.8
alpha-Chlorotoluene	µg/m³	*N/A*	N/A	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Cumene	µg/m³	*N/A*	420	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Cyclohexane	µg/m³	*N/A*	6300	<3.3	<3.3	<4.7	<3.9	<3.5	<3.3	<4.2	<3.4	<4.5	<3.6	<3.4	<3.5	<3.5
o-Cymene	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Dibromochloromethane	µg/m³	*N/A*	0.09	<9.9	<9.9	<14	<12	<10	<10.0	<13	<10	<13	<11	<10	<10	<10
1,2-Dibromoethane (EDB)	µg/m³	*N/A*	0.0041	<9.9	<9.9	<14	<12	<10	<10.0	<13	<10	<13	<11	<10	<10	<10
1,2-Dichlorobenzene	µg/m³	*N/A*	210	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
1,3-Dichlorobenzene	µg/m³	*N/A*	N/A	<11	<11	<15	<13	<11	<11	<14	<11	<15	<12	<11	<11	<11
1,4-Dichlorobenzene	µg/m³	*N/A*	0.22	<11	<11	<15	<13	<11	<11	<14	<11	<15	<12	<11	<11	<11
1,1-Dichloroethane	µg/m³	*N/A*	1.5	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
1,2-Dichloroethane	µg/m³	*N/A*	0.094	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
1,1-Dichloroethene	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
cis-1,2-Dichloroethene	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	31	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
trans-1,2-Dichloroethene	µg/m³	*N/A*	63	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
1,2-Dichloropropane	µg/m³	*N/A*	0.24	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
cis-1,3-Dichloropropene	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
trans-1,3-Dichloropropene	µg/m³	*N/A*	N/A	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Diisopropyl Ether	µg/m³	*N/A*	730	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
1,4-Dioxane	µg/m³	*N/A*	0.32	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Ethanol	µg/m³	*N/A*	N/A	<83	<83	<120	<97	<87	<83	<110	<86	<110	<90	<86	<87	<87
Ethyl Acetate	µg/m³	*N/A*	N/A	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Ethyl Benzene	µg/m³	*N/A*	0.97	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Ethyl tert-Butyl Ether	µg/m³	*N/A*	N/A	<4.1	<4.1	<5.9	<4.9	<4.4	<4.2	<5.3	<4.3	<5.6	<4.5	<4.3	<4.3	<4.4
4-Ethyltoluene	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Freon 11	µg/m³	*N/A*	N/A	<2.5	<2.5	<3.6	<2.9	<2.6	<2.5	<3.2	<2.6	<3.4	<2.7	<2.6	<2.6	<2.6
Freon 113	µg/m³	*N/A*	N/A	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
Freon 114	µg/m³	*N/A*	N/A	<2.5	<2.5	<3.6	<2.9	<2.6	<2.5	<3.2	<2.6	<3.4	<2.7	<2.6	<2.6	<2.6
Freon 12	µg/m³	*100*	N/A	2.5	2.6	<3.6	<2.9	<2.6	2.7	<3.2	<2.6	<3.4	3	2.9	3	3.1
Heptane	µg/m³	*N/A*	N/A	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Hexachlorobutadiene	µg/m³	*N/A*	0.11	<17	<17	<24	<19	<17	<17	<21	<17	<22	<18	<17	<17	<17

				Lot 1		Lot 5	Lot 7		Lot 8	Lot 9	Lot 13	Lot 127	Lot 166		Lot 237	
				M121364D	M121364D	M121364A	M121364B	M121364B	M121364C	M121364H	M121364E	M121364I	M121364G	M121364G	M121364F	M121364F
			Sample ID	Lot 1 Near House	Lot 1 Driveway	Lot 5 Backyard	Lot 7 Outdoor Kitchen	Lot 7 Outdoor Kitchen PM	Lot 8 Front Yard	Lot 9 crest of Property	[redacted]	Lot 127	Lot 166 Front	Lot 166 House	Lot 237 yard	Lot 237 Yard
			Sample Date	12-13/07/2012	12-13/07/2012	11/07/2012	11/07/2012 0:00	11/07/2012 0:00	12-13/07/2012	19/07/2012	16/07/2012	19/07/2012	17/07/2012	17/07/2012 0:00	17/07/2012	17/07/2012 0:00
Analyte	Unit	Criteria														
		NEPM Air Toxics - Health (2011)	USEPA RSLS - Health (2012)													
Hexane	µg/m³	*N/A*	730	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
2-Hexanone	µg/m³	*N/A*	31	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
m,p-Xylene	µg/m³	*935*	N/A	<11	<11	<15	<13	<11	<11	<14	<11	<15	<12	<11	<11	<11
Methyl Methacrylate	µg/m³	*N/A*	730	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Methyl tert-butyl ether	µg/m³	*N/A*	9.4	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
4-Methyl-2-pentanone	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Naphthalene	µg/m³	*N/A*	0.072	<17	<17	<25	<20	<18	<17	<22	<18	<24	<19	<18	<18	<18
2-Propanol	µg/m³	*N/A*	N/A	<83	<83	<120	<97	<87	<83	<110	<86	<110	<90	<86	<87	<87
Propene	µg/m³	*N/A*	N/A	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<81	<8.6	<11	<9.0	<8.6	<8.7	<8.7
Propylbenzene	µg/m³	*N/A*	1000	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Styrene	µg/m³	*N/A*	1000	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
1,1,1,2-Tetrachloroethane	µg/m³	*N/A*	0.33	<8.3	<8.3	<12	<9.7	<8.7	<8.3	<11	<8.6	<11	<9.0	<8.6	<8.7	<8.7
1,1,2,2-Tetrachloroethane	µg/m³	*N/A*	0.042	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Tetrachloroethene	µg/m³	*N/A*	N/A	<9.1	<9.1	<13	<11	<9.6	<9.2	<12	<9.5	<12	<9.9	<9.5	<9.6	<9.6
Tetrahydrofuran	µg/m³	*N/A*	2100	<3.3	<3.3	<4.7	<3.9	<3.5	<3.3	<4.2	<3.4	<4.5	<3.6	<3.4	<3.5	<3.5
Toluene	µg/m³	*405*	5200	7	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	13	29
1,2,4-Trichlorobenzene	µg/m³	*N/A*	2.1	<30	<30	<43	<35	<31	<30	<38	<31	<40	<33	<31	<31	<31
1,1,1-Trichloroethane	µg/m³	*N/A*	5200	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
1,1,2-Trichloroethane	µg/m³	*N/A*	0.15	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Trichloroethene	µg/m³	*N/A*	N/A	<7.4	<7.4	<11	<8.8	<7.8	<7.5	<9.5	<7.7	<10	<8.1	<7.7	<7.8	<7.8
1,2,4-Trimethylbenzene	µg/m³	*N/A*	7.3	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
1,3,5-Trimethylbenzene	µg/m³	*N/A*	N/A	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
2,2,4-Trimethylpentane	µg/m³	*N/A*	N/A	<7.4	<7.4	<11	<8.8	<7.8	<7.5	<9.5	<7.7	<10	<8.1	<7.7	<7.8	<7.8
Vinyl Acetate	µg/m³	*N/A*	210	<5.8	<5.8	<8.3	<6.8	<6.1	<5.8	<7.4	<6.0	<7.8	<6.3	<6.0	<6.1	<6.1
Vinyl Bromide	µg/m³	*N/A*	0.076	<6.6	<6.6	<9.5	<7.8	<7.0	<6.7	<8.5	<6.9	<9.0	<7.2	<6.9	<6.9	<7.0
Vinyl Chloride	µg/m³	*N/A*	0.16	<3.3	<3.3	<4.7	<3.9	<3.5	<3.3	<4.2	<3.4	<4.5	<3.6	<3.4	<3.5	<3.5
o-Xylene	µg/m³	*935*	100	<5.0	<5.0	<7.1	<5.8	<5.2	<5.0	<6.4	<5.2	<6.7	<5.4	<5.2	<5.2	<5.2
Total VOC as n-hexane	mg/m³	*N/A*	N/A	<0.17	<0.17	<0.24	<0.19	<0.17	<0.17	0.44	<0.17	<0.22	<0.18	<0.17	0.23	0.18
Helium	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hydrogen	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methane	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Carbon Dioxide	% by Vol	*N/A*	N/A	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.04
Ethane	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Carbon Monoxide	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylene	% by Vol	*N/A*	N/A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hydrogen Sulphide	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Carbonyl Sulphide	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Methyl Mercaptan	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Ethyl Mercaptan	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Dimethyl Sulfide	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
n-Propyl Mercaptan	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Thiophene	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
n-Butyl Mercaptan	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Tetrahydrothiophene	ppm	*N/A*	N/A	<0.021	<0.021	<0.030	<0.024	<0.022	<0.021	<0.027	<0.022	<0.028	<0.023	<0.022	<0.022	<0.022
Work Order Number			N/A	M121364D			M121364B						M121364G		M121364F	
Sample Number				2012018098			2012018084						2012018005		2012018017	

Comments

"-" not applicable

N/A - no screening criteria available in NEPM Air Toxics and US EPA RSLs

	Lot 1 Dam			Lot 5 Dam		
	Primary	Duplicate		Primary	Duplicate	
Analyte	2012016387	2012016388	RPD	2012016377	2012016378	RPD
2,3,4,6-Tetrachlorophenol	0	0	--	0	0	--
2,4,5-Trichlorophenol	0	0	--	0	0	--
2,4,6-Trichlorophenol	0	0	--	0	0	--
2,4-Dichlorophenol	0	0	--	0	0	--
2,4-Dimethylphenol	0	0	--	0	0	--
2,4-Dinitrophenol	0	0	--	0	0	--
2,6-Dichlorophenol	0	0	--	0	0	--
2-Chlorophenol	0	0	--	0	0	--
2-Methyl-4,6-dinitrophenol	0	0	--	0	0	--
2-Nitrophenol	0	0	--	0	0	--
3-Methylcholanthrene	0	0	--	0	0	--
4-Chloro-3-methylphenol	0	0	--	0	0	--
4-Nitrophenol	0	0	--	0	0	--
7,12-Dimethylbenz(a)anthracene	0	0	--	0	0	--
Acenaphthene	0	0	--	0	0	--
Acenaphthylene	0	0	--	0	0	--
Aluminium	1.4	1.5	-6.9	9.3	8.9	4.4
Anthracene	0	0	--	0	0	--
Arsenic	0.003	0.003	0.0	0.001	0.001	0.0
Barium	0.022	0.026	-16.7	0.086	0.086	0.0
Benzene	0	0	--	0	0	--
Benzo (a) pyrene	0	0	--	0	0	--
Benzo (b) fluoranthene	0	0	--	0	0	--
Benzo (ghi) perylene	0	0	--	0	0	--
Benzo (k) fluoranthene	0	0	--	0	0	--
Benzo(a)anthracene	0	0	--	0	0	--
Beryllium	0	0	--	0	0	--
Bicarbonate (as CaCO3)	43	42	2.4	0	0	--
Biological Oxygen Demand	9	9	0.0	0	0	--
Boron	0.022	0.023	-4.4	0.02	0.019	5.1
C10-C14	0	0	--	0	0	--
C15-C28	0	0	--	0	0	--
C29-C36	0	0	--	0	0	--
C6-C9	0	0	--	0	0	--
Cadmium	0	0	--	0	0	--
Calcium	0.35	0.4	-13.3	0.68	0.65	4.5
Carbonate (as CaCO3)	0	0	--	0	0	--
Chloride	19	18	5.4	9	9	0.0
Chromium	0.002	0.003	-40.0	0	0	--
Chrysene	0	0	--	0	0	--
Cobalt	0.002	0.002	0.0	0.003	0.003	0.0
Coliforms	3600	3000	18.2	0	0	--
Conductivity (uS/cm)	130	130	0.0	260	260	0.0
Copper	0.001	0.001	0.0	0.004	0.004	0.0
Dibenz (ah) anthracene	0	0	--	0	0	--
Dinoseb	0	0	--	0	0	--
Dissolved Organic Carbon	8	8	0.0	4	4	0.0
E.coli	3600	3000	18.2	0	0	--
Ethylbenzene	0	0	--	0	0	--
Faecal Coliforms	3600	3000	18.2	0	0	--
Fluoranthene	0	0	--	0	0	--
Fluorene	0	0	--	0	0	--
Fluoride	0	0	--	0	0	--
Hexachlorophene	0	0	--	0	0	--
Hydroxide (as CaCO3)	0	0	--	0	0	--
Indeno (1,2,3-cd) pyrene	0	0	--	0	0	--
Iron	1.3	1.3	0.0	0.038	0.032	17.1
Lead	0.003	0.003	0.0	0.002	0.002	0.0
m&p-Cresol	0	0	--	0	0	--
m&p-Xylenes	0	0	--	0	0	--
Magnesium	2.8	2.9	-3.5	4.7	4.7	0.0
Manganese	0.035	0.04	-13.3	0.062	0.06	3.3
Mercury	0	0	--	0	0	--
Molybdenum	0	0	--	0	0	--
Naphthalene	0	0	--	0	0	--
Nickel	0.001	0.002	**-66.7**	0.007	0.007	0.0
Nitrate as N	0.02	0.02	0.0	0	0	--
Nitrite as N	0	0	--	0	0	--
o-Cresol	0	0	--	0	0	--
o-Xylene	0	0	--	0	0	--
Pentachlorophenol	0	0	--	0	0	--
pH (pH Units)	6.8	6.9	-1.5	4.6	4.5	2.2
Phenanthrene	0	0	--	0	0	--
Phenol	0	0	--	0	0	--
Potassium	0.62	0.65	-4.7	0.92	0.89	3.3
Pyrene	0	0	--	0	0	--
Selenium	0	0	--	0	0	--
Silica (SiO2)	13	14	-7.4	2.7	2.6	3.8
Silver	0	0	--	0	0	--
Sodium	25	26	-3.9	25	25	0.0
Standard Plate Count (CFU/ML)	1700	3000	**-55.3**	0	0	--
Strontium	0.008	0.008	0.0	0.01	0.011	-9.5
Sulphate as SO4(2-)	0	0	--	70	70	0.0
Thermotolerant Coliforms	3600	3000	18.2	0	0	--
Toluene	0	0	--	0	0	--
Total Alkalinity (as CaCO3)	43	42	2.4	0	0	--
Total Aluminium	1.4	1.7	-19.4	9.3	9	3.3
Total Anions (meq/L)	1.4	1.4	0.0	1.7	1.7	0.0
Total Arsenic	0.003	0.003	0.0	0.001	0.001	0.0
Total Barium	0.022	0.028	-24.0	0.086	0.086	0.0
Total Beryllium	0.001	0.001	0.0	0	0	--
Total Boron	0.022	0.023	-4.4	0.021	0.019	10.0
Total C6-C36	0	0	--	0	0	--
Total Cadmium	0	0	--	0	0	--
Total Cations (meq/L)	1.4	1.4	0.0	1.6	1.6	0.0
Total Chromium	0.002	0.003	-40.0	0	0	--
Total Cobalt	0.002	0.003	-40.0	0.003	0.003	0.0
Total Copper	0.001	0.001	0.0	0.004	0.004	0.0
Total Cyanide	0	0	--	0	0	--
Total Dissolved Solids	640	700	-9.0	150	160	-6.5
Total Iron	1.3	1.4	-7.4	0.048	0.051	-6.1
Total Lead	0.003	0.003	0.0	0.002	0.002	0.0
Total Manganese	0.04	0.049	-20.2	0.062	0.06	3.3
Total Mercury	0	0	--	0	0	--
Total Molybdenum	0	0	--	0	0	--
Total Nickel	0.001	0.002	**-66.7**	0.011	0.016	-37.0
Total Nitrogen	0.3	0.3	0.0	0.2	0.2	0.0
Total Organic Carbon	9	9	0.0	4	5	-22.2
Total Phosphorous	0	0	--	0	0	--
Total Selenium	0	0	--	0	0	--
Total Silica (SiO2)	380	390	-2.6	3.3	3.1	6.2
Total Silver	0	0	--	0	0	--
Total Strontium	0.008	0.008	0.0	0.012	0.011	8.7
Total Suspended Solids	150	130	14.3	0	0	--
Total Vanadium	0.009	0.011	-20.0	0	0	--
Total Zinc	0.016	0.016	0.0	0.03	0.03	0.0
Vanadium	0.009	0.01	-10.5	0	0	--
Zinc	0.016	0.013	20.7	0.029	0.03	-3.4

Comments
RPDs outside the acceptable limit of 50% are in bold

	Lot 1 East			Lot 127 Rear			Lot 166 South			Lot 5 SS4		
	Primary	Field Duplicate	RPD	Primary	Field Duplicate	RPD	Primary	Field Duplicate	RPD	Primary	Field Duplicate	RPD
Analyte	2012016798	2012016799		2012016811	2012016812		2012016807	2012016810		2012016782	2012016783	
Aluminium	2800	6200	**-75.55555556**	6500	8000	-20.68966	2700	1600	**51.16279**	2200	2300	-4.444444
Boron	0	0		2	2		0	0	-	2	2	0
Ca/Mg Ratio	0	0		1.7	2.1	-21.05263	0	0	-	0	0	-
Calcium	1200	510	**80.70175439**	2400	2300	4.255319	120	270	**-76.92308**	120	100	18.18182
Cation Exchange Capacity (meq/100g)	4.5	4.4	2.247191011	13.3	13.8	-3.690037	3.4	2.4	34.48276	5.7	6.1	-6.779661
Conductivity (1:5)	160	35	**128.2051282**	55	70	-24	20	30	-40	160	140	13.33333
Copper	0	0		8	7	13.33333	0	0	-	0	0	-
Exch-Aluminium (meq/100g)	0	0		0	0		0	0	-	0	0	-
Exch-Calcium (meq/100g)	2	3		8	9	-11.76471	0	0	-	0	0	-
Exch-Magnesium (meq/100g)	0	0		5	4	22.22222	2	2	0	5	5	
Exch-Potassium (meq/100g)	0	0		0	0		0	0	-	0	0	-
Exch-Sodium (%)	0	0		0	0		0	0	-	0	0	-
Exch-Sodium (meq/100g)	0	0		0	0		0	0	-	0	0	-
Iron	5500	12000	**-74.28571429**	12000	12000		3300	3600	-8.695652	16000	16000	0
Magnesium	130	120	8	530	600	-12.38938	240	190	23.25581	550	610	-10.34483
Manganese	22	15	37.83783784	97	82	16.75978	13	43	**-107.1429**	17	18	-5.714286
Molybdenum	0	0		0	0		0	5	-200	0	0	-
pH	5.8	6	-3.389830508	5.6	5.8	-3.508772	6.1	5.7	6.779661	6.3	5.7	10
Potassium	130	120	8	270	280	-3.636364	150	170	-12.5	81	94	-14.85714
Sodium	89	84		150	140	6.896552	84	70	18.18182	790	780	1.273885
Sulphur	0	0		0	0		0	0	-	0	0	-
Total Carbon	34000	22000	**59.70149254**	62000	47000	27.52294	19000	21000	-10	7800	8900	-13.17365
Total Nitrogen	1300	1600	-20.68965517	2800	2500	11.32075	1300	1300	0	350	240	37.28814
Total Phosphorus	59	50	16.51376147	250	230	8.333333	47	59	-22.64151	41	37	10.25641
Zinc	3	12	-120	620	480	25.45455	11	48	**-125.4237**	3	3	0

Comments

RPDs outside the acceptable limit of 50% are in bold

Annex A

References

REFERENCES

AS 4482 series – Guide to the investigation and sampling of sites with potentially contaminated soil

AS 3580 series – Methods for Sampling and Analysis of Ambient Air.

DEHPs 'Monitoring and Sampling Manual 2009. Environmental Protection (Water) Policy 2009. Version 2, September 2010'.

NEPM (1999). *National Environment Protection (Assessment of Site Contamination) Measure*, National Environment Protection Council.

NEPM (2003). *National Environment Protection (Air Toxics) Measure*, National Environment Protection Council.

NEPM (2004) Air Toxics Measure

NHMRC (2004). *Australian Drinking Water Guidelines* National Health and Medical Research Council.

QCGs Scope of Works: Water, Air, and Soil Monitoring of Private Land in Kenya Block QCOPS-OPS-USP-SOW-000020_0 (QGC Scope of Works)

Queensland Government Simtars, *Gas Monitoring at Tara Gas Field for Safety and Health Division, DEEDI Brisbane* report (7 May 2010)

TPHCWG (1997). *Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)*, Total Petroleum Hydrocarbon Criteria Working Group

US EPA (2012). *Regional Screening Levels for Chemical Contaminants. May*.

WHO (2000). *Guidelines for Air Quality*, World Health Organisation.

WHO (2005). *Petroleum Products in Drinking-water. Background document for developing of WHO Guidelines for Drinking Water Quality.*, World Health Organisation, .

WHO (2008). *Guidelines for Drinking Water Quality*, World Health Organisation.

Annex B

Scope of Works: Water, Air, and Soil Monitoring of Private Land in Kenya Block (QCOPS-OPS-USP-SOW-000020)

Production Chemistry

Scope of work – A Health/Occupational hygiene/Chemistry review of the results from sampling at the Tara Estates

QCOPS-OPS-USP-SOW-000023_0

QGC LIMITED

275 George Street
Brisbane QLD 4000

GPO Box 3107
Brisbane QLD 4001

Tel: +61 (0)7 3024 9000
Fax: +61 (0)7 3024 8999

www.qgc.com.au

ABN 11 089 642 553

Revision Record

Issue	Date	Reason for Issue	Responsible	Accountable
A	5/10/2012	Initial Draft	Melinda Toyne	D. Trevithick-Harney

Note: This copy may not be the current revision. Refer to the Document Management System before use.

1.0 Overview

QGC operates coal seam gas extraction and processing facilities in the Surat Basin. Private landowners within the Tara Estates have voiced concerns that they are experiencing adverse health conditions due to the close location of and operation of QGC's CSG facilities.

As part of a commitment to the local community, QGC promised to conduct a detailed sampling and analysis programme to determine if QGC's CSG activities are impacting on the health of local residences.

SGS Leeder consulting was engaged to conduct sampling at four residential locations within the Tara estate. The scope of sampling and analysis was defined in document (QCOPS-OPS-USP-SOW-000020_0) which included:

- Air monitoring
- Drinking Water and recreational water Quality
- Soil Monitoring

Once confirmation that the sampling would occur, the number of sampling locations was then expanded to nine residential locations due to more landowners expressing an interest in participating in the investigation. The sampling programme was conducting over two weeks in July 2012.

A desk top health/occupational hygiene/chemistry review is required on the results of sampling conducted at the 9 locations within the Tara Estates in July 2012. All samples were taken and analysed by SGS Leeder a NATA certified third party laboratory (in some cases specialised analysis have been sub contracted out to other third party laboratories).

2.0 Reporting requirements

2.1. Executive Summary

To summarise the results of the following lines of investigation.

Structured to detail specify/answer the following:

- Location of where the sampling was conducted
- Distance to QGC infrastructure/operations
- Are there any detectable chemical impact of QGC's CSG activities on the landowners?
- Are there any detectable chemical impact from QGC's CSG activities that is impacts the health of the landowners?
- Are there any identifiable health/occupational hygiene impacts of concern that could impacts on the landowners health? If yes what would these health impacts be?
- Are there any activities of concern that could impacts on the landowner's health? If yes what would these health impacts be?

2.2. Site location

Detail the site location of each of the 9 landholders sampling locations and put the locations in context to the distance from current QGC CSG infrastructure and operations. It may be of value to review the historical weather patterns and wind direction if available.

2.3. Site Activities (QGC)

Details what infrastructure QGC has in the immediate area (+10 km). Describes the function of each infrastructure present and what chemical emission expected during normal operation. For example:

Well head

- To extract coal seam methane and water from the Walloons coal seam.
- Coal seam methane has a chemical composition of 98% Methane, 1.7% Nitrogen, 0.3% Carbon Dioxide.
- Coal Seam Water has a chemical composition TDS 2300mg/L, Sodium 1000mg/l Chloride 330 mg/l, total Alkalinity 1800 mg/l pH 8.8

2.4. Review of Tara Estates Air quality versus Coal Seam Gas composition

Review the air quality analysed at each of the land owners' property and compare it with CSG composition to determine if there are any species present that can be linked with emissions from QGC's operations.

2.5. Review of Tara Estates Water quality versus CSG extracted water composition

Review the water quality analysed at each of the land owners' property and compare it with CSG water composition to determine if there are any species present that can be linked with water releases from QGC's operations.

2.6. Review of Tara Estates Drinking Water quality versus Australian Drinking Water Guidelines

Review the quality of the drinking water sampled at each of the land owners properties and compare it with the Australian Standard for Drinking Water. If parameters detected are outside the Australian Drinking Water Standard need to indicate what potential heath effects would be experienced for each exceedences.

2.7. Review of Tara Estates Dam Water quality versus Australian Recreational Water Guidelines

Review the quality of the dam water sampled at each of the land owners properties and compare it with the Australian Standard for Recreational Water. If parameters detected are outside the Australian Recreational Water Standard please indicate what potential heath effects would be experienced for each exceedences. Also need to review the impacts of using this water for showering and watering plants for human consumption would be required.

2.8. Review of soil sampling events

Review the soil quality detected and look for any link to CSG water quality or if the soil present is representative of sodic soil that is typical for the area.

2.9. Review of photographs and field observations taken during the sampling event

Review the photographs and observations made during the sampling event and look for areas of concerns or activities that may have a negative impact to the health of the land owners, for example:

- Use of 1000L chemical containers for water storage options for shower water
- Incineration of waste near house and burying of ash in shallow pits

Note: This copy may not be the current revision. Refer to the Document Management System before use.

- Collection and consumption of mushrooms
- Sewage treatment
- Storage of Lead acid batteries
- Location of diesel generator
- Impact of domestic animals

Though these activities can not be reviewed against Australian Standards or have detailed chemical investigational data associated with them, the highlighting of activities of medical concern could then be the basis of other investigation/conversations with Queensland Health or if required independent medical practitioners.

2.10. Conclusions

A detailed summary and discussion on whether there is evidence of QGC's CSG activities impacting on the residences of the Tara Estates. Please note that noise is covered in a separate investigation.

Detailed analysis and reporting on the impacts of drinking water and other observations noted at each of the land owners properties and the potential heath impacts of any exceedences detected could have on the land owners.

3.0 Documentation

- 9 SGS Leeder reports containing data for each individual land owner
- Maps of the Sampling locations and associated QGC infrastructure
- Australian Drinking Water Standard
- Australian Recreational Water Standard
- Chemical composition of CSG gas from the Codie field
- Chemical composition of produced water from the Codie field

Note: This copy may not be the current revision. Refer to the Document Management System before use.

Annex C

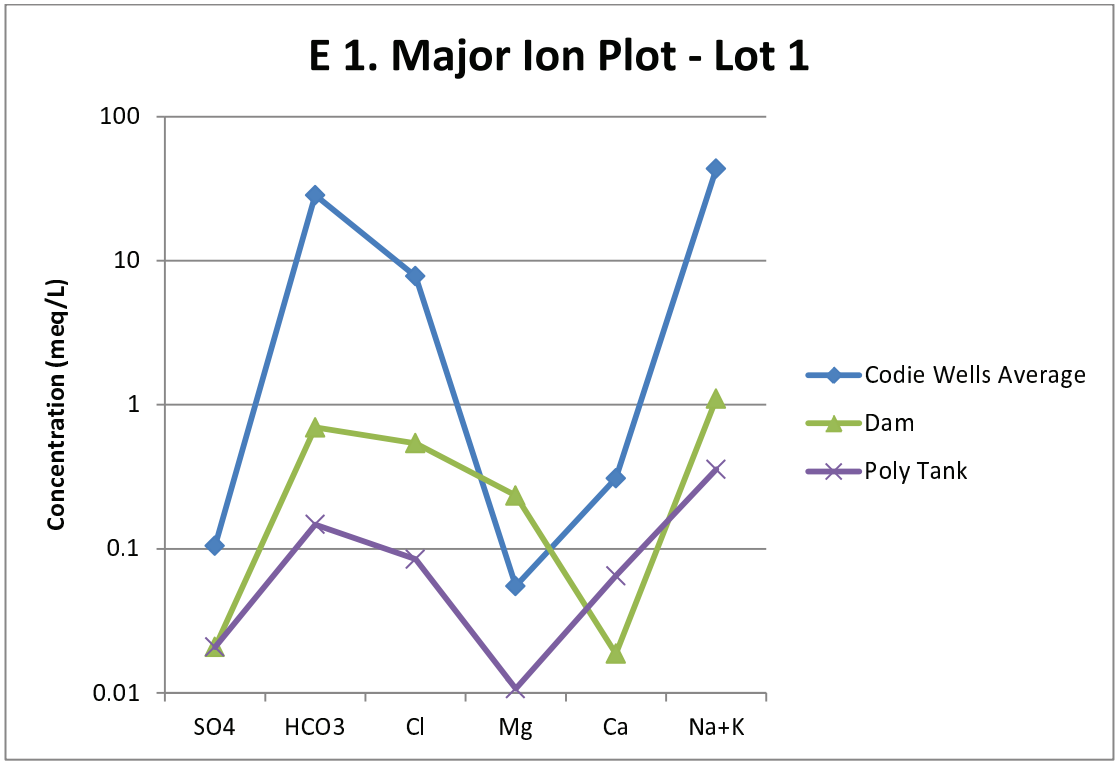
Lot Figures

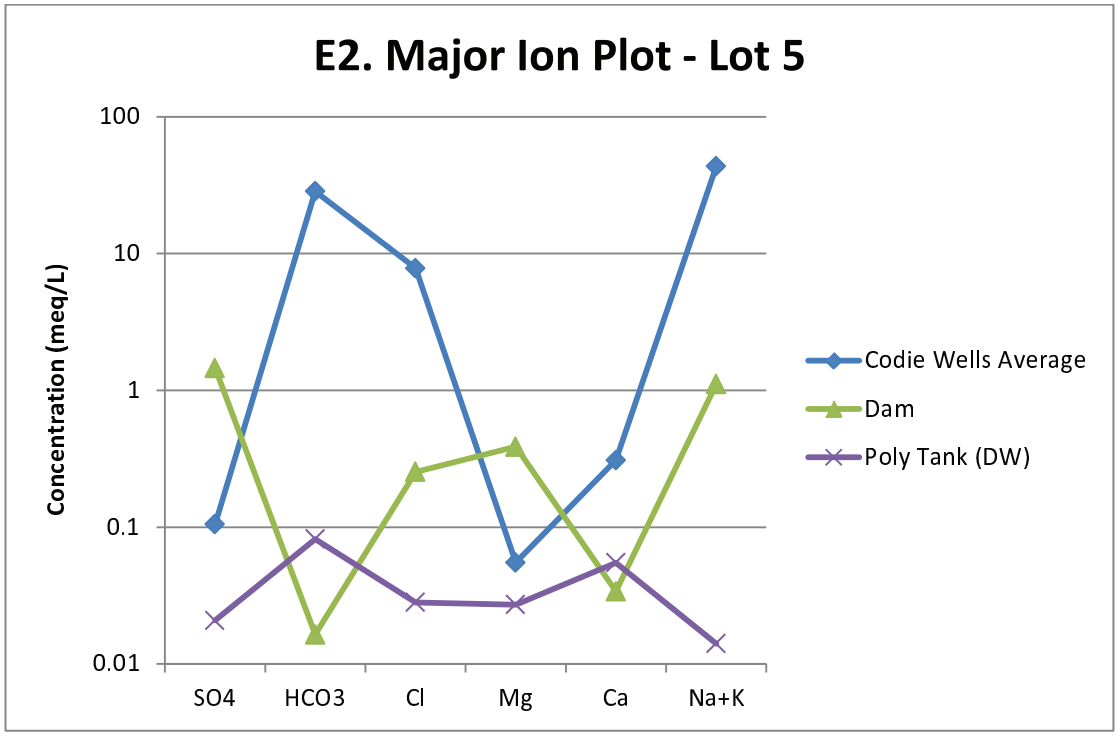
Annex D

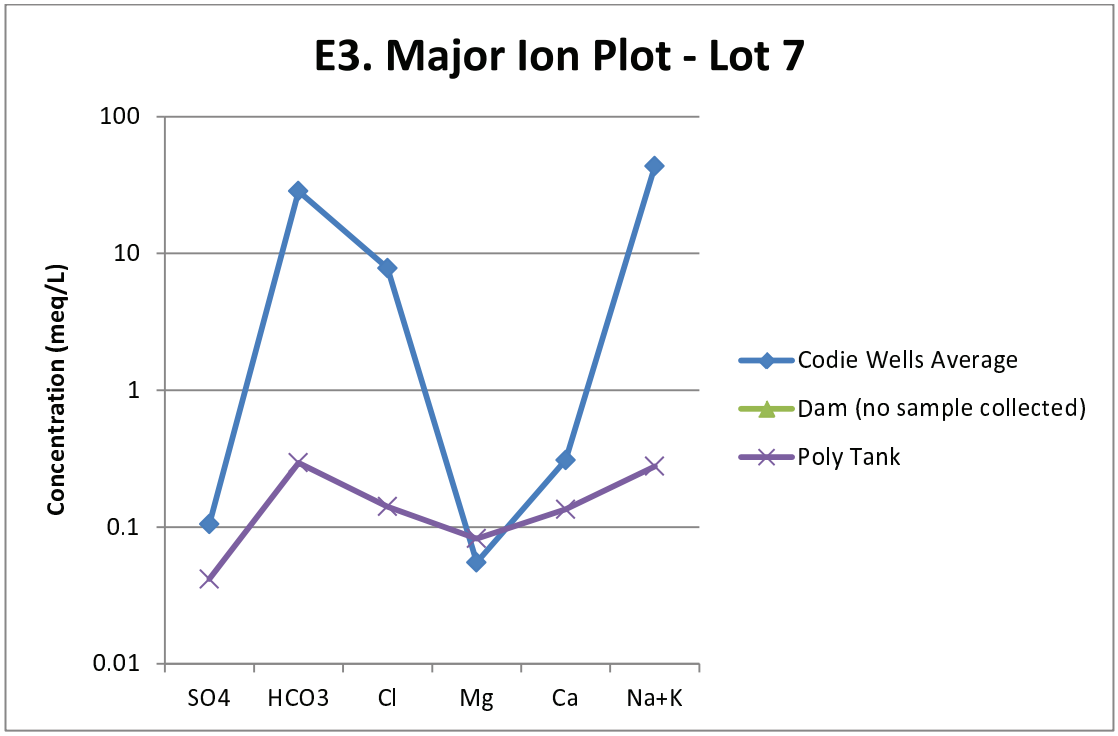
SGS Reports

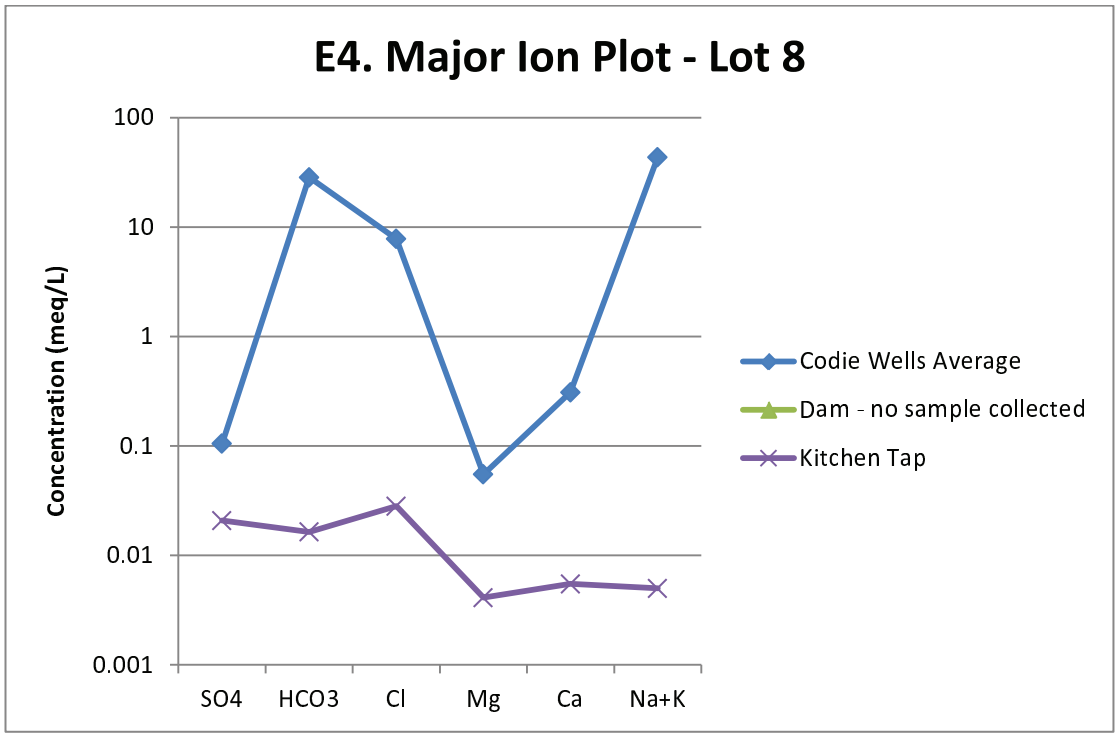
Annex E

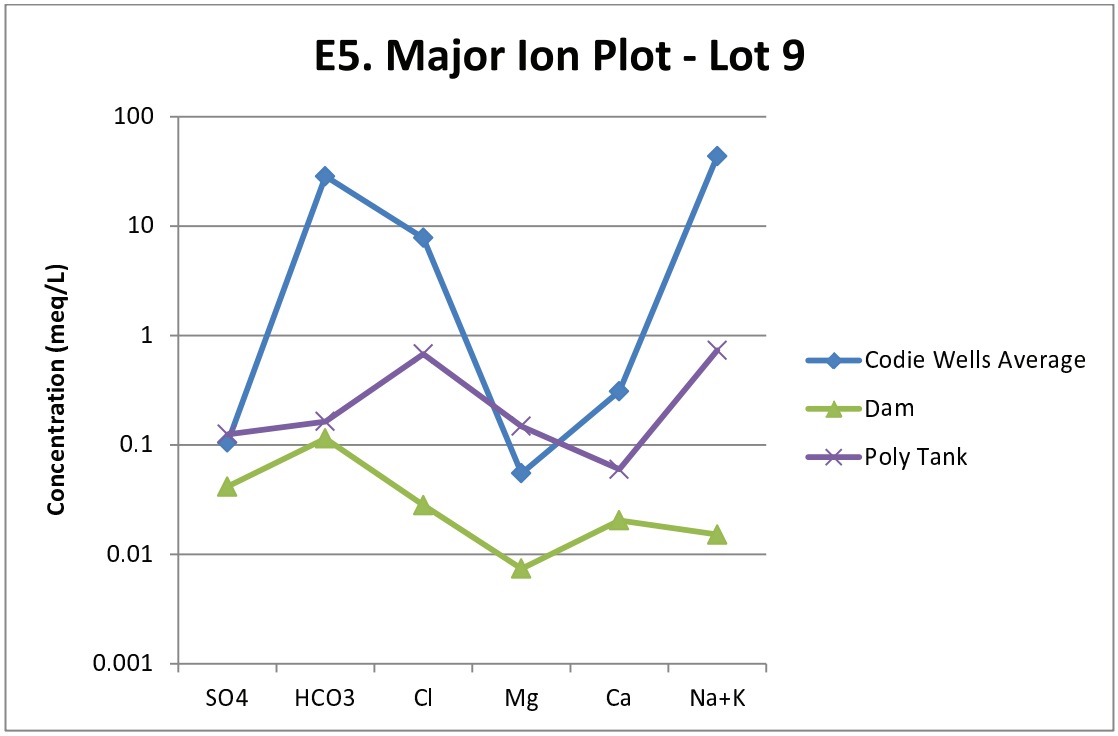
Scholler Diagram

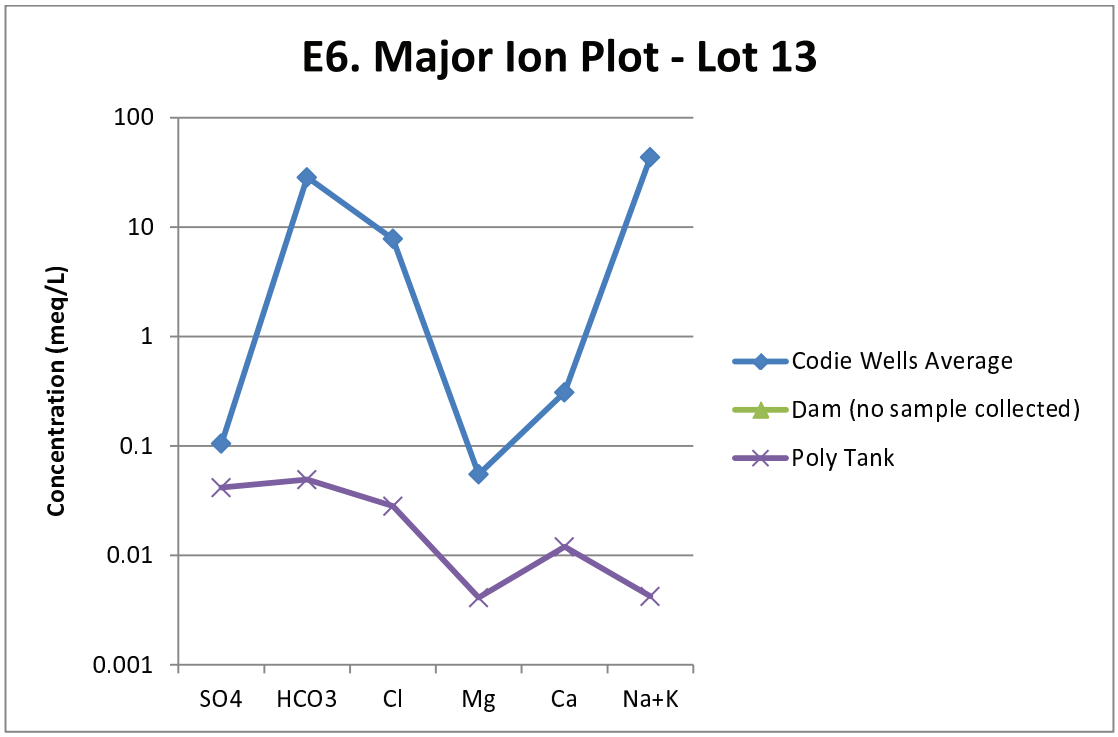

E 1. Major Ion Plot - Lot 1
Concentration (meq/L)
100
10
1
0.1
0.01
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam
Poly Tank

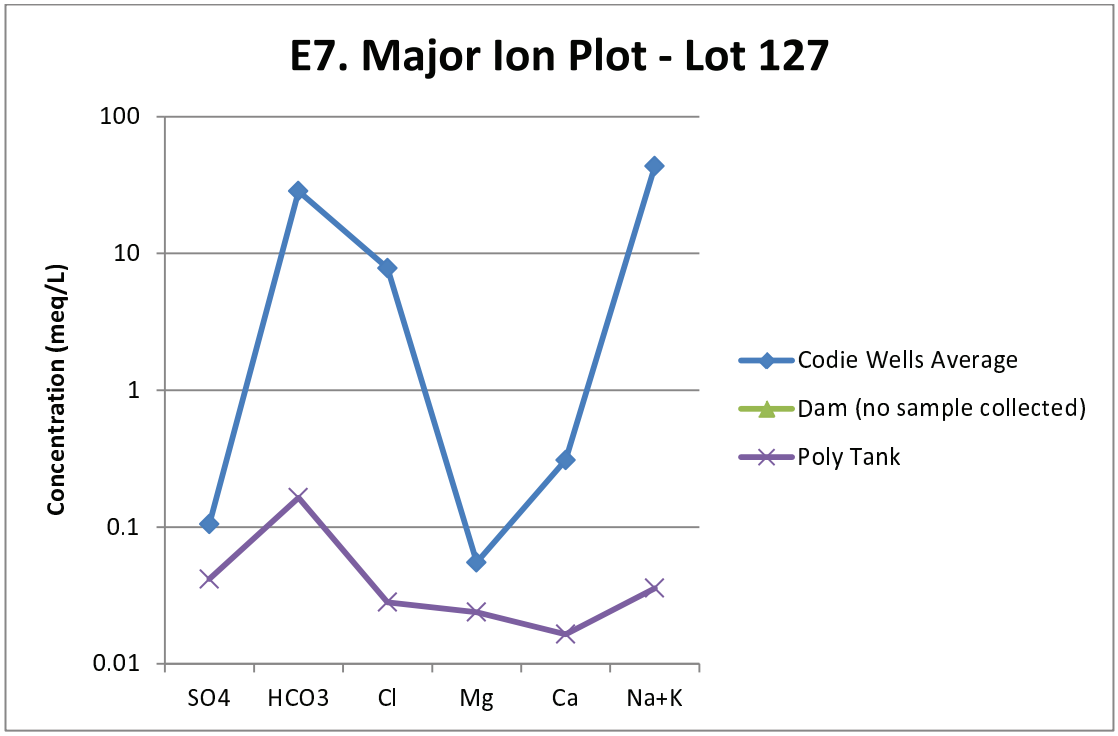

E2. Major Ion Plot - Lot 5
Concentration (meq/L)
100
10
1
0.1
0.01
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam
Poly Tank (DW)

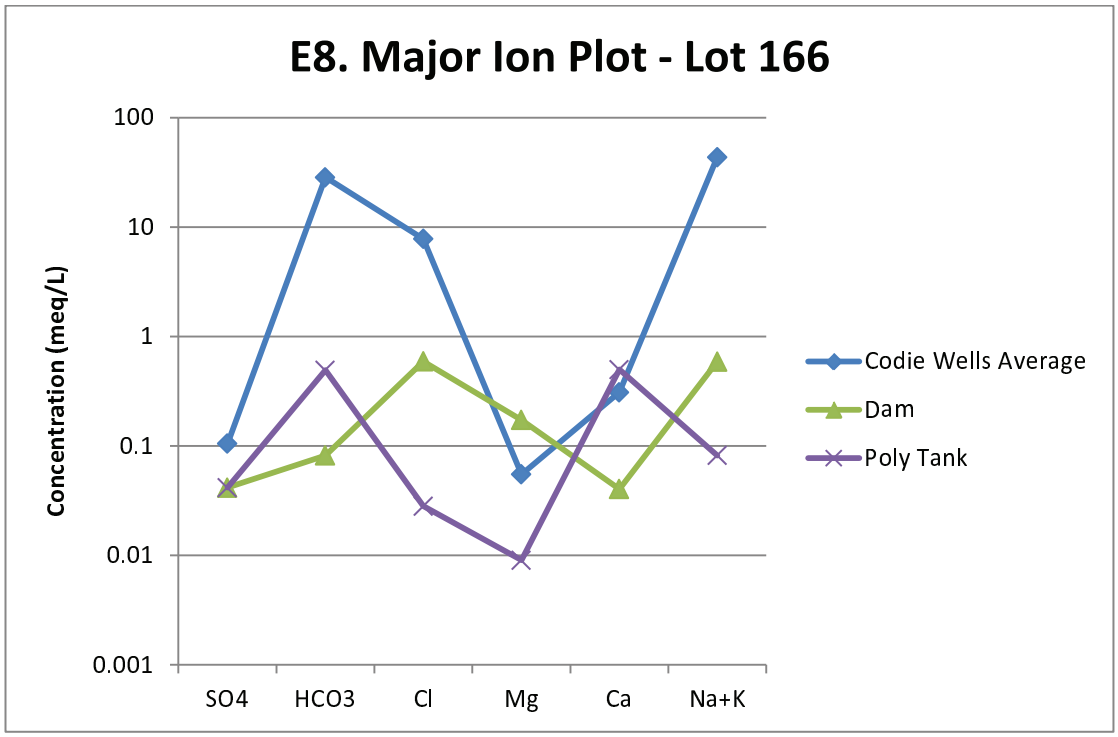

E3. Major Ion Plot - Lot 7
Concentration (meq/L)
100
10
1
0.1
0.01
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam (no sample collected)
Poly Tank

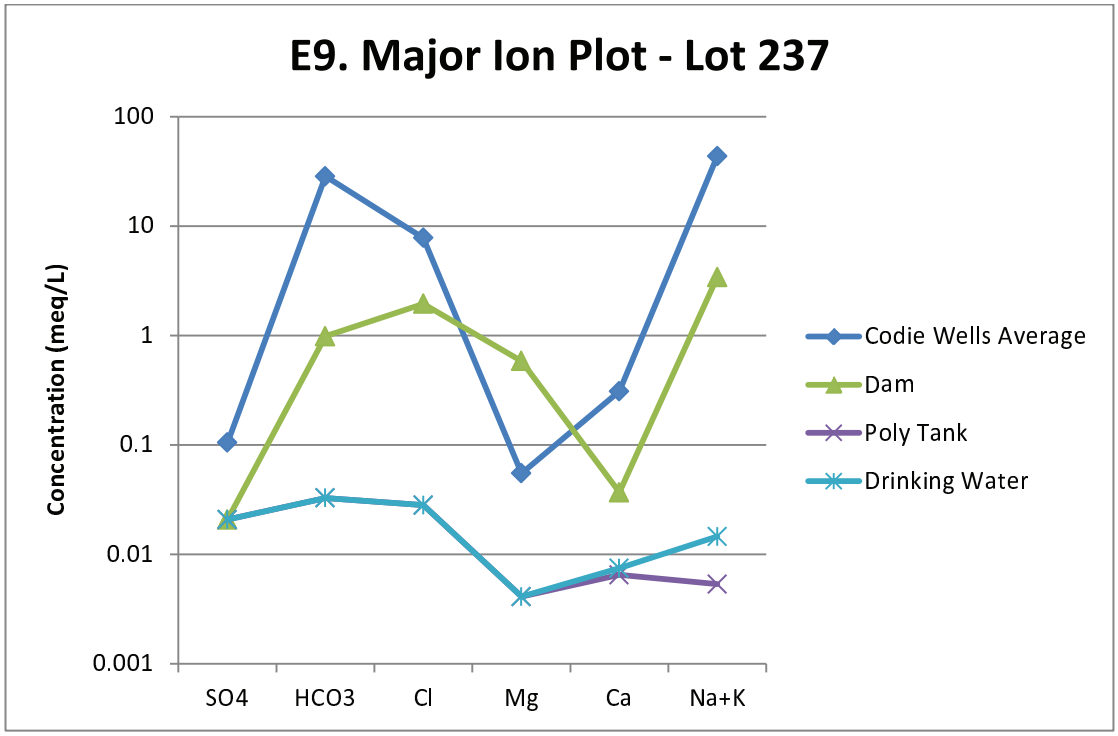

E4. Major Ion Plot - Lot 8
Concentration (meq/L)
100
10
1
0.1
0.01
0.001
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam - no sample collected
Kitchen Tap


E5. Major Ion Plot - Lot 9
Concentration (meq/L)
100
10
1
0.1
0.01
0.001
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam
Poly Tank


E6. Major Ion Plot - Lot 13
Concentration (meq/L)
100
10
1
0.1
0.01
0.001
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam (no sample collected)
Poly Tank


E7. Major Ion Plot - Lot 127
Concentration (meq/L)
100
10
1
0.1
0.01
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam (no sample collected)
Poly Tank


E8. Major Ion Plot - Lot 166
Concentration (meq/L)
100
10
1
0.1
0.01
0.001
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam
Poly Tank


E9. Major Ion Plot - Lot 237
Concentration (meq/L)
100
10
1
0.1
0.01
0.001
SO4
HCO3
Cl
Mg
Ca
Na+K
Codie Wells Average
Dam
Poly Tank
Drinking Water