AGL Upstream Investments Pty Ltd

WKMB06A & WKMB06B Drilling completion report

Gloucester Gas Project

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PARSONS BRINCKERHOFF

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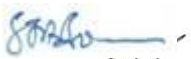
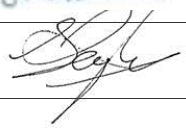
Reviewed by:	Stuart Brown	Date: 07/07/2015	Signature: 
Approved by:	Sean Daykin	Date: 07/07/2015	Signature: 

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Glossary

Alluvium	Unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans.
Alluvial aquifer	Permeable zones that store and produce groundwater from unconsolidated alluvial sediments. Shallow alluvial aquifers are generally unconfined aquifers.
Aquifer	Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
Aquifer, confined	An aquifer that is overlain by low permeability strata. The hydraulic conductivity of the confining bed is significantly lower than that of the aquifer.
Aquifer, semi-confined	An aquifer overlain by a low-permeability layer that permits water to slowly flow through it. During pumping, recharge to the aquifer can occur across the leaky confining layer – also known as a leaky artesian or leaky confined aquifer.
Aquifer, unconfined	Also known as a water table aquifer. An aquifer in which there are no confining beds between the zone of saturation and the surface. The water table is the upper boundary of an unconfined aquifer.
Aquitard	A low permeability unit that can store groundwater and also transmit it slowly from one formation to another. Aquitards retard but do not prevent the movement of water to or from adjacent aquifers.
Australian Height Datum (AHD)	The reference point (very close to mean sea level) for all elevation measurements, and used for correlating depths of aquifers and water levels in bores.
Bore	A structure drilled below the surface to obtain water from an aquifer or series of aquifers.
Coal	A sedimentary rock derived from the compaction and consolidation of vegetation or swamp deposits to form a fossilised carbonaceous rock.
Coal seam	A layer of coal within a sedimentary rock sequence.
Coal seam gas (CSG)	Coal seam gas is a form of natural gas (predominantly methane) that is extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as microgram per litre (water sample) or micrograms per kilogram (sediment sample).
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
Discharge	The volume of water flowing in a stream or through an aquifer past a specific point in a given period of time.

Electrical conductivity (EC)	A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often used as a measure of water salinity.
Fracture	Breakage in a rock or mineral along a direction or directions that are not cleavage or fissility directions.
Fractured rock aquifer	These occur in sedimentary, igneous and metamorphosed rocks which have been subjected to disturbance, deformation, or weathering, and which allow water to move through joints, bedding planes, fractures and faults. Although fractured rock aquifers are found over a wide area, they generally contain much less groundwater than alluvial and porous sedimentary rock aquifers.
Groundwater	The water contained in interconnected pores or fractures located below the water table in the saturated zone.
Groundwater flow	The movement of water through openings in sediment and rock within the zone of saturation.
Groundwater system	A system that is hydrogeologically more similar than different in regard to geological province, hydraulic characteristics and water quality, and may consist of one or more geological formations.
Hydraulic conductivity	The rate at which water of a specified density and kinematic viscosity can move through a permeable medium (notionally equivalent to the permeability of an aquifer to fresh water).
Hydraulic gradient	The change in total hydraulic head with a change in distance in a given direction.
Hydraulic head	Is a specific measurement of water pressure above a datum. It is usually measured as a water surface elevation, expressed in units of length. In an aquifer, it can be calculated from the depth to water in a monitoring bore. The hydraulic head can be used to determine a hydraulic gradient between two or more points.
Hydrogeology	The study of the interrelationships of geologic materials and processes with water, especially groundwater.
Hydrology	The study of the occurrence, distribution, and chemistry of all surface waters.
Lithology	The study of rocks and their depositional or formational environment on a large specimen or outcrop scale.
MicroSiemens per centimetre (µS/cm)	A measure of water salinity commonly referred to as EC (see also Electrical Conductivity). Most commonly measured in the field with calibrated field meters.
Monitoring bore	A non-pumping bore, is generally of small diameter that is used to measure the elevation of the water table and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
Oxidation reduction potential (ORP)	The oxidation redox potential is a measure (in volts) of the affinity of a substance for electrons – its electronegativity – compared with hydrogen (which is set at 0). Substances more strongly electronegative than (i.e. capable of oxidising) hydrogen have positive redox potentials. Substances less electronegative than (i.e. capable of reducing) hydrogen have negative redox potentials. Also known as redox potential.

Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.
Permian	The last period of the Palaeozoic era that finished approximately 230 million years before present.
Piezometer	See monitoring bore.
Quaternary	The most recent geological period extending from approximately 2.5 million years ago to the present day.
Recharge	The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. The addition of water to an aquifer.
Recovery	The difference between the observed water level during the recovery period after cessation of pumping and the water level measured immediately before pumping stopped.
RL	Reduced level or height, usually in metres above or below an arbitrary or standard datum.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	Fresh water quality – water with a salinity <800 µS/cm. Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm. Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm. Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm. Moderately saline quality – water that is more saline than slightly saline water and generally waters between 10,000 and 20,000 µS/cm. Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 µS/cm. Seawater quality – water that is generally around 55,000 µS/cm.
Screen	A type of bore lining or casing of special construction, with apertures designed to permit the flow of water into a bore while preventing the entry of aquifer or filter pack material.
Sandstone	Sandstone is a sedimentary rock composed mainly of sand-sized minerals or rock grains (predominantly quartz).
Sedimentary rock aquifer	These occur in consolidated sediments such as porous sandstones and conglomerates, in which water is stored in the intergranular pores, and limestone, in which water is stored in solution cavities and joints. These aquifers are generally located in sedimentary basins that are continuous over large areas and may be tens or hundreds of metres thick. In terms of quantity, they contain the largest volumes of groundwater.

Shale	A laminated sedimentary rock in which the constituent particles are predominantly of clay size.
Siltstone	A fine-grained rock of sedimentary origin composed mainly of silt-sized particles (0.004 to 0.06 mm).
Standing water level (SWL)	The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels.
Stratigraphy	The depositional order of sedimentary rocks in layers.
Surface water-groundwater interaction	This occurs in two ways: (1) streams gain water from groundwater through the streambed when the elevation of the water table adjacent to the streambed is greater than the water level in the stream; and (2) streams lose water to groundwater through streambeds when the elevation of the water table is lower than the water level in the stream.
Total dissolved solids (TDS)	A measure of the salinity of water, usually expressed in milligrams per litre (mg/L). See also EC.
Water bearing zone	Geological strata that are saturated with groundwater but not of sufficient permeability to be called an aquifer.
Water quality	Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water quality data	Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists.
Water table	The top of an unconfined aquifer. It is at atmospheric pressure and indicates the level below which soil and rock are saturated with water.
Well	Pertaining to a gas exploration well or gas production well.
Siltstone	A fine-grained rock of sedimentary origin composed mainly of silt-sized particles (0.004 to 0.06 mm).

Abbreviations

AGL	AGL Upstream Investments Pty Ltd
ALS	Australian Laboratory Services
BTEX	Benzene, toluene, ethyl-benzene and xylenes
BoM	Bureau of Meteorology
BP	Before Present
CDFM	Cumulative deviation from mean
CSG	Coal seam gas
DIC	Dissolved inorganic carbon
DO	Dissolved oxygen
EC	Electrical conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
GDE	Groundwater Dependent Ecosystems
GFDA	Gas Field Development Area
GGP	Gloucester Gas Project
GMWL	Global Meteoric Water Line
GRL	Gloucester Resources Limited
H_2O	Water
LMWL	Local Meteoric Water Line
LoR	Limit of reporting
LTA	Long term average
MEA	Monoethanolamine
MGA	Map grid of Australia
NOW	NSW Office of Water
ORP	Oxidation-reduction potential
PEL	Petroleum Exploration Licence

PPL	Petroleum Production Lease
QA/QC	Quality assurance/quality control
THPS	Tetrakis (hydroxymethyl) phosphonium sulphate
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
TDS	Total dissolved solids
TOC	Total organic carbon

Units

ºC	degrees Celsius
µg/L	micrograms per litre
µS/cm	microSiemens per centimetre
%	percent
‰	per mil
km	kilometres
km^2	square kilometres
L/s	litres per second
m	metres
m/d	metres per day
mAHD	metres Australian Height Datum
mbgl	metres below ground level
mg/L	milligram per litre
mm	millimetres
TU	tritium unit
V	volt
yrs BP	years before present

Executive summary

AGL Upstream Investments Pty Ltd (AGL) is proposing to build the Gloucester Gas Project (GGP) which comprises several stages of development facilitating the extraction of coal seam gas from the Gloucester Basin. Part 3A Approval and EPBC Approval has been granted for the Stage 1 area of the GGP.

A comprehensive surface water and groundwater monitoring network comprising nested monitoring bores and surface water monitoring sites was established during the Phase 2 Groundwater Investigations (Parsons Brinckerhoff 2012). Subsequent and ongoing site investigations have continued to expand this network since January 2011. Surface water and groundwater investigations and monitoring programs are ongoing.

This report details the completion of nested groundwater monitoring bores on the floodplain at the Waukivory Pilot site in November 2014; one groundwater monitoring bore in the Quaternary alluvium (WKMB06A) and one groundwater monitoring bore in the shallow sandstone of the Leloma Formation (shallow rock and thrust fault sub-crop) (WKMB06B).

Following the completion of the two monitoring bores, in-situ pressure transducers (dataloggers) were installed, hydraulic testing performed and samples collected for baseline groundwater quality analysis.

The summary findings are:

- WKMB06A was completed at the base of the alluvium
- WKMB06B intersects a weathered zone of the shallow rock within an identified thrust fault zone beneath the alluvium
- There was minimal groundwater inflow during drilling through the rock profile suggesting low permeability strata within the thrust-fault zone
- The geophysical logging provides no evidence of enhanced connectivity between the deeper groundwater systems, the shallow rock and the alluvium
- Slug test analysis yielded hydraulic conductivity estimates of the alluvium screened formation at WKMB06A ranging from 10.46 to 28.19 m/d
- Slug test analysis yielded hydraulic conductivity estimates of the shallow rock screened formation at WKMB06B ranging from 4.6×10^{-3} to 6.5×10^{-3} m/d
- Groundwater in the alluvium is brackish and slightly acidic. Groundwater salinity in the shallow rock is marginal and slightly alkaline
- Aluminium, arsenic, barium, bromine, copper, iron, lead, strontium and zinc were detected in both the alluvium and shallow rock monitoring bores
- Cadmium and cobalt were detected in the alluvium monitoring bore only
- Boron, molybdenum, nickel and uranium were detected in the shallow rock monitoring bore only
- No phenolic compounds were detected in the alluvium and the shallow rock monitoring bores
- Low concentrations of PAHs were detected in the alluvium monitoring bore
- Low concentrations of toluene and TPH C_6-C_9 were detected in the shallow rock monitoring bore
- TPH C_{10}-C_{14} and C_{15}-C_{28} were detected in the alluvium monitoring bore
- Dissolved methane was detected in both the alluvium and shallow rock monitoring bores.

1. Introduction

1.1 Background

AGL Upstream Investments Pty Ltd (AGL) is proposing to build the Gloucester Gas Project (GGP) which comprises several stages of development facilitating the extraction of coal seam gas (CSG) from the Gloucester Basin. Concept Plan and Project Approval (Part 3A Approval) for the Stage 1 Gas Field Development Area (GFDA) was granted on 22 February 2011 under Part 3A of the *Environmental Planning and Assessment Act (1979)* (EP&A Act). In addition the project received approval under the *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) (EPBC Approval) on 11 February 2013.

AGL holds Petroleum Exploration Licence (PEL) 285, under the *Petroleum (Onshore) Act 1991*, covering the whole of the Gloucester Basin, approximately 100 km north of Newcastle, NSW. PEL 285 expired on 15 April 2012 and was renewed on 6 August 2014. The Stage 1 GFDA with AGL owned properties is shown in Figure 1.1.

A dedicated water monitoring network is in place which has enabled the collection of baseline water level and water quality data for the different groundwater and surface water systems within the Gloucester Basin. There are now more than 50 dedicated water monitoring locations and more than four years of baseline monitoring (water levels and water quality) across the Gloucester Basin.

This completion report details the installation of two monitoring bores on the floodplain at the Waukivory Pilot Project site (Figure 1.1) in November 2014. The Waukivory Pilot Project is an exploration activity as distinct from broader activities associated with the development phase of the Gloucester Gas Project (GGP). Following the completion of the two monitoring bores (WKMB06A and WKMB06B), in-situ pressure transducers with loggers (dataloggers) were installed, hydraulic testing performed and baseline groundwater quality sampling and analysis undertaken.

1.2 Objectives

This supplementary drilling program was designed to provide additional monitoring locations and groundwater data to assess whether there was any near surface connectivity between the alluvium and shallow rock in the expected thrust fault sub-crop area beneath the Avon River floodplain. The drilling and monitoring program was completed after the fracture stimulation of gas well Waukivory 13 but before the depressurisation phase when flowback and produced water is removed from the targeted deep coal seams.

The specific objectives of the drilling program (and the longer term monitoring program that follows) were to:

- expand the groundwater monitoring network at the Waukivory Pilot site to collect additional groundwater quality and level data
- assess the natural characteristics and variability of the local groundwater systems
- assess the connectivity between the alluvium and the underlying shallow rock in an area where a major thrust fault sub-crops
- increase the understanding of groundwater flow within the thrust fault systems at the Waukivory Pilot site
- enhance the conceptual understanding of the underlying groundwater systems, including groundwater flow and aquifer connectivity, in a suspected groundwater discharge area.

1.3 Scope of works

The scope of works for the field program and reporting is as follows:

- establishment of one alluvial groundwater monitoring bore targeting the Avon River alluvium
- establishment of one groundwater monitoring bore targeting the shallow sandstone in a thrust fault zone of the Leloma Formation
- installation of in-situ dataloggers in both groundwater monitoring bores
- hydraulic testing (rising and falling head tests) in both groundwater monitoring bores
- baseline groundwater quality testing including field parameters, major cations and anions, dissolved metals, nutrients, dissolved gases, hydrocarbons and isotopes
- reporting to describe the methodology and results for the drilling and installation of the monitoring bores and initial groundwater level and groundwater quality monitoring results.

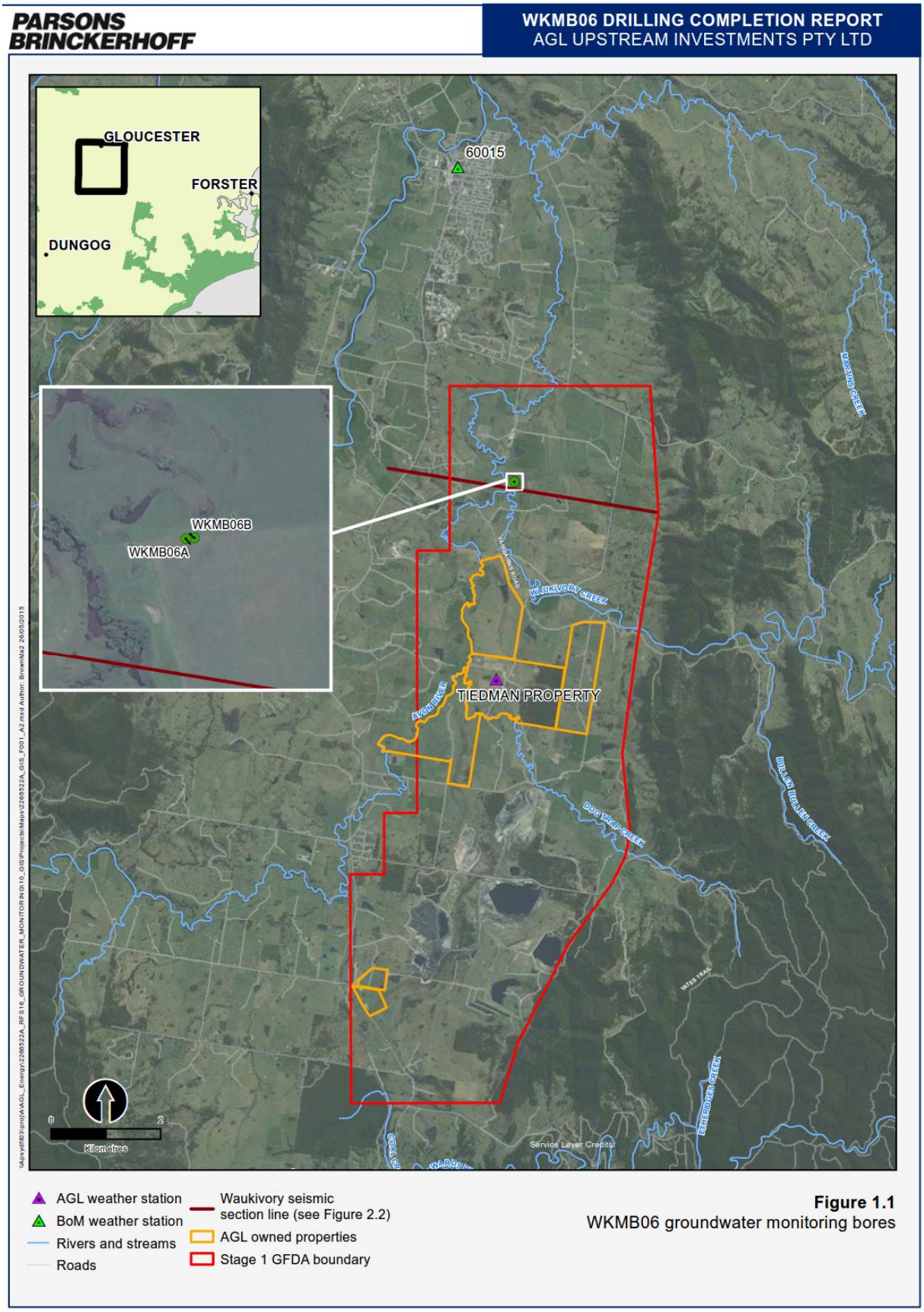


Figure 1.1 Location of WKMB06A and WKMB06B groundwater monitoring bores

2. Site characterisation

2.1 Site location

The Waukivory Pilot site is located approximately 4 km south east of Gloucester on land owned by Gloucester Resources Ltd (GRL). The monitoring bore site is positioned to the east of the Avon River which runs south to north through the property. The site has an elevation of approximately 100 metres Australian Height Datum (mAHD) and is relatively flat with a gentle slope towards the river. The surrounding properties are primarily used for grazing.

2.2 Rainfall

AGL has operated a weather station on the Tiedman property just south of the Project site since 2011. The closest Bureau of Meteorology (BoM) weather station to the Waukivory site, at Gloucester Post Office (60015), has been operational since 1888. Locations of the weather stations are shown in Figure 1.1.

Rainfall data for the period January 2011 to December 2014 are presented in Figure 2.1. The AGL weather station commenced monitoring in June 2011. For most of the period from March 2014 to December 2014, rainfall was below the monthly average, as indicated by the downward trend of the cumulative deviation plot, with only August 2014 and December 2014 recording higher than average rainfall. Total annual rainfall in 2014 was 720 mm which is significantly below the long term average for Gloucester.

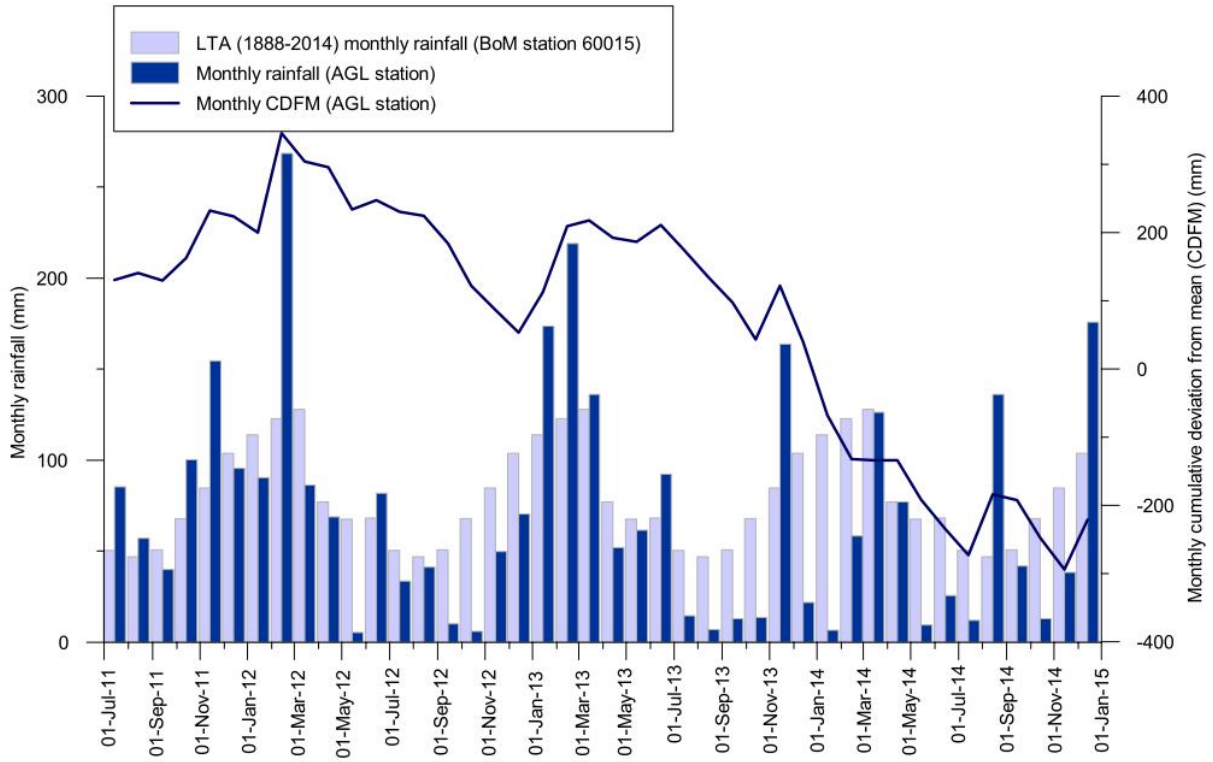


Figure 2.1 Monthly rainfall and cumulative deviation from the monthly mean (CDFM) rainfall at the AGL Gloucester station since installation in July 2011 (AGL, 2014a)

2.3 Surface hydrology

The Gloucester Basin is a narrow, north-south trending, elongated geological basin approximately 40 km long and 10 km wide, extending from Gloucester in the north to Stroud in the south. The Gloucester Basin is located high in the Manning River and Karuah River coastal catchments. The area occupied by the sedimentary rocks of the Basin (about 217 km^2) is small in comparison to the size of these catchments.

There is a surface water divide between the Wards River catchment (part of the Karuah River catchment) and the Avon River catchment (part of the Manning River catchment). In the northern Avon River catchment, surface water flow is generally to the north. In the southern Wards River catchment, surface water flow is generally to the south.

The Avon River includes the tributaries of Dog Trap Creek and Waukivory Creek within the Stage 1 GFDA. The Waukivory Pilot area is mostly located on the floodplain at the confluence of Waukivory Creek and the Avon River (Figure 1.1).

2.4 Geological setting

The Gloucester Basin comprises a thick succession of Permian sedimentary rocks representing deposition in both terrestrial and marine environments during a complex period of subsidence, uplift and relative sea level change (marine transgression and regression).

The Basin is a synclinal intermontane structure formed in part of the New England Fold Belt between a major Permian plate margin and the Sydney-Gunnedah Basin (Lennox 2009). The north–south trending synclinal nature of the Gloucester Basin resulted from the collision between the East Australian and Pacific Plates.

Following a period of extension during the Early Permian, the Gloucester Basin has undergone periods of normal and reverse faulting, with large scale tilting associated with late stage compressional movements towards the end of the Permian (Hughes 1984). Reverse faults dominate present day structure. A comparison with the contemporary horizontal stress field map (Hillis *et al* 1998) indicates the Basin is likely to be under compression in an east-west orientation.

The stratigraphy dips steeply (up to 90°) on the flanks of the Basin, dipping towards the north-south trending synclinal basin axis and flattening toward the centre of the Basin. Early Permian and Carboniferous hard resistive volcanics form the ridgelines of the Basin: the Mograni Range to the east; and the Gloucester and Barrington Tops to the west.

Overlying the Permian stratigraphy is a thin sequence of surficial Quaternary sedimentary deposits and regolith. The Quaternary sediments are non-uniform in thickness, and comprise unconsolidated alluvial sediments (sand, gravel, silt and clay) along the drainage channels and colluvial deposits across the rest of the plain sourced from the surrounding outcropping Permian deposits.

The Gloucester Basin is divided into three major Permian stratigraphic units each representing a distinct depositional setting: the Gloucester Coal Measures, the Dewrang Group, and the basal Alum Mountain Volcanics. The generalised stratigraphy of the Basin is summarised in Table 2.1. The development in the Stage 1 GFDA is targeting the intermediate and deep coal seams in the Gloucester Coal Measures generally below depths of approximately 200 to 1000 m.

The fault zones identified at the Waukivory Pilot site are mostly reverse faults where older rock strata are thrust over younger strata as a result of compressional movements in the basin. Figure 2.2 shows the trace of the major faults identified on a seismic section through the Waukivory area.

The locations for WKMB06A and WKMB06B were determined based on AGL's analysis of geophysical seismic sections (Figure 2.2) and local geological interpretation. WKMB06B was located and designed to

intercept the thrust fault zone that sub-crops in the vicinity (Figure 2.2) and to monitor the groundwater regime within the shallow fault zone. This fault zone shows significant displacement of the strata on either side of the fault plane. Such features can cause permeable horizons to be truncated against a low-permeability lithology such as shale. WKMB06A was located and designed to monitor the River Avon alluvium above the thrust fault zone and assess any potential interaction between the fault zone and groundwater within the shallow alluvium. The hydrogeology of the thrust fault zone is discussed further in Section 2.5.1.

Table 2.1 Stratigraphy of the Gloucester Basin

Period	Group	Sub-group	Formation	Approx. thickness (m)	Coal seam	Depositional environment	Tectonic events
Upper Permian	Gloucester Coal Measures	Craven	Crowthers Road Conglomerate	350		Marine regression, pro-gradation of alluvial fans	Uplift to west of Gloucester Basin
			Leloma	585	Linden		
					JD		
					Bindaboo		
					Deards		
			Jilleon	175	Cloverdale		
					Roseville		
					Tereel/Fairbairns		
			Wards River Conglomerate	Variable			
			Wenham	23.9	Bowens Road		
					Bowens Road Lower		
		Speldon Formation				Marine transgression but also some progradation of alluvial fans in the west related to uplift	Extension (normal fault development) and regional subsidence. Uplift to west of Basin
		Avon	Dog Trap Creek	126	Glenview		
			Waukivory Creek	326	Avon		
					Triple		
					Rombo		
					Glen Road		
					Valley View		
					Parkers Road		
	Dewrang	Mammy Johnsons		300	Mammy Johnsons	Marine transgression, regression and further marine transgression	Extension (normal fault development) and regional subsidence
		Weismantel		20	Weismantel		
		Duralie Road		250			
Lower Permian	Alum Mountain Volcanics				Clareval	Arc-related rift	Rift?
					Basal		

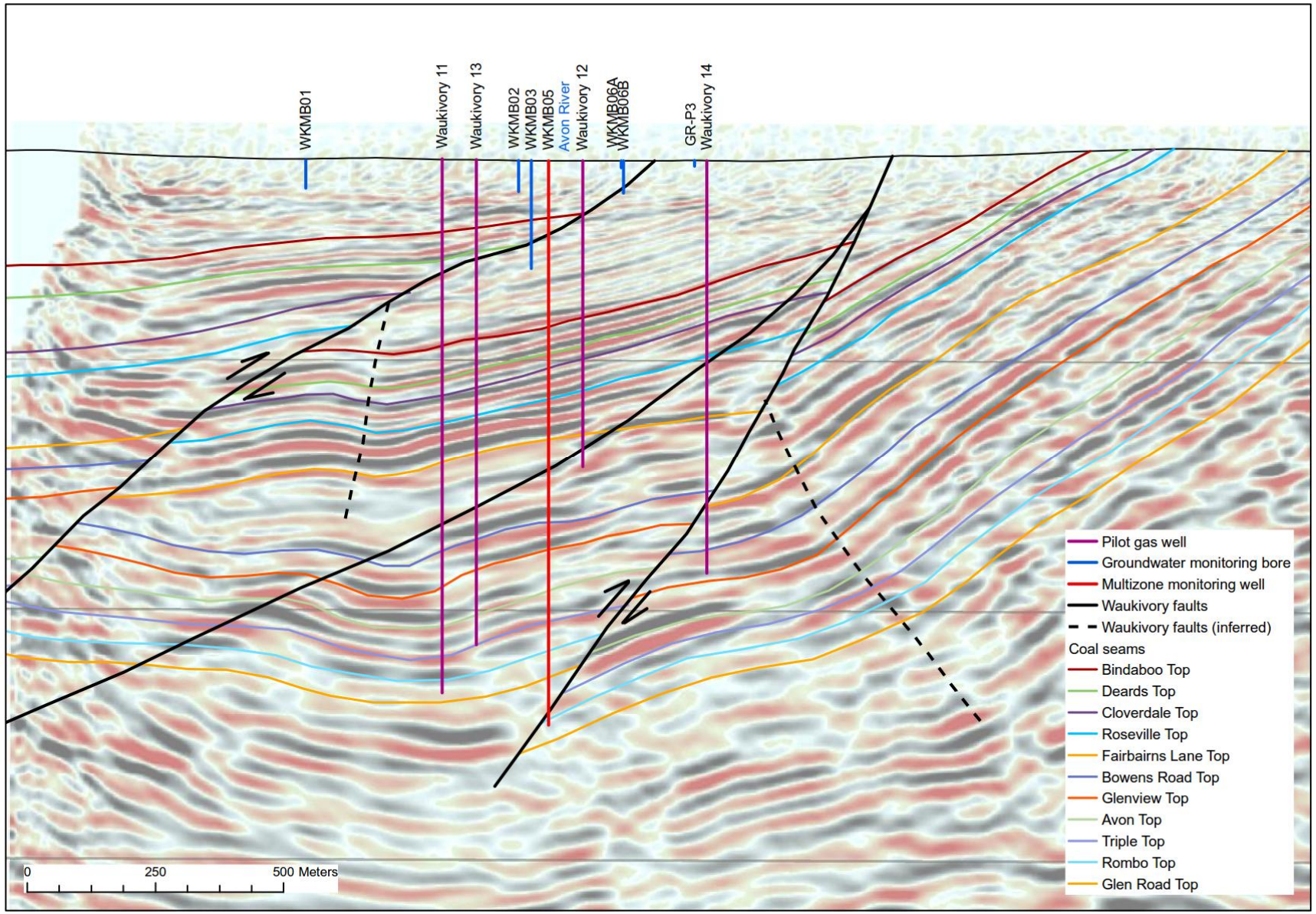


Figure 2.2 Waukivory interpreted seismic section (from Parsons Brinckerhoff 2014a) (line of section is shown on Figure 1.1)

2.5 Hydrogeological setting

Four broad hydrogeological units have been identified within the Gloucester Basin (Table 2.2). The permeability and groundwater flow characteristics of rocks within the Gloucester Basin are controlled by several factors including lithology, depth, and the degree of fracturing and faulting. In this sense hydrogeological units and flow systems do not always correspond with defined geological boundaries.

Table 2.2 Four hydrogeological units – Gloucester Basin

Unit	Aquifer type	Formation name	General lithology	Hydraulic characteristics
Alluvial deposits	Semi-confined, clay capped, porous, granular	Quaternary alluvium	Clay/mixed gravels	Heterogeneous, highly variable permeability associated with varying lithology
Shallow Rock (<150 m)	Semi-confined, fractured rock	Upper Permian Coal Measures, Alum Mountain Volcanics	Interbedded sandstone/siltstone with bedding plane fractures	Heterogeneous, high and low permeability domains associated with fault zones and fracturing
Interburden of deep coal measures	Confined, fractured rock, aquitard	Upper Permian Coal Measures	Interbedded indurated sandstone/siltstone and claystone	Low permeability associated with sparse fractures, permeability decreases with depth
Deep coal Seams	Confined, fractured rock, water bearing zones	Upper Permian Coal Measures	Coal/shale	Low permeability associated with cleating and fractures in coal seams, permeability decreases with depth

The four hydrogeological units are summarised as follows:

1. **Alluvial deposits** adjacent to major creeks and rivers comprising unconsolidated sand, gravel, and clay. The deposits are typically 12 to 15 m thick. These systems are heterogeneous but generally permeable with rapid recharge, through-flow, and discharge associated with interactions with streams, and to a lesser extent with the underlying less permeable shallow rock. Hydraulic conductivity measurements range from 0.3 to 300 metres per day (m/d), averaging around 10 m/d.
2. **Shallow rock** comprising variably weathered and fractured Permian rocks extending to approximately 150 m below the surface, across all sub-cropping Permian units. The shallow rock zone is heterogeneous with relatively impermeable domains separated by more permeable domains, but on the whole it is more permeable than the deeper coal measures. The domains of higher permeability are due to a higher density of fracturing associated with an irregular weathering profile and the near-surface expression of faulting. Aquifer zones observed during drilling occur within 75 m of the surface. Groundwater flow within this zone is more strongly controlled by weathering and fracturing than the attitude of geological strata. Hydraulic conductivity of the shallow rock ranges from 10 m/d to $1x10^{-6}$ m/d at a depth of 150 m, but is typically in the order of 10^{-3} to 10^{-4} m/d.
3. **Deep coal measures interburden**. Sandstone and siltstone units that form the interburden to coal seams are indurated and typically of very low permeability, forming aquitards and confining layers. The permeability of the interburden decreases with depth such that, at the maximum depth of CSG production, it is likely to be in the order of 10^{-5} to 10^{-7} m/d, or less.
4. **Deep coal seams**. Coal seams tend to be slightly more permeable than interburden and commonly form weak water bearing zones at depth. Permeability and storage are provided by small fractures and cleats in the coal. As with interburden, drill-stem tests clearly show that the permeability of coal seams generally decreases with depth. At the maximum depth of CSG production, the permeability of coal seams is very low (10^{-4} to 10^{-6} m/d), but may be an order of magnitude higher than the interburden.

The Alum Mountain Volcanics underlie the Permian Coal Measures, and form the impermeable base of the Gloucester Basin. The Alum Mountain Volcanics outcrop in the eastern and western boundaries of the Basin, forming the elevated topography of the Gloucester and Barrington Tops to the west, and the Mograni Range to the east.

2.5.1 Thrust fault zone

Hydrographs from WKMB06A and WKMB06B are discussed in the Waukivory Pilot Project surface water and groundwater monitoring quarterly reports (Parsons Brinckerhoff, 2015a and 2015b). The hydrographs show a very slight upward vertical gradient between the shallow rock and the alluvium, which is characteristic of groundwater discharge areas. The hydrographs show no anomalous water level responses and therefore provide no evidence of connectivity between the fracture simulation zones and the shallow groundwater system via the thrust fault zone.

This is consistent with the conceptual hydrogeological model whereby deeper groundwater migrates through the shallow fractured rock and into the base of the alluvium before mixed shallow and deep groundwater discharges as baseflow to surface waters.

3. Bore installation and field testing

Parsons Brinckerhoff provided hydrogeological services for the site investigation program as well as Health Safety and Environmental management.

Parsons Brinckerhoff supplied all the required technical services including geological, hydrogeological and surveying services. The subcontractors engaged to complete the site investigation program were:

- Highland Drilling (drilling and monitoring bore completions);
- Water N Tipper Hire Pty Ltd (fresh water deliveries);
- Mid Coast Liquid Waste Pty Ltd (offsite water and mud disposal);
- CalCo Surveyors Pty Ltd (surveying services).

3.1 Health, safety and environment

Onsite health, safety and environment issues were managed through a health, environment and safety plan (HESP) (Parsons Brinckerhoff 2014b), construction and environment management plan (CEMP) (Parsons Brinckerhoff 2014c) and safety management plan (SMP) (Parsons Brinckerhoff 2014d); these documents were prepared in advance of the drilling program and were reviewed and approved by AGL's safety team. Highland Drilling provided safe working method statements (SWMS) (Highland Drilling 2013a) and job safety analyses (JSA) (Highland Drilling 2013b) covering works relating to the drilling and construction of the boreholes, these documents were also reviewed and approved by AGL.

Highland Drilling and Parsons Brinckerhoff staff as well as any site visitors were required to undergo a site induction during which they were given an overview of the commitments included in the HESP, SMP and CEMP and how these applied to their specific duties.

3.1.1 Health, environment and safety plan

Parsons Brinckerhoff developed a comprehensive site specific HESP for the supervision of drilling work and groundwater monitoring activities at the Gloucester sites: *Health, Environment and Safety Plan (HESP) AGL – Gloucester Groundwater Investigations* (Parsons Brinckerhoff 2014b). This plan detailed the planned field tasks and the associated risk, and introduced mitigation measures to manage the risks. Measures include risk elimination, substitution and implementation of controls, training and use of personal protective equipment.

3.1.2 Safety management plan

The installation of the monitoring bores was conducted in accordance with the SMP which was developed by Parsons Brinckerhoff and approved by AGL (Parsons Brinckerhoff 2014d). The SMP is to be read in conjunction with the following AGL and Highland Drilling documents which together cover the health, safety and environmental working procedures for AGL's GGP:

- Gloucester Gas Project Health and Safety Management Plan (AGL 2014b);
- Gloucester Gas Project Emergency Response Procedure (AGL 2014c);
- Upstream Gas Golden Rules (AGL 2010);

- Standard Work Method Statement – Gloucester drilling task (Highland Drilling 2013a);
- Job Safety Analysis – Gloucester drilling (Highland Drilling 2013b).

All fieldwork undertaken at the drill site was covered under the aforementioned documents, including exploratory drilling and subsequent testing, and groundwater monitoring and sampling. These documents aim to ensure that the health, safety and welfare of Parsons Brinckerhoff employees and subcontractors are upheld through systematically identifying and documenting hazards, and assessing and controlling the associated risks.

Prior to the commencement of the field program, a desktop risk assessment for the drilling and construction of each borehole was undertaken, as per the requirements of the SMP. Taking into consideration the borehole depth and the likely strata to be drilled through (i.e. faults and/or producing coal seams) the bores were assessed to be either high, medium or low risk. The risk rating determines the construction method and level of well control required, i.e. the practices used to prevent and/or manage the influx of formation fluids/gas in the borehole (blowouts) and this is often via the use of a Blowout Preventer (BoP) and drill muds.

WKMB06A was assessed to be low risk and was drilled using a Tubex casing advance system. WKMB06B was assessed to be low risk and was drilled using air rotary and downhole hammer.

3.1.3 Construction and environment management plan

All site operations were undertaken in accordance with the environmental management systems as detailed in the site specific CEMP.

A detailed water management plan was a critical part of the CEMP detailing the stringent measures implemented to ensure compliance to zero discharge of produced (drilling) waters to adjacent land and surface water receivers. The water management plan stated that:

- All water utilised during the drilling process was supplied by AGL through Water N Tipper Hire Pty Ltd;
- All groundwater produced during the drilling operations was contained in above ground storage tanks. If the capacity of the tanks reached 80%, work on that bore ceased until excess water in the tanks could be emptied;
- All cuttings produced during drilling were contained in above ground tanks and were dried and used for internal farm track maintenance;
- All groundwater produced during the drilling was collected by Mid Coast Liquid Waste Pty Ltd and transported to AGL's Tiedman property, where water from the exploration programs is currently stored in lined holding dams.

Runoff waters from rainfall events were diverted from the drilling areas (where required) by the construction of diversion bunds on the up-gradient side of the site. Water from the drill pads and any constructed access tracks was diverted away by sand bag bunds, silt fencing and other control structures so as to direct water onto adjacent grassed areas and not erode the drill pads, fire trails and track areas.

3.1.4 Wellsite Permit to Work System

The internationally recognised Wellsite Permit to Work System (www.wellsite.org.au) was utilised for the groundwater drilling program. The system provides the means to manage field safety aspects in a systematic, formalised and auditable manner. As a standardised work planning mechanism, the Wellsite Permit to Work System was used for all non-routine tasks where a health and safety plan did not exist (including hot works), thus forcing the individual to undertake a documented work plan and assessment of the risks.

3.2 Drilling and installation

The drilling and installation of the bores was undertaken in November 2014 by Highland Drilling, using a rotary drilling rig under the supervision of a Parsons Brinckerhoff hydrogeologist.

AGL submitted a Category 1 notification together with the required Site Disturbance Notices to the Division of Resources and Energy (DRE) under the reconnaissance drilling program requirements of PEL 285. Test (monitoring bore) licences under the Water Act 1912 were obtained by AGL prior to the monitoring bore drilling program (Table 3.1). The bore licence is included in Appendix A and geological bore logs are included in Appendix B.

Table 3.1 Monitoring bore licences

NOW Licence no.	No. of bores	Local bore ID	Site location (property)	Lot	DP	Bore type
20B173856	2	WKMB06A WKMB06B	Waukivory	251	785579	Monitoring

The drilling and completion of the groundwater monitoring bores was carried out in accordance with the NSW Office of Water (NOW) bore licence conditions and followed a detailed design and specification compliant with the *National Uniform Drillers Licencing Committee (NUDLC) 2012, Minimum Construction Requirements for Water Bores in Australia, Edition 3*.

The WKMB06 monitoring bores were drilled using rotary air with a Tubex system to support the alluvium. Drilling through the shallow rock at the WKMB06B sites was with air rotary and downhole hammer.

The geology was logged at 1 m intervals and instantaneous water flow recorded at the end of each drill rod (every 6 m) once drilling had penetrated the water table. Water quality physico-chemical parameters were measured using a calibrated YSI^{TM} water quality meter and included temperature, Electrical Conductivity (EC), pH, Dissolved Oxygen (DO), Total Dissolved Solids (TDS) and Oxidation Reduction Potential (ORP). The parameters concentrations are shown on the geological bore logs in Appendix B.

Airlift development was continuous during drilling and the boreholes were further developed once the target depth had been reached until the discharge water was free of sediment and the water quality physico-chemical parameters stabilised.

The bores were designed such that the screened section of both monitoring bores was aligned with the most productive water bearing zone. A washed and graded (3 to 5 mm) gravel filter pack was installed in the annulus around the screen and extended 1 m and 3 m above the screened section in WKMB06A and WKMB06B respectively.

Coated bentonite pellets were installed 1 to 3 m above the gravel pack. A cement grout mix was then injected in a controlled manner to seal the annulus to the ground surface. The bentonite seal and cement grout ensure hydraulic isolation of the screened section preventing any flow of groundwater through the annulus of the bore. Following the construction of each bore, the site was reinstated and a lockable steel monument welded over the bores and surrounded at its base by a concrete slab.

The bores were surveyed for coordinates and elevation (Table 3.2). Bore construction details and initial manual standing water levels (SWLs) following bore installation are also presented in Table 3.2.

Table 3.2 Bore construction details

	WKMB06A	WKMB06B
Easting (MGA 94)	402779.06	402787.49
Northing (MGA 94)	6452659.49	6452660.09
Ground level elevation (mAHD)	100.18	100.47
Top of casing (mAHD)	100.70	100.94
Total depth (mbgl)	13.35	64 (collapsed to 63)
Bore diameter (mm)	140	140
Predominant drill bit used	Down hole hammer (Tubex)	Down hole hammer
Depth of 6" surface casing (mbgl)	4	15.4
Construction details	50 mm uPVC casing and screen	50 mm uPVC casing and screen
Screened interval (mbgl)	6.35 – 12.35	52 – 61
Screened interval (mAHD)	93.83 – 87.83	48.47 – 39.47
Screened formation	Alluvium	Fracture zone
Hydrogeological unit	Alluvium	Shallow rock
Lithology	Alluvium	Sandstone
Inflow (L/s)	<0.1	<0.1
Peak inflow depth (mbgl)	6.35 – 12.35	60 – 64
Initial standing water level (mAHD)	96.05	96.79

(1) mAHD – metres Australian Height Datum.
(2) mbgl – metres below ground level.

3.3 Field testing

3.3.1 Hydraulic conductivity testing

Falling and rising head ('slug') tests were conducted at both monitoring bores to estimate the horizontal hydraulic conductivity of the screened water bearing zones.

Slug tests are simple field procedures designed to calculate the approximate hydraulic conductivity of water bearing formations adjacent to monitoring bore screens.

A falling head test is achieved by introducing a 'slug' device to displace the water column within the monitoring bore causing the water level to instantaneously rise and water to flow from the bore into the aquifer via the well screen (Butler, 1998). The water level decay is recorded until the water level has returned to static level.

A rising head test is then conducted where the slug is removed causing a reduction in the bore water level with respect to the screened formation. Water then moves from the formation into the bore via the well screen. The water level recovery is recorded until the water level has returned to static level.

3.3.2 Groundwater level measurements

Following the completion of each monitoring bore, *in-situ* pressure, temperature and EC transducers (dataloggers) were installed and programmed to record measurements every 6 hours. To verify the level recorded by the dataloggers, manual measurements are recorded quarterly using an electronic dip meter.

A barometric logger installed above the water table at Waukivory monitoring bore WKMB02 records changes in atmospheric pressure. Data from this logger is used to correct for the effects of changing barometric pressure on groundwater levels.

The two new monitoring bores are part of the live telemetry of data from the Waukivory Pilot site. Telemetry equipment was installed at the site in November 2014 and water level information is displayed on AGL's water portal (AGL 2015).

3.3.3 Groundwater quality sampling

Baseline groundwater sampling was undertaken at the Waukivory monitoring bores (WKMB06A and WKMB06B) on 18 and 19 November 2014.

3.3.3.1 Sampling techniques

A 12-volt electric submersible pump was used to purge and obtain groundwater quality samples from WKMB06A as this bore is screened within relatively high permeability alluvium. A minimum of three well volumes was purged from the monitoring bore prior to sampling to allow collection of representative groundwater samples.

Monitoring bore WKMB06B was sampled using a dedicated micro-purge™ system, which allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer. The direct intake of formation water eliminates the need to purge relatively large volumes of groundwater prior to sampling.

3.3.3.2 Analytical suite

Physico-chemical parameters including temperature, EC, pH, dissolved oxygen (DO), total dissolved solids (TDS) and oxidation reduction potential (ORP) (Table 3.3) were measured during and following purging using a calibrated hand-held YSI™ water quality meter to ensure a representative groundwater sample was collected. Samples undergoing dissolved metal analysis were filtered through 0.45 µm filters in the field prior to collection.

Groundwater samples collected in the field were analysed for the comprehensive suite shown in Table 3.3.

Table 3.3 Groundwater analytical suite

Category	Suite of analytes	
Physico-chemical parameters	Electrical Conductivity (EC) Total Dissolved Solids (TDS) Temperature Free and total residual chlorine	pH Redox potential (ORP) Dissolved oxygen
General parameters (lab)	EC TDS (measured)	pH Total suspended solids
Major ions	Calcium Magnesium Sodium Potassium	Chloride Carbonate Bicarbonate Sulphate Fluoride
Dissolved metals and minor/ trace elements	Aluminium Antimony Arsenic Barium Beryllium Boron Bromine Cadmium Chromium Cobalt Copper Iron	Lead Manganese Mercury Molybdenum Nickel Selenium Strontium Tin Uranium Vanadium Zinc
Other analytes	Total organic carbon (TOC) Silica Free and total residual chlorine	Monoethanolamine (MEA) Tetrakis (hydroxymethyl) phosphonium sulphate (THPS)
Nutrients	Nitrate Nitrite Total nitrogen	Ammonia Total Kjeldahl Nitrogen Reactive and total phosphorus
Dissolved gases	Methane	
Hydrocarbons	Phenolic compounds Polycyclic aromatic hydrocarbons (PAH) Total petroleum hydrocarbons (TPH)	Benzene, toluene, ethyl-benzene and xylenes (BTEX) Volatile organic compounds (VOC's)
Isotopes	Oxygen-18 (^{18}O) Deuterium (^{2}H) Tritium (^{3}H)	Carbon-13 dissolved inorganic carbon ($^{13}C_{DIC}$) Carbon-13 methane ($^{13}C\text{-}CH_4$) and deuterium methane ($^{2}H\text{-}CH_4$) Radiocarbon (^{14}C)

The samples were sent to the following laboratories under appropriate chain-of-custody protocols:

- Australian Laboratory Service (ALS) Environmental Pty Ltd, Smithfield, Sydney (NATA accredited laboratory) – chemistry analysis.
- GNS Stable Isotope Laboratory, Lower Hutt, New Zealand – oxygen-18 and deuterium analysis.
- Australian National University (ANU) Research School of Earth Sciences, Canberra – strontium 87/76 analysis.
- GNS Tritium and Water Dating Laboratory Lower Hutt, New Zealand – tritium analysis.
- UC Davis Stable Isotope Facility, Davis, California, USA – carbon-13 ($^{13}C_{DIC}$) and methane isotope analysis ($^{13}C\text{-}CH_4$ and $^{2}H\text{-}CH_4$).
- Rafter Radiocarbon Laboratory, Lower Hutt, New Zealand – carbon-14 (^{14}C) analysis.
- Envirolab Services, Sydney NSW (NATA accredited laboratory) – THPS analysis.

3.3.3.3 Quality assurance

Field QA/QC

All sampling was undertaken in accordance with Parsons Brinckerhoff's sampling procedures (Appendix C) and the Australia/New Zealand standards for water quality sampling (AS/NZS 5667). The following QA/QC procedures were applied:

- Dedicated sampling equipment (such as micro-purge™ low flow sampling pumps) and disposable (single use) equipment specific to each sample location:
  - a dedicated micro-purge™ pump was installed at WKMB06B. This type of equipment is used for lower yielding bores and deeper bores with high purge volumes for the Waukivory groundwater monitoring network, allowing for less groundwater disturbance and minimising loss of volatiles and disturbance of redox conditions
  - samples for metals were field filtered using single use filters and syringes
- Unstable parameters were analysed in the field, i.e. physical parameters, including pH and free chlorine.
- The hand-held water quality meter was calibrated each day for EC and pH.
- Two to three well volumes were purged prior to sampling, following stabilisation (±10% for EC and ±0.05 pH units) of key field parameters; note the micro-purge™ low flow sampling pump was designed to reduce the volume of purging required.
- Nitrile gloves were worn while collecting water samples.
- Samples were collected in appropriate bottles with appropriate preservation solutions, as specified by the NATA accredited laboratories.
- All bottles for volatile analysis were filled as far as practicable to avoid any head space and loss of volatiles.
- All sample bottles were labelled with the sample ID, date, time and samplers initials.
- Samples were placed in eskies containing ice immediately upon collection.
- Where sample storage was required overnight, samples were kept chilled and secure.
- A chain-of-custody form was completed for each batch of samples, and eskies securely sealed prior to delivery to the laboratory.
- Samples were delivered to the laboratories within the specified holding times, with the exception of pH and free chlorine, which were also analysed in the field.

Laboratory QA/QC

The laboratories conduct their own internal QA/QC program to assess the accuracy and precision of the analytical procedures. These programs include analysis of laboratory sample duplicates, spike samples, certified reference standards, surrogate standards/spikes and laboratory blanks. Laboratory QC reports are provided in Appendix D.

3.4 Geophysical logging

Geophysical logging of WKMB06B was undertaken on 12 November 2014 and comprised the following suite:

- Density
- Deviation
- Neutron
- Tele viewer
- Temperature
- Velocity

4. Results

4.1 Hydraulic conductivity testing

Estimates of hydraulic conductivity have been derived according to the Springer-Gelhar (1991) and Hvorslev (1951) methods with the analytical software package AQTESOLV Version 4.5. Results are presented as in Table 4.1. The AQTESOLV analytical reports are included in Appendix E. The hydraulic conductivity estimates for WKMB06A (alluvium) and WKMB06B (shallow rock) are consistent with previous hydraulic conductivity estimates obtained from testing in the Gloucester Basin (Parsons Brinckerhoff 2014e).

The water level in WKMB06A showed an underdamped oscillatory response to the slug testing. Such a response is best analysed using the Springer-Gelhar (1991) analytical method as this method accounts for inertial effects in the well and oscillatory slug test response in a high-hydraulic conductivity formation.

Hvorslev (1951) has been selected for WKMB06B as this method is well suited to non-leaky confined formations.

Table 4.1 Hydraulic conductivity results from slug tests

	WKMB06A	WKMB06B
Screen depth (mbgl)	6.35 – 12.35	52 – 61
Start water depth (mbgl)	4.68	3.30
Screened formation	Alluvium	Leloma Formation
Hydrogeological unit	Alluvium	Shallow rock
Lithology	Alluvial gravel	Sandstone
Number of slug tests	3	2
Response	Oscillatory (under-damped)	Log-linear
Analysis method	Springer-Gelhar	Hvorlslev
Hydraulic conductivity (m/d)	28.19 (falling head test) 10.46 (rising head test)	4.6×10^{-3} (falling head test) 6.5×10^{-3} (rising head test)

4.2 Groundwater levels

Table 3.2 shows the standing water level to be higher in WKMB06B than WKMB06A. This slight upward gradient is consistent with the conceptual model whereby diffuse groundwater discharge is occurring from the bedrock to the base of the alluvium.

4.3 Groundwater quality

Sampling for groundwater quality analysis was undertaken on 18 and 19 November 2014. A comprehensive suite of elements and compounds were analysed in each sample (Section 3). Full water quality results are presented in Appendix F and laboratory reports are presented in Appendix G.

4.3.1 Physico-chemical parameters

Field measurements of Electrical Conductivity (EC) and pH were taken at the time of sampling.

Groundwater in the alluvium bore (WKMB06A) was found to be brackish (2,926 µS/cm) with a slightly acidic pH of 6.37.

Groundwater in the shallow rock bore (WKMB06B) was found to be fresher than that of the overlying alluvium with an EC of 1,278 µS/cm and slightly alkaline with a pH of 8.44.

The salinity (EC) of groundwater in the Gloucester basin typically increases with depth however, due to the fractured nature of the shallow rock it is possible that preferential pathways for rainfall may exist that can lead to slightly fresher water at depth. In addition, groundwater at the base of the alluvium receives diffuse saline discharge from the underlying rock and this may concentrate in the shallow unconfined aquifer through evapotranspiration processes.

4.3.1 Major ions

The major ion characteristics of groundwater samples are shown in the piper diagram in Figure 4.1. A piper diagram is a graphical representation of the relative concentrations of major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, HCO_3^{-}+CO_3^{2-} and SO_4^{2-}) and is used to distinguish the chemical profile of major water types.

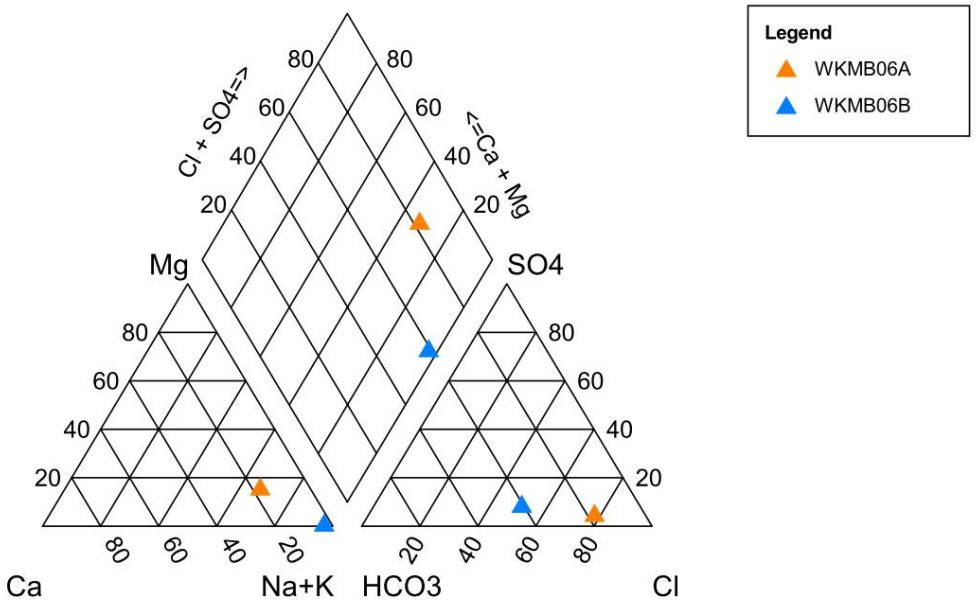


Figure 4.1 Piper plot of water chemistry

Groundwater in the alluvium bore (WKMB06A) is dominated by sodium, chloride and bicarbonate; and groundwater in the shallow rock bore (WKMB06B) is dominated by sodium and bicarbonate.

4.3.2 Dissolved metals

Concentrations of detected dissolved metals in the alluvial and shallow rock groundwater are presented in Figure 4.2. The major findings for dissolved metals are as follows:

- Aluminium, arsenic, barium, bromine, copper, iron, lead, strontium and zinc were detected at low concentrations in both the alluvium and shallow rock monitoring bores
- Cadmium and cobalt were detected at low concentrations in the alluvium monitoring bore only
- Boron, molybdenum, nickel and uranium were detected at low concentrations in the shallow rock monitoring bore only.

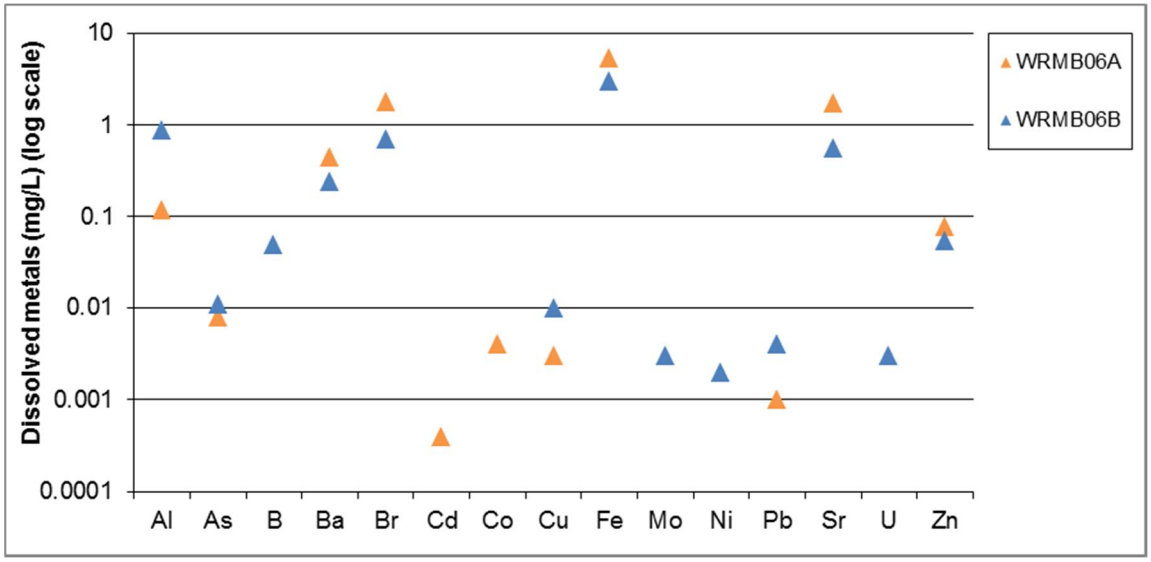


Figure 4.2 Detected dissolved metal concentrations in groundwater

4.3.3 Nutrients

The major findings for nutrients are as follows:

- nitrate was detected the shallow rock (0.02 mg/L)
- ammonia concentrations were 0.21 mg/L in the alluvium and 0.37 mg/L in the shallow rock
- TOC was detected in WKMB06A at a concentration of 3 mg/L
- total phosphorus was detected in both bores at concentrations of 0.06 mg/L (WKMB06A) and 0.63 mg/L (WKMB06B).

4.3.4 Hydrocarbons

No phenolic compounds were detected in the alluvium and the shallow rock groundwater. The following PAHs were detected in the alluvium groundwater:

- Naphthalene (3.4 µg/L)
- Acenaphthene (5.4 µg/L)
- Fluorene (4.6 µg/L)
- Phenanthrene (7.5 µg/L)

- Low levels of toluene (27 µg/L) and TPH C_6-C_9 (40 µg/L) were detected in the shallow rock groundwater
- TPH C_{10}-C_{14} (170 µg/L) and C_{15}-C_{28} (100 µg/L) were detected in the alluvium groundwater.

These compounds are typically found in groundwater located in or derived from sedimentary basin rocks with coal rich sediments.

4.3.5 Dissolved gases

Dissolved methane was detected in the alluvium (12 µg/L) and the shallow rock (10,300 µg/L) groundwater. No other dissolved hydrocarbon gases were detected.

4.4 Environmental Isotopes

The following environmental isotopes were analysed:

- Oxygen-18 and deuterium (^{2}H) analysis (GNS Stable Isotope Laboratory, New Zealand)
- Tritium (^{3}H) analysis (GNS Tritium and Water Dating Laboratory, New Zealand)
- Carbon-13 ($^{13}C_{DIC}$) and methane isotope analysis (^{13}C-CH_4 and ^{2}H-CH_4) (UC Davis Stable Isotope Facility)
- Radiocarbon (^{14}C) analysis (Rafter Radiocarbon Laboratory)

The environmental isotope data is shown in Table 4.2 and laboratory results are provided in Appendix H.

Table 4.2 Isotope results

Isotope	WKMB06A	WKMB06B
Oxygen-18 (‰)	-4.77	-4.89
Deuterium (‰)	-26.4	-26.4
δ^{13}C (‰)	-9.94 ± 0.2	-15.47 ± 0.2
^{14}C (pMC)	89.47 ± 0.23	30.12 ± 0.24
Tritium (TU)	0.245 ± 0.016	0.046 ± 0.014
CH_4 (µg/L)	12	10,300
δ^2H_{CH4} (‰)	below detection	-209.6
$\delta^{13}C_{CH4}$ (‰)	-57.21	-75.13

The estimated age of the groundwater from the radiocarbon analysis is shown in Table 4.3.

Table 4.3 Radiocarbon age analysis

Sample ID	Sample date	^{14}C uncorrected age (yrs BP)	^{14}C corrected age (yrs BP)
WKMB06A	18/11/14	831 ± 20	Modern
WKMB06B	19/11/14	9578 ± 63	6,700

4.4.1 Stable isotopes

Stable isotopes of water, oxygen-18 (^{18}O) and deuterium (^{2}H) provide information about the origin of natural waters and the processes that have affected groundwater since it entered the groundwater system.

The Global Meteoric Water Line (GMWL) provides an important key to the interpretation of ^{18}O and ^{2}H data. It is a line that defines the relationship between ^{18}O and ^{2}H in fresh surface waters and precipitation from a number of global reference sites. Water with an isotopic composition that lies on the GMWL is assumed to have originated from the atmosphere and to be unaffected by other geochemical processes. Samples that plot significantly off the GMWL can indicate fractionation, which is a modification by processes such as evaporation and interaction with rock minerals. The stable isotope composition of rain is also influenced by altitude, climatic conditions and rainfall intensity, such that rain from different locations can plot at different positions along the GMWL.

Stable isotopes of water values are compared to the GMWL ($\delta^2H = 8.13\ \delta^{18}O + 10.8$) (Rozanski *et al*. 1993) and the Local Meteoric Water Line (LMWL) (Sydney region) ($\delta^2H = 8.3\ \delta^{18}O + 16.3$) (Crosbie *et al*. 2012) in Figure 4.3.

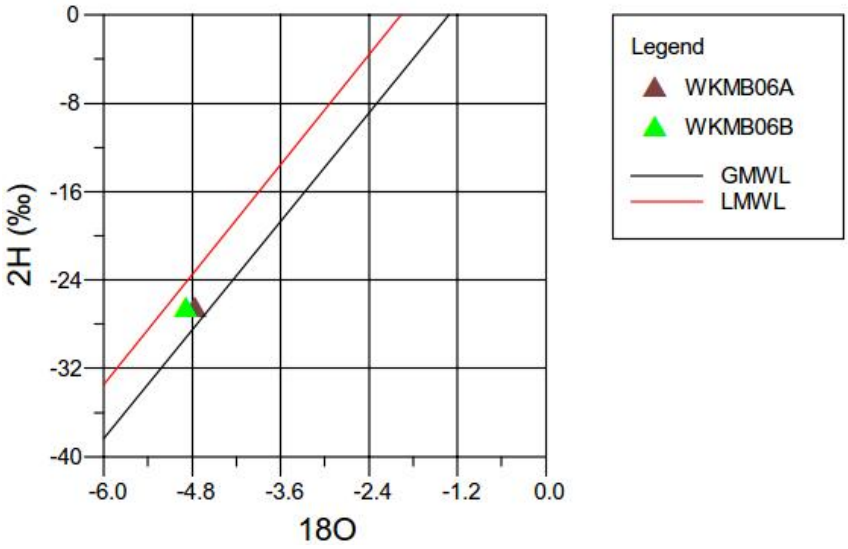


Figure 4.3 Deuterium versus oxygen-18

Both bores have similar stable isotope values and plot between the LMWL and GMWL, indicating that the groundwater is of meteoric origin.

4.5 Geophysical logging

Geophysical logging of WKMB06B was undertaken on 12 November 2014. The complete dataset is shown in Appendix I. The interpretation relevant to this investigation is as follows:

The resistivity log shows that the water level during logging was approximately 26 to 28mbgl. The neutron, density, resistivity and velocity logs above this level have therefore been discarded as these logs are known to be affected by saturation.

Both the calliper and gamma logs show there is disturbed strata below the alluvium from approximately 15 to 26.5 mbgl, which is indicative of a weathered zone comprising faulted or fractured rock. The fluctuations in bore diameter shown by the calliper log suggest that minor horizontal fractures intersect the bore within this zone. This is expected to enhance permeability and hence the connectivity between

this shallow fractured rock zone and the overlying alluvium. The bore log (Appendix A) shows this zone to be dominated by siltstone and associated with two regions of groundwater inflow.

From 26.5 mbgl to end of hole, the formation is shown to be relatively uniform with occasional areas where the neutron log indicates high porosity and the gamma log indicates low clay content, most notably 27 to 29 mbgl, 34 to 36.5 mbgl and 54 to 56 mbgl. The calliper log does not indicate these areas to be fractured; however, groundwater inflows were observed during drilling. The bore log shows the lower two horizons to be dominated by sandstone.

The bore log records fracturing in the interval from 51 to 59 mbgl, with some minor groundwater inflows within this zone. These observations are not corroborated by the calliper log, which indicates one minor fracture at approximately 55 mbgl; this may be due to the fractures being infilled by quartz or difficulties in identifying fractured horizons from cuttings when using the downhole hammer drilling method. The acoustic velocity log shows an increase from 54 to 56 m, which is indicative of relatively high porosity and consistent with the presence of a fracture.

From analysis of the geophysical logging, WKMB06B has intersected weathered and fractured zones within the shallow rock beneath the alluvium. However, the geophysical logging does not unequivocally identify a major fault zone in WKMB06B and provides no evidence of enhanced connectivity between the deeper groundwater systems and the shallow rock.

5. Conclusions

The drilling program detailed in this report established one nested groundwater monitoring site (a total of two monitoring bores) at the Waukivory Pilot site within the GGP in November 2014; one groundwater monitoring bore in the Quaternary alluvium (WKMB06A) and one groundwater monitoring bore into an identified thrust-fault zone within the shallow rock of the Leloma Formation (WKMB06B).

The summary findings of the local geology and the fault sub-crop are:

- WKMB06A was completed at the base of the alluvium
- WKMB06B intersects a weathered zone of the shallow rock beneath the alluvium
- There was minimal groundwater inflow during drilling through the rock profile suggesting low permeability strata within the thrust-fault zone
- The geophysical logging provides no evidence of enhanced connectivity between the deeper groundwater systems, the shallow rock and the alluvium

The summary findings of the hydraulic testing are:

- Slug test analysis yielded hydraulic conductivity estimates of the screened formation at WKMB06A ranging from 10.46 to 28.19 m/d;
- Slug test analysis yielded hydraulic conductivity estimates of the screened formation at WKMB06B ranging from 4.6×10^{-3} to 6.5×10^{-3} m/d.

The summary findings of the baseline water quality analysis are:

- Groundwater in the alluvium is brackish and slightly acidic. Groundwater salinity in the shallow rock is marginal and slightly alkaline;
- Aluminium, arsenic, barium, bromine, copper, iron, lead, strontium and zinc were detected in both the alluvium and shallow rock monitoring bores
- Cadmium and cobalt were detected in the alluvium monitoring bore only
- Boron, molybdenum, nickel and uranium were detected in the shallow rock monitoring bore only.
- No phenolic compounds were detected in the alluvium and the shallow rock monitoring bores.
- Low concentrations of PAHs were detected in the alluvium monitoring bore.
- Low concentrations of toluene and TPH C_6-C_9 were detected in the shallow rock monitoring bore.
- TPH C_{10}-C_{14} and C_{15}-C_{28} were detected in the alluvium monitoring bore.
- Dissolved methane was detected in both the alluvium and shallow rock monitoring bores.

6. Statement of limitations

6.1 Scope of services

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client (AGL) and Parsons Brinckerhoff (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

6.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

6.3 Environmental conclusions

In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

6.4 Report for benefit of client

The report has been prepared for the benefit of the client (and no other party). Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Parties other than the client should not rely upon the report or the accuracy or

completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

6.5 Other limitations

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

7. References

- AGL Energy Ltd (2010) Upstream Gas Golden Rules.
- AGL (2014a) *Weather station data*, http://agk.com.au/gloucester/index.php/weather/, accessed 15/07/14.
- AGL Energy Ltd (2014b) Gloucester Gas Project Health and Safety Management Plan, DCS_GN_HSE_MP_003.
- AGL Energy Ltd (2014c) Gloucester Gas Project Emergency Response Procedure, DCS_GN_HSE_MP_004.
- AGL 2015, Water Portal. http://www.agl.com.au/waterportal
- Bouwer, H. (1989) The Bouwer and Rice slug test, Ground Water, vol. 27, no. 3, pp. 304-309.
- Bureau of Meteorology (2014) *Climate data,* http://www.bom.gov.au/climate/data/, accessed 10/11/14.
- Butler, J. J. (1998). The design, performance and analysis of slug tests. Boca Raton, Florida: Lewis Publishers.
- Highland Drilling (2013a) Safe work method statement & risk assessment: Gloucester groundwater project, dated June 2013.
- Highland Drilling (2013b) Job safety analysis: Gloucester groundwater project, construction of monitoring bores, dated June 2013.
- Hillis R. R., Meyer J. J. and Reynolds S. D. (1998) The Australian Stress Map. Exploration geophysics (1998):420 – 427.
- Hughes, W.W., Wilcox, R.D. and Wilcock, S.W. (1984) Regional exploration of the Gloucester Basin, Report prepared for Esso Australia Ltd.
- Hvorslev M. J. (1951) Time lag and soil permeability in groundwater observations. U.S. Army Corps of Engineers Water-way Experimentation Station, Bulletin 36.
- Lennox, M. (2009) Stroud Gloucester Trough: Review of the Geology and Coal Development, Ashley Resources, Sydney, dated January 2009.
- National Uniform Drillers Licencing Committee (NUDLC) (2012) Minimum Construction Requirements for Water Bores in Australia, Edition 3.
- Parsons Brinckerhoff (2012) Phase 2 Groundwater Investigations – Stage 1 Gas Field Development Area, Gloucester Gas Project, PR_5630, dated January 2012, Parsons Brinckerhoff, Sydney.
- Parsons Brinckerhoff (2014a) GGP Monitoring Bore Installation, 2162406E-WR-GLO-STG2 RevB, dated October 2014, Parsons Brinckerhoff, Sydney.
- Parsons Brinckerhoff (2014b) Health, Environment & Safety Plan: Gloucester Gas Project, Groundwater Investigations, 2268522A, dated October 2014, Parsons Brinckerhoff Sydney.
- Parsons Brinckerhoff (2014c) Construction & Environment Management Plan: Gloucester Gas Project, Additional Monitoring Bores, Groundwater Investigations, 201409890-WAT-RPT-7593 RevB, dated October 2014, Parsons Brinckerhoff, Sydney.
- Parsons Brinckerhoff (2014d) Safety Management Plan: Gloucester Gas Project, Groundwater Investigations, 201409890-UGE-RPT-7278, dated October 2014, Parsons Brinckerhoff, Sydney.
- Parsons Brinckerhoff (2014e) Drilling completion report: Faulkland and Bucketts Way groundwater monitoring bores. 2193324A-WAT-RPT-001 RevD dated December 2014, Parsons Brinckerhoff, Sydney.

- Parsons Brinckerhoff (2015a), Surface Water and Groundwater Monitoring Report to 31 December 2014. 2268523A-WAT-RPT-001 RevF dated 27 February 2015, Parsons Brinckerhoff, Sydney.
- Parsons Brinckerhoff (2015b), Waukivory Pilot Project Surface and Groundwater Monitoring Report to 31 March 2015. 2268523A-WAT-REP-002 RevD dated 28 May 2015, Parsons Brinckerhoff, Sydney.
- SRK Consulting (2005) Gloucester Basin Geological Review, SRK Project Number GBA001.
- Waterra (2011) Waterra 3 Part Well Slugs User Guide, Waterra (UK) Ltd www.waterrauk.com, accessed August 2011.
- Weight, WD and Sonderegger, JL (2001). Manual of applied field hydrogeology. McGraw Hill.

Appendix A

Bore licence

NSW Office of Water

Hunter Region
Po Box 2213
3/26 Honeysuckle Drive
Dangar NSW 2309
Phone: (02) 49042500

BORE LICENSE CERTIFICATE
UNDER SECTION 115 OF THE WATER ACT, 1912

20BL173856

Department of Primary Industries Office of Water

A G L Upstream Investments Pty Ltd
Locked Bag 1837
St Leonards NSW 2065

LICENSE NUMBER
20BL173856
DATE LICENSE VALID FROM
31-Oct-2014
DATE LICENSE VALID TO
PERPETUITY
FEE
$0.00

ABN 47661556763 GST NIL

LOCATION OF WORKS

Portion(s) or Lot/Section/DP	PARISH	COUNTY
251//785579	Gloucester	Gloucester

TYPE OF WORKS	PURPOSE(S) FOR WHICH WATER MAY BE USED
Bore	Monitoring Bore

CONDITIONS APPLYING TO THIS LICENSE ARE

As shown on the attached Condition Statement

COPY

NSW Office of Water

CONDITIONS STATEMENT REFERRED TO ON 20BL173856 ISSUED UNDER PART V OF THE WATER ACT, 1912 ON 31-Oct-2014

(1) THE LICENCE SHALL LAPSE IF THE WORK IS NOT COMMENCED AND COMPLETED WITHIN ONE YEAR OF THE DATE OF ISSUE OF THE LICENCE.

(2) THE LICENSEE SHALL ALLOW NSW OFFICE OF WATER OR ANY PERSON AUTHORISED BY IT, FULL AND FREE ACCESS TO THE WORKS, EITHER DURING OR AFTER CONSTRUCTION, FOR THE PURPOSE OF CARRYING OUT INSPECTION OR TEST OF THE WORKS AND ITS FITTINGS AND SHALL CARRY OUT ANY WORK OR ALTERATIONS DEEMED NECESSARY BY THE DEPARTMENT FOR THE PROTECTION AND PROPER MAINTENANCE OF THE WORKS, OR THE CONTROL OF THE WATER EXTRACTED AND FOR THE PROTECTION OF THE QUALITY AND THE PREVENTION FROM POLLUTION OR CONTAMINATION OF SUB-SURFACE WATER.

(3) WATER SHALL NOT BE PUMPED FROM THE BORE AUTHORISED BY THIS LICENSE FOR ANY PURPOSE OTHER THAN GROUNDWATER INVESTIGATION.

(4) THE WORK SHOULD BE CONSTRUCTED TO SEAL OFF WATER FROM ANY AQUIFER OTHER THAN THE TARGET AQUIFER BY:
(A) INSERTING THE APPROPRIATE LENGTH OF CASING TO A DEPTH IMMEDIATELY ABOVE THE TARGET AQUIFER
(B) CEMENTING BETWEEN THE CASING(S) AND THE WALLS OF THE BORE HOLE FROM THE BOTTOM OF THE CASING TO GROUND LEVEL.

(5) THE LICENSEE SHALL NOTIFY NSW OFFICE OF WATER IF A FLOWING SUPPLY OF WATER IS OBTAINED. THE BORE SHALL THEN BE LINED WITH CASING AND CEMENTED AND A SUITABLE CLOSING GEAR SHALL BE ATTACHED TO THE BOREHEAD AS SPECIFIED BY NSW OFFICE OF WATER.

(6) IF A WORK IS ABANDONED AT ANY TIME THE LICENSEE SHALL NOTIFY NSW OFFICE OF WATER THAT THE WORK HAS BEEN ABANDONED AND SEAL OFF THE AQUIFER IN ACCORDANCE WITH THE MINIMUM CONSTRUCTION REQUIREMENTS FOR WATER BORES IN AUSTRALIA.

(7) THE LICENCE HOLDER MUST, WITHIN 2 MONTHS OF COMPLETION OF THE CONSTRUCTION OF THE WORK, OR WITHIN 2 MONTHS AFTER THE ISSUE OF THE APPROVAL IF THE WORK IS EXISTING, SUBMIT TO THE DEPARTMENT THE FOLLOWING:
(I) THE COMPLETED APPROVED FORM (FORM A),
(II) DETAILS OF THE LOCATION OF THE WORK ON A COPY OF THE LOT AND DEPOSITED PLAN, THE WORKS GPS REFERENCE, AND THE RESPECTIVE DISTANCE(S) OF THE WORK FROM THE PROPERTY BOUNDARIES,
(III) IF THE MINISTER HAS REQUESTED ANY WATER ANALYSIS AND/OR PUMPING TESTS TO BE CARRIED OUT, DETAILS OF THE WATER ANALYSIS AND/OR PUMPING TESTS AS REQUIRED BY THE MINISTER,

(8) THE HOLDER OF THE LICENCE SHALL NOT ALLOW ANY WATER EXTRACTED FROM THE BORE TO DISCHARGE INTO OR ONTO:
- ANY LAND
- ANY RIVER, CREEK OR WATERCOURSE;

(9) THE LICENCE HOLDER SHALL NOT DISTURB THE HABITAT OF ANY NATIVE FLORA AND/OR FAUNA.

(10) THE LICENCE HOLDER IS NOT AUTHORISED BY THIS LICENCE TO REMOVE OR CLEAR ANY NATIVE VEGETATION OR TREES AS DESCRIBED WITHIN THE NATIVE VEGETATION CONSERVATION ACT 1997 OR NATIVE VEGETATION ACT 2003. ANY VEGETATION REMOVAL WILL REQUIRE SEPARATE

Appendix B

Bore logs

BORE COMPLETION REPORT - WKMB06A

Project: AGL Gloucester Gas Project
Location: WKMB06
Easting: 402779.06 **Northing:** 6452659.49
Top of casing elevation: 100.7 mAHD
Grid system: MGA 94 Zone 56 **Stick-up height:** 0.52 m

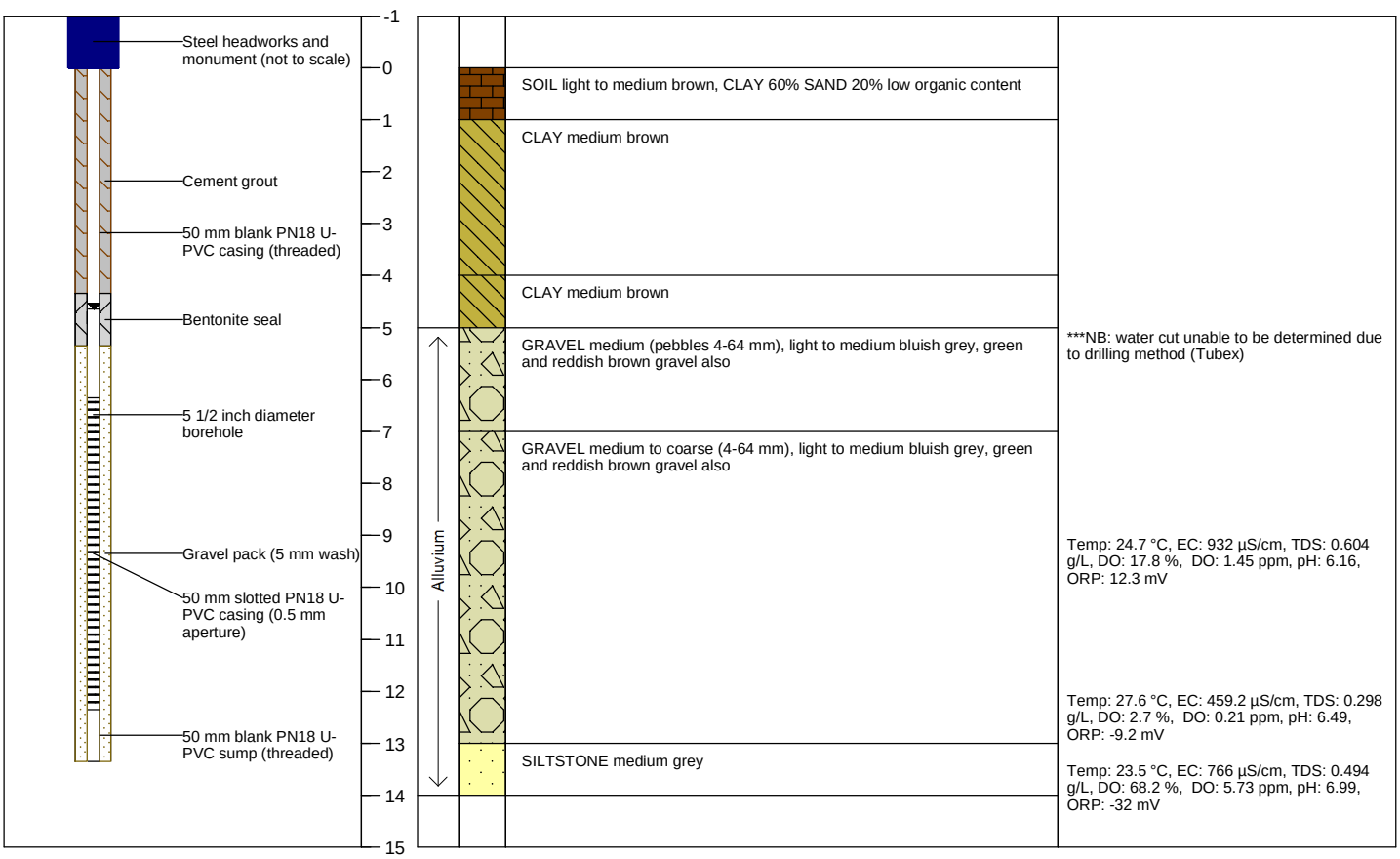
Drilling contractor: Highland Drilling
Driller: I. Palk **Rig:** HD20
Drilling method: Rotary air **Total drilled depth:** 13.35 m

Borehole diameter:	205 mm	0 - 5 m	**Bit:** Blade
Borehole diameter:	150 mm	0 - 13.35 m	**Bit:** Tubex

Purpose of bore: Groundwater monitoring bore
Screened Formation: Alluvium
Logged by: K. Maher
Start date: 13/11/2014
Completion date: 14/11/2014

Static WL: 96.05 mAHD 4.65 mbtoc
Water level date: 17/11/14

Plain casing: 0-6.35 m: 50 mm PVC Class 18
Screen: 6.35-12.35 m: 50 mm PVC Class 18 (0.5 mm slots)
Sump: 12.35-13.35 m: 50 mm PVC Class 18
Cement grout: 0-4.35 m: 0.03 m3
Gravel backfill: NA
Bentonite seal: 4.35-5.35 m
Gravel pack: 5.35-13.35 m: 5 mm washed gravel
Bentonite plug: NA



PARSONS BRINCKERHOFF

Drawing No.:	WKMB06A - Bore construction		
Revision:	A	Date drawn:	22/1/2015
Drawn by:	K. Maher	Checked by:	S. Daykin
Project No.	2268522A		

AGL

AGL Upstream Investments Pty Ltd
WKMB06A

WKMB06 Drilling Completion Report

BORE COMPLETION REPORT - WKMB06B

Project: AGL Gloucester Gas Project
Location: WKMB06
Easting: 402787.49 **Northing:** 6452660.09
Top of casing elevation: 100.94 mAHD
Grid system: MGA 94 Zone 56 **Stick-up height:** 0.47 m

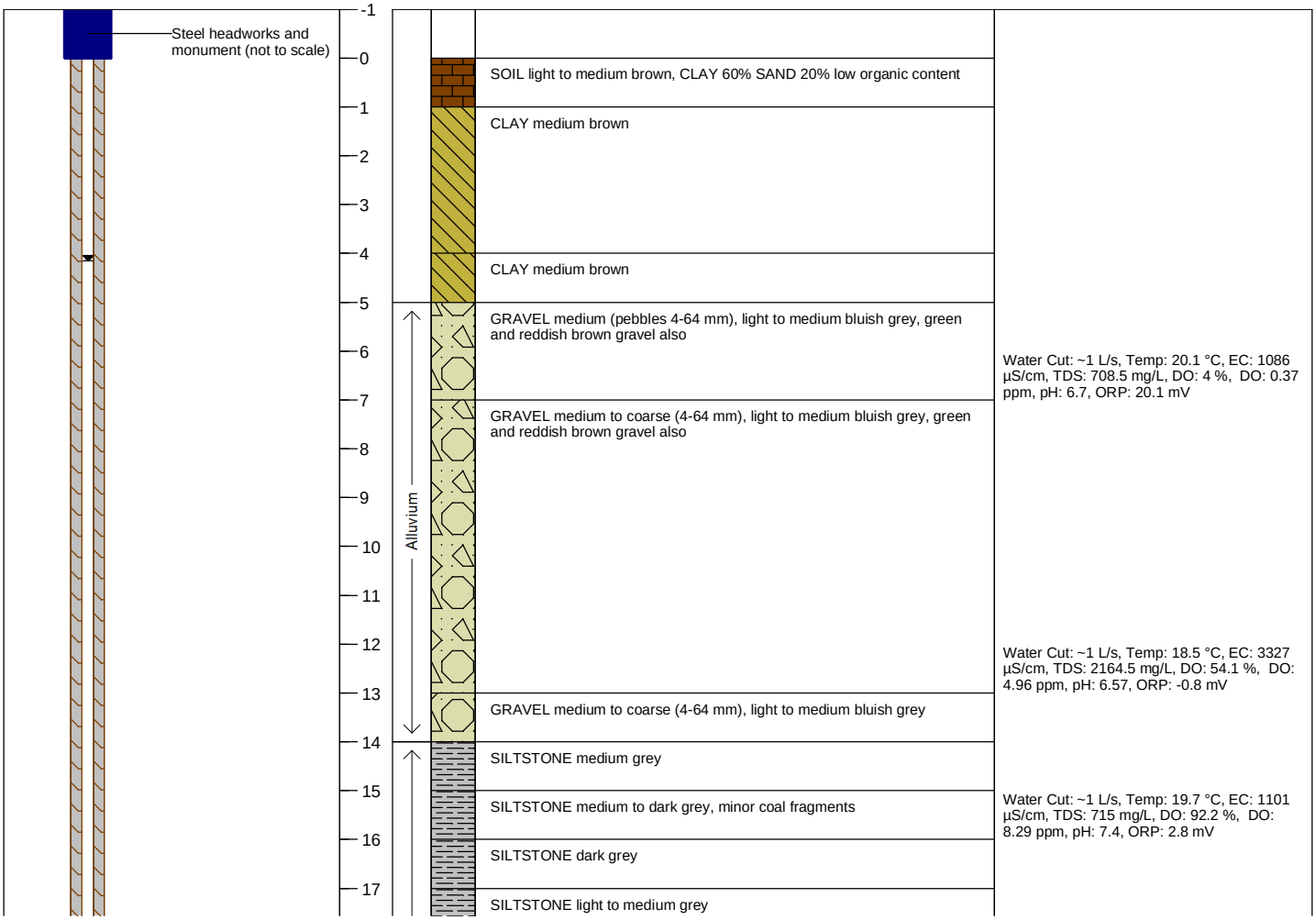
Drilling contractor: Highland Drilling
Driller: I. Palk **Rig:** HD20
Drilling method: Rotary air **Total drilled depth:** 64 m

Borehole diameter:	150 mm	0-15.4 m	**Bit:** Tubex
Borehole diameter:	140 mm	14-63 m	**Bit:** DHH

Purpose of bore: Groundwater monitoring bore
Screened Formation: Shallow rock (fracture zone)
Logged by: K. Maher
Start date: 11/11/14
Completion date: 12/11/14

Static WL: 96.79 mAHD 4.15 mbtoc
Water level date: 17/11/14

Plain casing: 0-52 m: 50 mm PVC Class 18
Screen: 52-61 m: 50 mm PVC Class 18 (0.5 mm slots)
Sump: 60-61 m: 50 mm PVC Class 18
Cement grout: 0-46 m: 0.62 m3
Gravel backfill: NA
Bentonite seal: 46-49 m
Gravel pack: 49-63 m: 5 mm washed gravel
Bentonite plug: NA



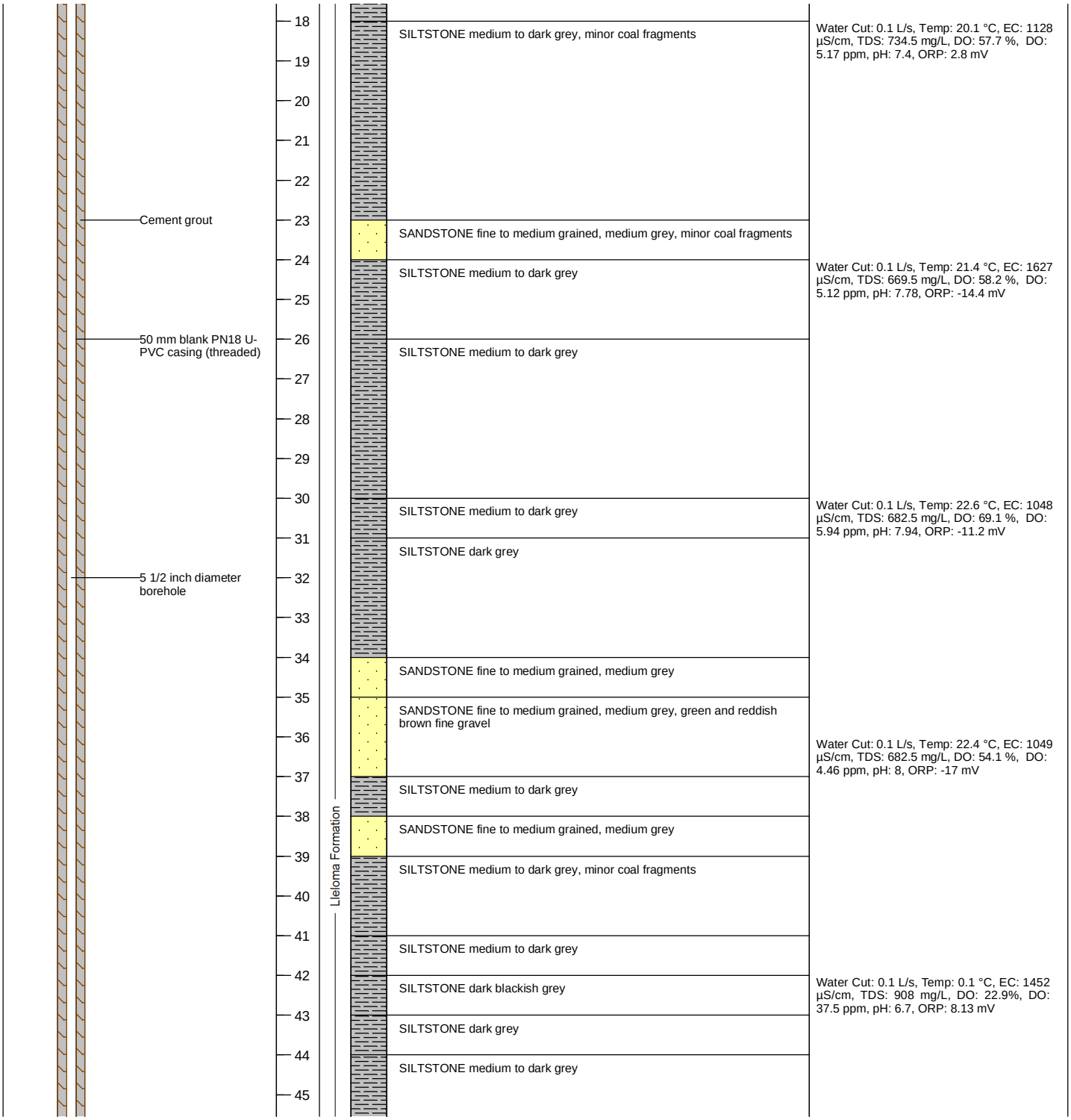
PARSONS BRINCKERHOFF

Drawing No.:	WKMB06B- Bore construction		
Revision:	A	Date drawn:	22/1/2015
Drawn by:	K. Maher	Checked by:	S. Daykin
Project No.	2268522A		

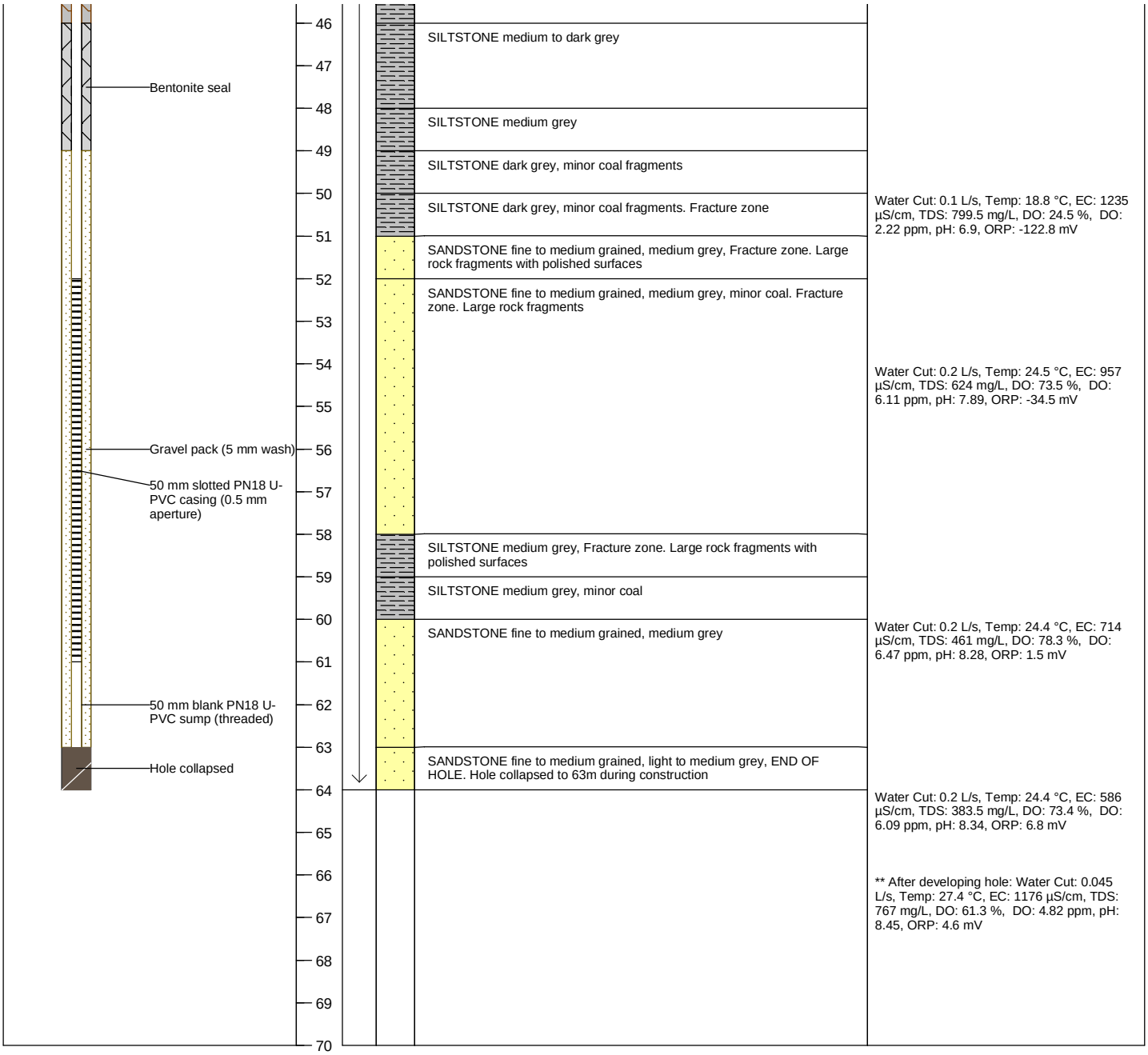
AGL

AGL Upstream Investments Pty Ltd
WKMB06B

WKMB06 Drilling Completion Report


BORE CONSTRUCTION
DEPTH (m)
STRATIGRAPHY
GRAPHIC LOG
LITHOLOGY
WATER QUALITY
Cement grout
50 mm blank PN18 U-PVC casing (threaded)
5 1/2 inch diameter borehole
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
Lieloma Formation
SILTSTONE medium to dark grey, minor coal fragments
SANDSTONE fine to medium grained, medium grey, minor coal fragments
SILTSTONE medium to dark grey
SILTSTONE medium to dark grey
SILTSTONE medium to dark grey
SILTSTONE dark grey
SANDSTONE fine to medium grained, medium grey
SANDSTONE fine to medium grained, medium grey, green and reddish brown fine gravel
SILTSTONE medium to dark grey
SANDSTONE fine to medium grained, medium grey
SILTSTONE medium to dark grey, minor coal fragments
SILTSTONE medium to dark grey
SILTSTONE dark blackish grey
SILTSTONE dark grey
SILTSTONE medium to dark grey
Water Cut: 0.1 L/s, Temp: 20.1 °C, EC: 1128 µS/cm, TDS: 734.5 mg/L, DO: 57.7 %, DO: 5.17 ppm, pH: 7.4, ORP: 2.8 mV
Water Cut: 0.1 L/s, Temp: 21.4 °C, EC: 1627 µS/cm, TDS: 669.5 mg/L, DO: 58.2 %, DO: 5.12 ppm, pH: 7.78, ORP: -14.4 mV
Water Cut: 0.1 L/s, Temp: 22.6 °C, EC: 1048 µS/cm, TDS: 682.5 mg/L, DO: 69.1 %, DO: 5.94 ppm, pH: 7.94, ORP: -11.2 mV
Water Cut: 0.1 L/s, Temp: 22.4 °C, EC: 1049 µS/cm, TDS: 682.5 mg/L, DO: 54.1 %, DO: 4.46 ppm, pH: 8, ORP: -17 mV
Water Cut: 0.1 L/s, Temp: 0.1 °C, EC: 1452 µS/cm, TDS: 908 mg/L, DO: 22.9%, DO: 37.5 ppm, pH: 6.7, ORP: 8.13 mV

BORE COMPLETION REPORT - WKMB06B



PARSONS BRINCKERHOFF

Drawing No.: WKMB06B- Bore construction	
Revision: A	Date drawn: 22/1/2015
Drawn by: K. Maher	Checked by: S. Daykin
Project No. 2268522A	

AGL

AGL Upstream Investments Pty Ltd

WKMB06B

WKMB06 Drilling Completion Report

Appendix C

Parsons Brinckerhoff sampling procedures

PARSONS BRINCKERHOFF

Groundwater Team

Standard Operating Procedure Groundwater and Surface Water Sampling

1. Purpose and scope

This procedure outlines general protocols and work practices to be applied when collecting groundwater and surface water samples.

It is noted that other methods of groundwater and surface water sampling are possible and that deviation from this standard operating procedure (SOP) may be appropriate in some circumstances. The rationale for any deviations from this SOP should be discussed and agreed to with the Project Manager (PM) prior to undertaking the works and documented during the works.

2. References

- AS/NZS 5667.1:1998: Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.
- AS/NZS 5667.11:1998: Water quality - Sampling - Guidance on sampling of groundwaters.
- AS/NZS 5667.6:1998: Water quality - Sampling - Guidance on sampling of rivers and streams.
- Australian and New Zealand Environmental Conservation Council, and Agricultural and Resource Management Council of Australia and New Zealand 2000 *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* October 2000.
- Geoscience Australia 2009, *Groundwater Sampling and Analysis – a field guide*, Geoscience Australia, Record 2009/27 95 pp.
- Parsons Brinckerhoff safe work method statements (SWMS's) for the use of the micropurge control box, generator, air compressor, Grundfos and 12-volt pump.
- State guidelines and regulations (as applicable).

3. Input documentation

- Site specific Health, Environment and Safety Plan (HESP), SWMS's and other related OHSE documents.
- Site specific access permits (if required).

4. Equipment

- Personal protective equipment and other safety equipment as identified in the HESP.
- Camera and mobile phone.
- Field data recording forms or all-weather field book, chain-of-custody forms (COC), marker pen (water proof – permanent is preferable) and pencil.
- Electronic dip meter (dipper).
- Water sampling collection equipment: water quality meter, calibration solutions, sample bottles, esky and ice.
- Groundwater sample collection equipment (as required): bailer, rope, pump, regulator, compressor, no-purge sampler, keys and screwdriver.

- Surface water sample collection equipment (as required): sampler (bomb, Van Dorn, telescopic sampler, long handled sampling pole, bucket).
- Decontamination equipment including clean buckets, phosphate free detergent e.g. Decon 90, potable water and deionised water (if required).
- Appropriately labelled waste disposal containers for off-site disposal of waste water (if required) e.g. 200 L drums.

5. Groundwater levels

- Slowly lower the dipper down the well and measure and record the depth to groundwater from the marked point at the top of the casing and record. If no marking is present, measure from the highest point of the casing and note this on the field data recording form.
- Measure and record the depth to the base of the well and record (typically for shallow bores).
- Before installing a data logger, a manual water level measurement should be taken as well as prior to every logger download.
- Program the data logger and then install the data logger into a bore by suspending the logger on a wire cable in the water column. Secure the logger with a wire cable to the top of the well casing using metal swages. Potential groundwater level variations in the bore and individual logger specifications (different loggers have different pressure thresholds) should be considered before the depth at which the logger is to be installed is determined, as the logger must remain below the groundwater level.

6. Purge volumes

- Typically three bore volumes are removed from a bore prior to sampling (moderate to high yielding bores). Less than three bore volumes can be removed prior to sampling in the following circumstances:
  - a bore is purged dry or drawn down to the level of the pump for low yielding bores
  - field parameters stabilise prior to the removal of three bore volumes (see Section 7)
  - no-purge sampling equipment is used
  - low-flow groundwater pumps are used, with the intake at the screened section.
- One bore volume (L) = approximately 2 x height of water column (m) for 50 mm wells.

7. Deployment and purging

- Decontaminate non-disposal groundwater sampling equipment.
- Calibrate the water quality meter daily.
- Unstable parameters should be measured in the field, such as temperature, dissolved oxygen (DO), oxidation-reduction potential (redox), electrical conductivity (EC) and pH as purging progresses. Total dissolved solids and carbon dioxide can also be measured in the field if required.
- Continue purging until at least three consecutive sets of field parameters are obtained and monitor the changes in pH, temperature and EC Samples should not be taken until consecutive sets of field parameters agree to within 10%:
- Qualitatively assess and record the colour of purged water, turbidity, any odours and other observations and note this on the field data recording form.

7.1 Pump selection

A range of methods can be used to obtain groundwater quality samples from monitoring bores. The most appropriate method for each bore should be selected based on the depth of the bore, the diameter of the bore, the depth to groundwater, and the permeability of the screened formation. Higher yielding monitoring bores are typically purged and sampled using a submersible (high-flow) pump. Lower yielding bores are typically sampled using a low-flow pump.

7.1.1 Submersible (high-flow) pump

- Refer to Parsons Brinckerhoff's SWMS's for the use of the micropurge control box, generator, air compressor, Grundfos and 12-volt pump.
- Three bore volumes are typically extracted.

7.1.2 Low-flow (micropurge) groundwater sampling

- The micropurge pump allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need to purge large volumes of groundwater from these bores.
- Refer to Parsons Brinckerhoff's SWMS for the micropurge.

7.1.3 Bailing

- Lower the bailer down the well and commence purging.
- Disturbance of groundwater in the well should be minimised by lowering and withdrawing the bailer gently. Volatilisation should be minimised when transferring liquid from the bailer into the sample bottle.

7.1.4 No-purge groundwater sampling

- Ensure that a sufficient volume of groundwater can be recovered to enable the required analysis, and measurement of groundwater quality parameters, can be conducted.
- Deploy and retrieve the no-purge sampler in the well in accordance with the manufacturer's instructions. No purging is required for this method of groundwater sampling.
- No-purge samplers include diffusion samplers e.g. PDBS, RPPS, PsMS, and RCS and grab samplers e.g. HydraSleeve® and Snap Sampler™.

8. Sampling

8.1 All water samples

- Label the lid and/or side of water sample bottles with sample ID, date and time.
- When collecting samples for volatile analysis, make sure all bottles are filled as far as practicable to minimise the headspace within the container and avoid potential loss of volatiles.
- Immediately place all samples into an esky pre-packed with ice or ice bricks, or a cooled field fridge. To reduce the potential for breakage, samples can be placed on the firm base of the esky with ice placed in a secure bag (to prevent leakage) on top. Samples should be arranged to minimise lateral movement during transport, and free space can be reduced by adding inert packing material (bubble wrap etc.) if required.

- Complete a quality control check of the labels of all samples submitted to the laboratory against the sample IDs on the COC.
- Transport all samples on ice (temperature below 4°C) to the laboratory as soon as practical with the completed and relinquished COC. The COC should include the following information: sample ID, date and time of sampling, project number, number of sample bottles, analysis requested, laboratory quote number, specific comments and remarks, name and signature of collector, date and time samples are relinquished, contact details.
- Decontaminate all non-disposable sampling equipment between sampling locations through the use of decon with tap water followed by a rinse with tap water. Deionised water should be used if a rinsate sample is required.
- Any split replicate (triplicate) samples should be sent directly to the secondary laboratory in a separate esky from that containing the primary samples, with all other samples sent to the primary laboratory.
- Typically samples should not be frozen. Exceptions include samples for total phosphorus (AS/NZS 5667.1:1998) however advice must be sought from the laboratory.

8.2 Surface water samples

- Sample surface water from upstream and work downstream. Take care to avoid disturbing sediment.
- Note and record the appearance of the surface water body, i.e. colour, turbidity, odour, surface crusts, films or floating material, algae, etc. Also note any other relevant observations such as dead or distressed vegetation, surface rubbish, surface sheen, etc.
- If sampling un-stratified surface waters, lower the surface water sampler carefully into the surface water body at a location well away from the edge. Collect the water sample from approximately 100 mm below the surface of the water body. Following collection, decant the surface water sample into the laboratory supplied sample containers. Use a dedicated sampling bottle for each location. Never submerse laboratory-supplied sample bottles that may contain acid or preservative, into the surface water body.
- If sampling stratified surface waters, lower a weighted sampler such as a bomb sampler or a Van Dorn sampler below the water surface to the depth required, and allow to fill until bubbles stop rising to the surface. When the bottle is full, gently remove it from the water.
- If sampling for metals, no filtering is required (total metals).

8.3 Groundwater samples

- Collect groundwater samples for volatile analytes first.
- If sampling for metals, groundwater samples are to be field filtered (typically filtered to 0.45 um).
- Withdraw sampling equipment from the well and replace/lock well caps and covers.

9. Quality Control (QC) sample collection

- The requirement for QC samples should be assessed depending on the project and client requirements. The following provides the types of QC samples that may be required and a suggested frequency:
  - Blind replicates (duplicates): 1 in 20 primary samples.
  - Split replicates (triplicates): 1 in 20 primary samples.

  - Rinsate blank: 1 per day of sampling or as specified with the client/PM. Run deionised water over the decontaminated field sampling equipment and into a laboratory provided sample container. Place in the esky or field fridge with the other samples. The rinsate blank shall be analysed for the same analytes as the field sample collected immediately prior to decontamination of the field equipment. Not necessary when dedicated equipment is used for purging and sampling.
  - Trip blank: 1 per esky or as specified with the client/PM. Two vials containing deionised water will be provided by the laboratory. Keep the vials in the same esky as the primary and blind replicate samples during transport to/from the site and during site works. The trip blank shall be analysed for the same volatile compounds as the primary samples. Record which eskys contained which trip blank samples on the COC in case detectable concentrations of contaminants are reported in trip blank samples.
  - Field blank and trip spike: as specified with the client/PM.
- Label QC samples 'QC**_date' with the first QC sample labelled QC01 and the second labelled QC02 etc. in order of collection. This includes blind and split replicates as well as rinsate, trip and field blanks and trip spikes.

10. Waste disposal

- Store and dispose of waste water appropriately. Waste water should not be disposed of onto the site surface or to sewer/stormwater without testing, unless approved by the client and appropriate procedures are in place to ensure that there is no adverse impact to the environment or human health.
- Waste water can be collected in appropriately labelled waste containers. 200 L drums are suitable for most projects requiring waste water removal.
- Refer to the Contaminated Land Management SOP for further details regarding waste disposal.

11. Output documentation

The following documents shall be placed on the electronic project file as soon as possible upon completion of the fieldwork:

- Field data recording forms or relevant pages from the all-weather field book.
- Completed COC.
- Signed HESP.

Appendix D

Laboratory QC reports

QUALITY CONTROL REPORT

Work Order	: **ES1425362**	Page	: 1 of 20
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: S DAYKIN	Contact	: Loren Schiavon
Address	: PO Box 5394 SYDNEY NSW 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sdaykin@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: ----	Telephone	: +61 2 8784 8503
Facsimile	: ----	Facsimile	: +61 2 8784 8500
Project	: 2268523A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2014
Sampler	: CS,BR,AM,SD	Issue Date	: 20-JAN-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics
Lana Nguyen	Senior LCMS Chemist	Sydney Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA005: pH (QC Lot: 3720286)									
ES1425281-005	Anonymous	EA005: pH Value	----	0.01	pH Unit	7.98	7.99	0.1	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3719742)									
ES1425362-001	WKMB06A	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	3020	3010	0.3	0% - 20%
ES1425363-007	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	642	643	0.2	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 3721649)									
ES1425024-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	382	348	9.2	0% - 20%
ES1425024-010	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	230	234	1.7	0% - 20%
EA025: Suspended Solids (QC Lot: 3721650)									
ES1425024-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	34	28	16.9	No Limit
ES1425024-010	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	7	10	43.5	No Limit
ED009: Anions (QC Lot: 3719561)									
ES1425261-001	Anonymous	ED009-X: Chloride	16887-00-6	0.100	mg/L	27.4	27.3	0.4	0% - 20%
ES1425363-003	Anonymous	ED009-X: Chloride	16887-00-6	0.100	mg/L	391	429	9.2	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3719743)									
ES1425362-001	WKMB06A	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	240	240	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	240	240	0.0	0% - 20%
ES1425363-007	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	111	110	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	111	110	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3719731)									
ES1425362-001	WKMB06A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	71	71	0.0	0% - 20%
ES1425363-007	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	<10	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 3719734)									
ES1425362-001	WKMB06A	ED045G: Chloride	16887-00-6	1	mg/L	814	849	4.2	0% - 20%
ES1425363-007	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	122	120	1.5	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 3722242)									
ES1425024-002	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	3	3	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	7	6	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	68	66	3.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
ES1425251-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	152	151	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED093F: Dissolved Major Cations (QC Lot: 3722242) - continued									
ES1425251-001	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	31	32	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	20	19	6.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3722243)									
ES1425024-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.025	0.026	0.0	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.203	0.197	3.0	0% - 20%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.014	0.015	9.4	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.09	0.09	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.21	0.19	8.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	1.32	1.31	0.8	0% - 20%
		EG020A-F: Bromine	7726-95-6	0.1	mg/L	0.3	0.3	0.0	No Limit
ES1425251-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.018	0.019	6.7	0% - 50%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3722243) - continued									
ES1425251-001	Anonymous	EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.06	0.10	53.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Bromine	7726-95-6	0.1	mg/L	0.2	0.1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3722244)									
ES1425251-001	Anonymous	EG020B-F: Strontium	7440-24-6	0.001	mg/L	0.127	0.126	1.3	0% - 20%
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
ES1425363-004	Anonymous	EG020B-F: Strontium	7440-24-6	0.001	mg/L	2.36	2.39	1.3	0% - 20%
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 3722241)									
ES1425024-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES1425024-010	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG052G: Silica by Discrete Analyser (QC Lot: 3719735)									
ES1425362-001	WKMB06A	EG052G: Reactive Silica	----	0.05	mg/L	32.9	33.4	1.6	0% - 20%
EK010/011: Chlorine (QC Lot: 3725239)									
ES1425362-001	WKMB06A	EK010: Chlorine - Free	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
		EK010: Chlorine - Total Residual	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
ES1425390-003	Anonymous	EK010: Chlorine - Free	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
		EK010: Chlorine - Total Residual	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 3719744)									
ES1425362-001	WKMB06A	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 3726214)									
ES1425362-001	WKMB06A	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.21	0.22	7.2	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3719732)									
ES1425362-001	WKMB06A	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EW1403489-015	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3726213)									
ES1425362-001	WKMB06A	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES1425750-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	47.1	47.9	1.7	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3726170)									
ES1425354-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	37.5	37.3	0.6	0% - 20%
ES1425540-005	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	10.7	10.5	1.9	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3726171)									
ES1425354-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	4.17	3.95	5.5	0% - 20%
ES1425540-005	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.45	0.64	33.7	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 3719733)									
ES1425362-001	WKMB06A	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 3722034)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP005: Total Organic Carbon (TOC) (QC Lot: 3722034) - continued									
ES1425352-002	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	1	1	0.0	No Limit
ES1425456-005	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	13	13	0.0	0% - 50%
EP033: C1 - C4 Hydrocarbon Gases (QC Lot: 3724323)									
ES1425352-001	Anonymous	EP033: Methane	74-82-8	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethene	74-85-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethane	74-84-0	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propene	115-07-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propane	74-98-6	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butene	25167-67-3	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butane	106-97-8	10	µg/L	<10	<10	0.0	No Limit
ES1425373-003	Anonymous	EP033: Methane	74-82-8	10	µg/L	286	289	1.1	0% - 20%
		EP033: Ethene	74-85-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethane	74-84-0	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propene	115-07-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propane	74-98-6	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butene	25167-67-3	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butane	106-97-8	10	µg/L	<10	<10	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP074B: Oxygenated Compounds (QC Lot: 3724110) - continued									
ES1425362-001	WKMB06A	EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
ES1425363-009	Anonymous	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
EP074D: Fumigants (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 3724110) - continued									
ES1425362-001	WKMB06A	EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
ES1425363-009	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP074F: Halogenated Aromatic Compounds (QC Lot: 3724110) - continued									
ES1425362-001	WKMB06A	EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 3724110)									
ES1425362-001	WKMB06A	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3724111)									
ES1425362-001	WKMB06A	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES1425363-009	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3724111)									
ES1425362-001	WKMB06A	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES1425363-009	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 3724111)									
ES1425362-001	WKMB06A	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES1425363-009	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 3724111) - continued									
ES1425363-009	Anonymous	EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP262: Ethanolamines (QC Lot: 3721470)									
ES1425362-001	WKMB06A	EP262: Ethanolamine	141-43-5	1	µg/L	<1	<1	0.0	No Limit
		EP262: Diethanolamine	111-42-2	1	µg/L	<1	<1	0.0	No Limit
ES1425363-010	Anonymous	EP262: Ethanolamine	141-43-5	1	µg/L	5050	5160	2.2	0% - 20%
		EP262: Diethanolamine	111-42-2	1	µg/L	38	45	14.9	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 3719742)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	105	95	113
EA015: Total Dissolved Solids (QCLot: 3721649)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	293 mg/L	92.7	67	125
				----	2000 mg/L	91.8	87	109
EA025: Suspended Solids (QCLot: 3721650)								
EA025H: Suspended Solids (SS)	----	5	mg/L	----	1000 mg/L	94.9	86	110
				<5	150 mg/L	94.0	83	129
ED009: Anions (QCLot: 3719561)								
ED009-X: Chloride	16887-00-6	0.1	mg/L	<0.100	2 mg/L	103	89	107
ED037P: Alkalinity by PC Titrator (QCLot: 3719743)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	86.8	81	111
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3719731)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	106	86	122
ED045G: Chloride Discrete analyser (QCLot: 3719734)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	109	75	123
				----	1000 mg/L	103	77	119
ED093F: Dissolved Major Cations (QCLot: 3722242)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	100	90	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	106	90	110
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	106	82	118
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	110	87	117
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722243)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	92.6	78	118
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	92.9	80	118
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	98.0	78	116
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	80	112
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.9	82	112
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.4	81	113
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	94.8	80	114
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	92.3	79	113
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.2	81	113
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	94.2	81	113
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	85.1	79	117

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722243) - continued								
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.0	81	115
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	96.4	73	125
EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	0.1 mg/L	92.5	76	120
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	89.4	81	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.6	80	116
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.1 mg/L	101	73	123
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	82.8	78	116
EG020A-F: Bromine	7726-95-6	0.1	mg/L	<0.1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722244)								
EG020B-F: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	94.0	80	112
EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 3722241)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	93.2	78	114
EG052G: Silica by Discrete Analyser (QCLot: 3719735)								
EG052G: Reactive Silica	----	0.05	mg/L	<0.10	5 mg/L	104	94	114
EK010/011: Chlorine (QCLot: 3725239)								
EK010: Chlorine - Free	----	0.2	mg/L	<0.2	----	----	----	----
EK010: Chlorine - Total Residual	----	0.2	mg/L	<0.2	----	----	----	----
EK040P: Fluoride by PC Titrator (QCLot: 3719744)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5.0 mg/L	100	75	119
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3726214)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1.0 mg/L	103	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3719732)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.9	83	119
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3726213)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	107	87	119
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3726170)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	1.0 mg/L	99.2	66	126
				----	5 mg/L	98.6	66	119
				<0.1	10 mg/L	91.0	66	114
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3726171)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	----	1.0 mg/L	95.4	66	124
				<0.01	4.42 mg/L	87.8	67	117
				----	0.442 mg/L	91.3	63	123
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3719733)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	104	82	122
EP005: Total Organic Carbon (TOC) (QCLot: 3722034)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP005: Total Organic Carbon (TOC) (QCLot: 3722034) - continued								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	106	76	120
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3724323)								
EP033: Methane	74-82-8	10	µg/L	<10	27.92 µg/L	106	86	114
EP033: Ethene	74-85-1	10	µg/L	<10	51.76 µg/L	101	87	111
EP033: Ethane	74-84-0	10	µg/L	<10	57.05 µg/L	100	87	111
EP033: Propene	115-07-1	10	µg/L	<10	74.71 µg/L	106	85	113
EP033: Propane	74-98-6	10	µg/L	<10	77.52 µg/L	109	84	112
EP033: Butene	25167-67-3	20	µg/L	<20	99.61 µg/L	108	83	115
EP033: Butane	106-97-8	20	µg/L	<20	103.19 µg/L	106	85	115
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 3724110)								
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	98.4	74	118
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	94.4	75	121
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	88.4	67	123
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	93.6	70	122
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	90.9	69	123
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	92.8	71	121
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	92.8	70	122
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	86.8	67	123
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	82.7	62	126
EP074B: Oxygenated Compounds (QCLot: 3724110)								
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	91.0	61.4	134
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	99.6	73.6	130
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	117	61	139
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	111	65	137
EP074C: Sulfonated Compounds (QCLot: 3724110)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	79.6	72.8	127
EP074D: Fumigants (QCLot: 3724110)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	89.2	61	119
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	93.3	76	120
EP074: cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	10 µg/L	100	62	120
EP074: trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	10 µg/L	101	61	119
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	106	69	117
EP074E: Halogenated Aliphatic Compounds (QCLot: 3724110)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	66.6	60.6	138
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	77.5	67.4	130
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	107	69.4	129
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	79.9	56	140
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	84.6	63	135

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 3724110) - continued								
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	85.9	65	131
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	83.6	69	123
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	82.2	70.2	128
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	91.7	71	119
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	96.9	75	119
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	97.5	77	117
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	91.8	61	119
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	90.7	73	119
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	95.1	63	121
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	101	78	122
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	99.0	74	120
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	101	74	118
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	105	75	123
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	102	79	121
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	95.0	72	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	103	66	114
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	93.2	60	120
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	99.9	70.6	128
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	110	70	124
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	111	74	128
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	105	71.8	126
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	102	66.4	136
EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	10 µg/L	80.0	58	132
EP074F: Halogenated Aromatic Compounds (QCLot: 3724110)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	96.2	80	118
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	97.7	76	116
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	90.4	71	121
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	90.2	71	121
EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	10 µg/L	93.0	74	120
EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	10 µg/L	95.8	72	120
EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	10 µg/L	95.4	77	117
EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	10 µg/L	82.7	60	126
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	91.8	67	125
EP074G: Trihalomethanes (QCLot: 3724110)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	98.6	76	118
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	95.2	64	118
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	102	65	115
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	120	73.5	126
EP075(SIM)A: Phenolic Compounds (QCLot: 3719879)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)A: Phenolic Compounds (QCLot: 3719879) - continued								
EP075(SIM): Phenol	108-95-2	0.2	µg/L	<1.0	20 µg/L	52.8	24.5	61.9
EP075(SIM): 2-Chlorophenol	95-57-8	0.2	µg/L	<1.0	20 µg/L	82.9	63.8	110
EP075(SIM): 2-Methylphenol	95-48-7	0.2	µg/L	<1.0	20 µg/L	81.8	55.9	112
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	0.4	µg/L	<2.0	40 µg/L	72.8	42.5	114
EP075(SIM): 2-Nitrophenol	88-75-5	0.2	µg/L	<1.0	20 µg/L	74.8	62.7	117
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.2	µg/L	<1.0	20 µg/L	78.8	59.9	112
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.2	µg/L	<1.0	20 µg/L	80.0	59.3	122
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.2	µg/L	<1.0	20 µg/L	82.5	64.3	118
EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.2	µg/L	<1.0	20 µg/L	89.9	63	119
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.2	µg/L	<1.0	20 µg/L	78.0	58.7	118
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.2	µg/L	<1.0	20 µg/L	84.2	50	108
EP075(SIM): Pentachlorophenol	87-86-5	0.4	µg/L	<2.0	40 µg/L	71.1	10	95
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3719879)								
EP075(SIM): Naphthalene	91-20-3	0.2	µg/L	<1.0	20 µg/L	79.9	58.6	119
EP075(SIM): Acenaphthylene	208-96-8	0.2	µg/L	<1.0	20 µg/L	78.1	63.6	114
EP075(SIM): Acenaphthene	83-32-9	0.2	µg/L	<1.0	20 µg/L	75.6	62.2	113
EP075(SIM): Fluorene	86-73-7	0.2	µg/L	<1.0	20 µg/L	82.6	63.9	115
EP075(SIM): Phenanthrene	85-01-8	0.2	µg/L	<1.0	20 µg/L	89.0	62.6	116
EP075(SIM): Anthracene	120-12-7	0.2	µg/L	<1.0	20 µg/L	88.2	64.3	116
EP075(SIM): Fluoranthene	206-44-0	0.2	µg/L	<1.0	20 µg/L	91.4	63.6	118
EP075(SIM): Pyrene	129-00-0	0.2	µg/L	<1.0	20 µg/L	92.0	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	0.2	µg/L	<1.0	20 µg/L	87.0	64.1	117
EP075(SIM): Chrysene	218-01-9	0.2	µg/L	<1.0	20 µg/L	84.7	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.2	µg/L	<1.0	20 µg/L	84.3	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.2	µg/L	<1.0	20 µg/L	82.0	61.7	117
EP075(SIM): Benzo(a)pyrene	50-32-8	0.2	µg/L	<0.5	20 µg/L	77.4	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.2	µg/L	<1.0	20 µg/L	77.2	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.2	µg/L	<1.0	20 µg/L	75.6	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.2	µg/L	<1.0	20 µg/L	75.4	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3719878)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	97.5	59	129
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	104	71	131
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	80.0	62	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3724111)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	101	75	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3719878)								
EP071: >C10 - C16 Fraction	>C10_C16	100	µg/L	<100	2500 µg/L	106	58.9	131

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3719878) - continued								
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	94.0	73.9	138
EP071: >C34 - C40 Fraction	----	50	µg/L	<100	1500 µg/L	79.3	67	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3724111)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	98.9	75	127
EP080: BTEXN (QCLot: 3724111)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	100	70	124
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	108	65	129
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	103	70	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	103	69	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	106	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	103	70	124
EP262: Ethanolamines (QCLot: 3721470)								
EP262: Ethanolamine	141-43-5	1	µg/L	<1	10 µg/L	108	70	130
EP262: Diethanolamine	111-42-2	1	µg/L	<1	10 µg/L	70.4	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED009: Anions (QCLot: 3719561)							
ES1425261-001	Anonymous	ED009-X: Chloride	16887-00-6	4 mg/L	# Not Determined	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3719731)							
ES1425362-001	WKMB06A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride Discrete analyser (QCLot: 3719734)							
ES1425362-001	WKMB06A	ED045G: Chloride	16887-00-6	250 mg/L	78.3	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722243)							
ES1425024-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	94.4	70	130
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	90.8	70	130
		EG020A-F: Barium	7440-39-3	0.2 mg/L	94.5	70	130
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	94.5	70	130
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	91.8	70	130
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	93.7	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722243) - continued							
ES1425024-002	Anonymous	EG020A-F: Copper	7440-50-8	0.2 mg/L	96.2	70	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	95.0	70	130
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	95.0	70	130
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	90.8	70	130
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	90.4	70	130
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	100	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3722241)							
ES1425024-001	Anonymous	EG035F: Mercury	7439-97-6	0.0100 mg/L	87.2	70	130
EG052G: Silica by Discrete Analyser (QCLot: 3719735)							
ES1425362-001	WKMB06A	EG052G: Reactive Silica	----	5 mg/L	# Not Determined	70	130
EK040P: Fluoride by PC Titrator (QCLot: 3719744)							
ES1425362-001	WKMB06A	EK040P: Fluoride	16984-48-8	5.0 mg/L	117	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3726214)							
ES1425362-001	WKMB06A	EK055G: Ammonia as N	7664-41-7	1 mg/L	99.9	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3719732)							
ES1425362-001	WKMB06A	EK057G: Nitrite as N	----	0.5 mg/L	95.2	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3726213)							
ES1425362-001	WKMB06A	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	110	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3726170)							
ES1425354-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	90.2	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3726171)							
ES1425354-002	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	98.1	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3719733)							
ES1425362-001	WKMB06A	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	96.2	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 3722034)							
ES1425362-001	WKMB06A	EP005: Total Organic Carbon	----	100 mg/L	105	70	130
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3724323)							
ES1425352-002	Anonymous	EP033: Methane	74-82-8	27.92 µg/L	111	70	130
		EP033: Ethene	74-85-1	51.76 µg/L	96.3	70	130
		EP033: Ethane	74-84-0	57.05 µg/L	95.3	70	130
		EP033: Propene	115-07-1	74.71 µg/L	97.7	70	130
		EP033: Propane	74-98-6	77.52 µg/L	101	70	130
		EP033: Butene	25167-67-3	99.61 µg/L	93.7	70	130
		EP033: Butane	106-97-8	103.19 µg/L	92.3	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 3724110)							
ES1425362-001	WKMB06A	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	73.4	70	130
		EP074: Trichloroethene	79-01-6	25 µg/L	85.6	70	130
EP074F: Halogenated Aromatic Compounds (QCLot: 3724110)							
ES1425362-001	WKMB06A	EP074: Chlorobenzene	108-90-7	25 µg/L	97.4	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3724111)							
ES1425362-001	WKMB06A	EP080: C6 - C9 Fraction	----	325 µg/L	110	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3724111)							
ES1425362-001	WKMB06A	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	107	70	130
EP080: BTEXN (QCLot: 3724111)							
ES1425362-001	WKMB06A	EP080: Benzene	71-43-2	25 µg/L	91.4	70	130
		EP080: Toluene	108-88-3	25 µg/L	108	70	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	108	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	112	70	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	112	70	130
		EP080: Naphthalene	91-20-3	25 µg/L	93.8	70	130
EP262: Ethanolamines (QCLot: 3721470)							
ES1425362-001	WKMB06A	EP262: Ethanolamine	141-43-5	10 µg/L	73.7	70	130
		EP262: Diethanolamine	111-42-2	10 µg/L	87.7	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED009: Anions (QCLot: 3719561)										
ES1425261-001	Anonymous	ED009-X: Chloride	16887-00-6	4 mg/L	# Not Determined	----	70	130	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3719731)										
ES1425362-001	WKMB06A	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3719732)										
ES1425362-001	WKMB06A	EK057G: Nitrite as N	----	0.5 mg/L	95.2	----	70	130	----	----
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3719733)										
ES1425362-001	WKMB06A	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	96.2	----	70	130	----	----

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED045G: Chloride Discrete analyser (QCLot: 3719734)										
ES1425362-001	WKMB06A	ED045G: Chloride	16887-00-6	250 mg/L	78.3	----	70	130	----	----
EG052G: Silica by Discrete Analyser (QCLot: 3719735)										
ES1425362-001	WKMB06A	EG052G: Reactive Silica	----	5 mg/L	# Not Determined	----	70	130	----	----
EK040P: Fluoride by PC Titrator (QCLot: 3719744)										
ES1425362-001	WKMB06A	EK040P: Fluoride	16984-48-8	5.0 mg/L	117	----	70	130	----	----
EP262: Ethanolamines (QCLot: 3721470)										
ES1425362-001	WKMB06A	EP262: Ethanolamine	141-43-5	10 µg/L	73.7	----	70	130	----	----
		EP262: Diethanolamine	111-42-2	10 µg/L	87.7	----	70	130	----	----
EP005: Total Organic Carbon (TOC) (QCLot: 3722034)										
ES1425362-001	WKMB06A	EP005: Total Organic Carbon	----	100 mg/L	105	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 3722241)										
ES1425024-001	Anonymous	EG035F: Mercury	7439-97-6	0.0100 mg/L	87.2	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 3722243)										
ES1425024-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	94.4	----	70	130	----	----
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	90.8	----	70	130	----	----
		EG020A-F: Barium	7440-39-3	0.2 mg/L	94.5	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	94.5	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	91.8	----	70	130	----	----
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	93.7	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.2 mg/L	96.2	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.2 mg/L	95.0	----	70	130	----	----
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	95.0	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	90.8	----	70	130	----	----
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	90.4	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	100	----	70	130	----	----
EP074E: Halogenated Aliphatic Compounds (QCLot: 3724110)										
ES1425362-001	WKMB06A	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	73.4	----	70	130	----	----
		EP074: Trichloroethene	79-01-6	25 µg/L	85.6	----	70	130	----	----
EP074F: Halogenated Aromatic Compounds (QCLot: 3724110)										
ES1425362-001	WKMB06A	EP074: Chlorobenzene	108-90-7	25 µg/L	97.4	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3724111)										
ES1425362-001	WKMB06A	EP080: C6 - C9 Fraction	----	325 µg/L	110	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3724111)										
ES1425362-001	WKMB06A	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	107	----	70	130	----	----
EP080: BTEXN (QCLot: 3724111)										
ES1425362-001	WKMB06A	EP080: Benzene	71-43-2	25 µg/L	91.4	----	70	130	----	----

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP080: BTEXN (QCLot: 3724111) - continued										
ES1425362-001	WKMB06A	EP080: Toluene	108-88-3	25 µg/L	108	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	25 µg/L	108	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	112	----	70	130	----	----
		EP080: ortho-Xylene	95-47-6	25 µg/L	112	----	70	130	----	----
		EP080: Naphthalene	91-20-3	25 µg/L	93.8	----	70	130	----	----
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3724323)										
ES1425352-002	Anonymous	EP033: Methane	74-82-8	27.92 µg/L	111	----	70	130	----	----
		EP033: Ethene	74-85-1	51.76 µg/L	96.3	----	70	130	----	----
		EP033: Ethane	74-84-0	57.05 µg/L	95.3	----	70	130	----	----
		EP033: Propene	115-07-1	74.71 µg/L	97.7	----	70	130	----	----
		EP033: Propane	74-98-6	77.52 µg/L	101	----	70	130	----	----
		EP033: Butene	25167-67-3	99.61 µg/L	93.7	----	70	130	----	----
		EP033: Butane	106-97-8	103.19 µg/L	92.3	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3726170)										
ES1425354-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	90.2	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3726171)										
ES1425354-002	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	98.1	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3726213)										
ES1425362-001	WKMB06A	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	110	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3726214)										
ES1425362-001	WKMB06A	EK055G: Ammonia as N	7664-41-7	1 mg/L	99.9	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1425362**	Page	: 1 of 12
Amendment	: **1**		
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: S DAYKIN	Contact	: Loren Schiavon
Address	: PO Box 5394 SYDNEY NSW 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sdaykin@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: ----	Telephone	: +61 2 8784 8503
Facsimile	: ----	Facsimile	: +61 2 8784 8500
Project	: 2268523A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2014
Sampler	: CS,BR,AM,SD	Issue Date	: 20-JAN-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005: pH							
Clear Plastic Bottle - Natural (EA005)							
WKMB06A	**18-NOV-2014**	**----**	----	----	**18-NOV-2014**	18-NOV-2014	✓
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
WKMB06A	**18-NOV-2014**	**---**	16-DEC-2014	----	**19-NOV-2014**	16-DEC-2014	✓
EA015: Total Dissolved Solids							
Clear Plastic Bottle - Natural (EA015H)							
WKMB06A	**18-NOV-2014**	**---**	25-NOV-2014	----	**20-NOV-2014**	25-NOV-2014	✓
EA025: Suspended Solids							
Clear Plastic Bottle - Natural (EA025H)							
WKMB06A	**18-NOV-2014**	**---**	25-NOV-2014	----	**20-NOV-2014**	25-NOV-2014	✓
ED009: Anions							
Clear Plastic Bottle - Natural (ED009-X)							
WKMB06A	**18-NOV-2014**	**----**	----	----	**19-NOV-2014**	16-DEC-2014	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
WKMB06A	**18-NOV-2014**	**---**	02-DEC-2014	----	**19-NOV-2014**	02-DEC-2014	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
WKMB06A	**18-NOV-2014**	**---**	16-DEC-2014	----	**19-NOV-2014**	16-DEC-2014	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
WKMB06A	**18-NOV-2014**	**---**	16-DEC-2014	----	**19-NOV-2014**	16-DEC-2014	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)							
WKMB06A	**18-NOV-2014**	**---**	16-DEC-2014	----	**21-NOV-2014**	16-DEC-2014	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
WKMB06A	**18-NOV-2014**	**---**	17-MAY-2015	----	**21-NOV-2014**	17-MAY-2015	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)							
WKMB06A	**18-NOV-2014**	**---**	17-MAY-2015	----	**21-NOV-2014**	17-MAY-2015	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
WKMB06A	**18-NOV-2014**	---	16-DEC-2014	----	**25-NOV-2014**	16-DEC-2014	✓
EG052G: Silica by Discrete Analyser							
Clear Plastic Bottle - Natural (EG052G)							
WKMB06A	**18-NOV-2014**	---	16-DEC-2014	----	**19-NOV-2014**	16-DEC-2014	✓
EK010/011: Chlorine							
Clear Plastic Bottle - Natural (EK010)							
WKMB06A	**18-NOV-2014**	**----**	----	----	**21-NOV-2014**	18-NOV-2014	×
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
WKMB06A	**18-NOV-2014**	---	16-DEC-2014	----	**19-NOV-2014**	16-DEC-2014	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
WKMB06A	**18-NOV-2014**	---	16-DEC-2014	----	**24-NOV-2014**	16-DEC-2014	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
WKMB06A	**18-NOV-2014**	---	20-NOV-2014	----	**19-NOV-2014**	20-NOV-2014	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
WKMB06A	**18-NOV-2014**	---	16-DEC-2014	----	**24-NOV-2014**	16-DEC-2014	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
WKMB06A	**18-NOV-2014**	**24-NOV-2014**	16-DEC-2014	✓	**24-NOV-2014**	16-DEC-2014	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
WKMB06A	**18-NOV-2014**	**24-NOV-2014**	16-DEC-2014	✓	**24-NOV-2014**	16-DEC-2014	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
WKMB06A	**18-NOV-2014**	---	20-NOV-2014	----	**19-NOV-2014**	20-NOV-2014	✓
EP005: Total Organic Carbon (TOC)							
Amber TOC Vial - Sulfuric Acid (EP005)							
WKMB06A	**18-NOV-2014**	**----**	----	----	**20-NOV-2014**	16-DEC-2014	✓
EP033: C1 - C4 Hydrocarbon Gases							
Amber VOC Vial - Sulfuric Acid (EP033)							
WKMB06A	**18-NOV-2014**	**----**	----	----	**21-NOV-2014**	02-DEC-2014	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
WKMB06A	**18-NOV-2014**	**21-NOV-2014**	25-NOV-2014	✓	**25-NOV-2014**	31-DEC-2014	✓
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074)							
WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP075(SIM)A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075(SIM)) WKMB06A	**18-NOV-2014**	**21-NOV-2014**	25-NOV-2014	✓	**25-NOV-2014**	31-DEC-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) WKMB06A	**18-NOV-2014**	**21-NOV-2014**	25-NOV-2014	✓	**25-NOV-2014**	31-DEC-2014	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber VOC Vial - Sulfuric Acid (EP080) WKMB06A	**18-NOV-2014**	**24-NOV-2014**	02-DEC-2014	✓	**24-NOV-2014**	02-DEC-2014	✓
EP262: Ethanolamines							
Amber Glass Bottle - Unpreserved (EP262) WKMB06A	**18-NOV-2014**	**----**	----	----	**21-NOV-2014**	25-NOV-2014	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	8	**12.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chlorine	EK010	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	13	**15.4**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	9	**11.1**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	17	**11.8**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	11	**18.2**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
pH	EA005	1	13	**7.7**	**10.0**	×	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	7	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	2	19	**10.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	13	**15.4**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	13	**7.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Fluoride by PC Titrator	EK040P	1	9	**11.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.0**	**15.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.0**	**15.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chlorine	EK010	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	13	**7.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	9	**11.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	9	**11.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	13	**7.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH	EA005	WATER	In house: Referenced to APHA 21st ed. 4500 H+ B. pH of water samples is determined by ISE either manually or by automated pH meter. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 21st ed., 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 21st ed., 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 21st ed., 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Standard Anions -by IC (Extended Method)	ED009-X	WATER	In house: Referenced to APHA 21st ed., 4110. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 21st ed., 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	In house: Referenced to APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Silica (Reactive) by Discrete Analyser	EG052G	WATER	In house: Referenced to APHA 21st ed. 4500-SiO2 D: Under Acdic conditions reactive silicon combines with ammonium molybdate to form a yellow molybdosilicic acid complex. This is reduced by 1-amino-2-naphthol-4-sulfonic acid to a silicomolybdenum blue complex which is measured by discrete analyser at 670 nm. This method is compliant with NEPM (2013) Schedule B(3)
Chlorine	EK010	WATER	In-house (DPD colourimetry)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 21st ed., 4500 F--C CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ammonium as N	EK055G-NH4	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 21st ed., 4500-NH3 G. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 21st ed., 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 21st ed., 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 21st Ed. 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 21st ed., 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
C1 - C4 Gases	EP033	WATER	Technical Guidance for the Natural Attenuation Indicators: Methane, Ethane, and Ethene, US EPA - Region 1, EPA New England, July 2001. Automated static headspace, dual column GC/FID. A 12 mL sample is pipetted into a 20 mL headspace vial containing 3g of sodium chloride and sealed. Each sample is equilibrated with shaking at 40 degrees C for 10 minutes prior to analysis by GC/FID using a pair of PLOT columns of different polarity.
TRH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Volatile Organic Compounds	EP074	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Ethanolamines by LCMSMS	EP262	WATER	In-house LC-MSMS: Benzoyl derivatives of target compounds are analysed by LC/MSMS in ESI Positive Mode.

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	ES1425261-001	Anonymous	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES1425362-001	WKMB06A	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG052G: Silica by Discrete Analyser	ES1425362-001	WKMB06A	**Reactive Silica**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK010/011: Chlorine						
Clear Plastic Bottle - Natural						
WKMB06A	----	----	----	21-NOV-2014	18-NOV-2014	**3**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP) - Continued					
pH	1	13	7.7	10.0	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

QUALITY CONTROL REPORT

Work Order	: **ES1425544**	Page	: 1 of 19
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: S DAYKIN	Contact	: Loren Schiavon
Address	: PO Box 5394 SYDNEY NSW 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sdaykin@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: ----	Telephone	: +61 2 8784 8503
Facsimile	: ----	Facsimile	: +61 2 8784 8500
Project	: 2268522A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 20-NOV-2014
Sampler	: ----	Issue Date	: 21-JAN-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
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Phalak Inthakesone	Laboratory Manager - Organics	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA005P: pH by PC Titrator (QC Lot: 3724049)									
ES1425544-001	WKMB06B	EA005-P: pH Value	----	0.01	pH Unit	8.26	8.22	0.5	0% - 20%
ES1425658-003	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	7.94	7.97	0.4	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 3724048)									
ES1425544-001	WKMB06B	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1290	1300	0.3	0% - 20%
ES1425658-003	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	19300	19300	0.05	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 3726217)									
ES1425360-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	244	242	0.6	0% - 20%
ES1425640-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	4260	4460	4.7	0% - 20%
EA025: Suspended Solids (QC Lot: 3726218)									
ES1425360-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
ES1425640-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	30	30	0.0	No Limit
ED009: Anions (QC Lot: 3724170)									
ES1425544-001	WKMB06B	ED009-X: Chloride	16887-00-6	0.100	mg/L	233	235	0.6	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 3724050)									
ES1425544-001	WKMB06B	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	262	262	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	262	262	0.0	0% - 20%
ES1425658-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	11500	11400	0.2	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	11500	11400	0.2	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3724041)									
ES1425544-001	WKMB06B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	57	49	14.2	0% - 20%
ES1425545-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	<10	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 3724040)									
ES1425544-001	WKMB06B	ED045G: Chloride	16887-00-6	1	mg/L	254	254	0.0	0% - 20%
ES1425545-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	113	114	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3726679)									
ES1425488-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.016	0.015	0.0	0% - 50%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 3726679) - continued									
ES1425488-001	Anonymous	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.017	0.018	0.0	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.005	0.005	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.022	0.023	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	0.01	0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	1.70	1.81	6.5	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Bromine	7726-95-6	0.1	mg/L	32.0	33.3	3.9	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 3726680)									
ES1425545-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG052G: Silica by Discrete Analyser (QC Lot: 3724043)									
ES1425544-001	WKMB06B	EG052G: Reactive Silica	----	0.05	mg/L	15.2	15.4	1.6	0% - 20%
EK010/011: Chlorine (QC Lot: 3725589)									
ES1425544-001	WKMB06B	EK010: Chlorine - Free	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
		EK010: Chlorine - Total Residual	----	0.2	mg/L	<0.2	<0.2	0.0	No Limit
ME1401646-004	Anonymous	EK010: Chlorine - Free	----	0.2	mg/L	0.3	0.3	0.0	No Limit
		EK010: Chlorine - Total Residual	----	0.2	mg/L	0.3	0.3	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 3724051)									
ES1425544-001	WKMB06B	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.6	0.5	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 3728118)									
ES1425544-001	WKMB06B	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.37	0.32	14.3	0% - 20%
ES1425642-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.06	46.4	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3724038)									
ES1425544-001	WKMB06B	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES1425545-005	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3728117)									
ES1425544-001	WKMB06B	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.0	No Limit
ES1425642-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.07	0.06	19.2	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3728156)									
ES1425544-001	WKMB06B	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.1	1.1	0.0	No Limit
ES1425643-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.4	2.3	0.0	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3728157)									

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3728157) - continued									
ES1425544-001	WKMB06B	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.63	0.63	0.0	0% - 20%
ES1425643-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.03	0.02	0.0	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 3724039)									
ES1425544-001	WKMB06B	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.56	0.56	0.0	0% - 20%
ES1425545-005	Anonymous	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 3726618)									
ES1425542-003	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	<1	<1	0.0	No Limit
ES1425611-003	Anonymous	EP005: Total Organic Carbon	----	1	mg/L	399	389	2.4	0% - 20%
EP033: C1 - C4 Hydrocarbon Gases (QC Lot: 3726748)									
ES1425544-001	WKMB06B	EP033: Methane	74-82-8	10	µg/L	10300	10400	1.2	0% - 20%
		EP033: Ethene	74-85-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethane	74-84-0	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propene	115-07-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propane	74-98-6	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butene	25167-67-3	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butane	106-97-8	10	µg/L	<10	<10	0.0	No Limit
ES1425638-005	Anonymous	EP033: Methane	74-82-8	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethene	74-85-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Ethane	74-84-0	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propene	115-07-1	10	µg/L	<10	<10	0.0	No Limit
		EP033: Propane	74-98-6	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butene	25167-67-3	10	µg/L	<10	<10	0.0	No Limit
		EP033: Butane	106-97-8	10	µg/L	<10	<10	0.0	No Limit
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP074: Styrene	100-42-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP074A: Monocyclic Aromatic Hydrocarbons (QC Lot: 3726507) - continued									
ES1425588-005	Anonymous	EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	<5	0.0	No Limit
EP074B: Oxygenated Compounds (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	240	230	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
ES1425588-005	Anonymous	EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	0.0	No Limit
		EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	0.0	No Limit
EP074C: Sulfonated Compounds (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP074: Carbon disulfide	75-15-0	5	µg/L	<5	<5	0.0	No Limit
EP074D: Fumigants (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	<5	0.0	No Limit
EP074E: Halogenated Aliphatic Compounds (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP074E: Halogenated Aliphatic Compounds (QC Lot: 3726507) - continued									
ES1425544-001	WKMB06B	EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
ES1425588-005	Anonymous	EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Iodomethane	74-88-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	<5	0.0	No Limit
		EP074: Trichloroethene	79-01-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromomethane	74-95-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	<5	0.0	No Limit
		EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	<5	0.0	No Limit
		EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Pentachloroethane	76-01-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloromethane	74-87-3	50	µg/L	<50	<50	0.0	No Limit
		EP074: Vinyl chloride	75-01-4	50	µg/L	<50	<50	0.0	No Limit
		EP074: Bromomethane	74-83-9	50	µg/L	<50	<50	0.0	No Limit
		EP074: Chloroethane	75-00-3	50	µg/L	<50	<50	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP074E: Halogenated Aliphatic Compounds (QC Lot: 3726507) - continued									
ES1425588-005	Anonymous	EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	<50	0.0	No Limit
EP074F: Halogenated Aromatic Compounds (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP074: Chlorobenzene	108-90-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromobenzene	108-86-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	0.0	No Limit
		EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	0.0	No Limit
EP074G: Trihalomethanes (QC Lot: 3726507)									
ES1425544-001	WKMB06B	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP074: Chloroform	67-66-3	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	<5	0.0	No Limit
		EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	<5	0.0	No Limit
		EP074: Bromoform	75-25-2	5	µg/L	<5	<5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3726508)									
ES1425544-001	WKMB06B	EP080: C6 - C9 Fraction	----	20	µg/L	40	40	0.0	No Limit
ES1425588-005	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3726508)									
ES1425544-001	WKMB06B	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	40	40	0.0	No Limit
ES1425588-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 3726508)									
ES1425544-001	WKMB06B	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	27	26	0.0	0% - 50%
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 3726508) - continued									
ES1425544-001	WKMB06B	EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES1425588-005	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP262: Ethanolamines (QC Lot: 3726229)									
ES1425544-001	WKMB06B	EP262: Ethanolamine	141-43-5	1	µg/L	<1	<1	0.0	No Limit
		EP262: Diethanolamine	111-42-2	1	µg/L	7	8	16.4	No Limit
ES1425638-005	Anonymous	EP262: Ethanolamine	141-43-5	1	µg/L	5690	5590	1.8	0% - 20%
		EP262: Diethanolamine	111-42-2	1	µg/L	161	162	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 3724048)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	2000 µS/cm	103	95	113
EA015: Total Dissolved Solids (QCLot: 3726217)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	----	2000 mg/L	91.4	87	109
				<10	293 mg/L	101	67	125
EA025: Suspended Solids (QCLot: 3726218)								
EA025H: Suspended Solids (SS)	----	5	mg/L	----	1000 mg/L	88.7	86	110
				<5	150 mg/L	94.7	83	129
ED009: Anions (QCLot: 3724170)								
ED009-X: Chloride	16887-00-6	0.1	mg/L	<0.100	2 mg/L	106	89	107
ED037P: Alkalinity by PC Titrator (QCLot: 3724050)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	107	81	111
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3724041)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	111	86	122
ED045G: Chloride Discrete analyser (QCLot: 3724040)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	107	75	123
				----	1000 mg/L	106	77	119
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726679)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	94.1	78	118
EG020A-F: Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.6	80	118
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	98.2	78	116
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	90.4	80	112
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.3	82	112
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.7	81	113
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	92.4	80	114
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	91.3	79	113
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.2	81	113
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	89.7	81	113
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	95.9	79	117
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	91.9	81	115
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	87.9	73	125
EG020A-F: Tin	7440-31-5	0.001	mg/L	<0.001	0.1 mg/L	95.2	76	120
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	88.1	81	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	96.4	80	116

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726679) - continued								
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.1 mg/L	91.0	73	123
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	88.6	78	116
EG020A-F: Bromine	7726-95-6	0.1	mg/L	<0.1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726681)								
EG020B-F: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	91.8	80	112
EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 3726680)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	96.5	78	114
EG052G: Silica by Discrete Analyser (QCLot: 3724043)								
EG052G: Reactive Silica	----	0.05	mg/L	<0.10	5 mg/L	102	94	114
EK010/011: Chlorine (QCLot: 3725589)								
EK010: Chlorine - Free	----	0.2	mg/L	<0.2	----	----	----	----
EK010: Chlorine - Total Residual	----	0.2	mg/L	<0.2	----	----	----	----
EK040P: Fluoride by PC Titrator (QCLot: 3724051)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5.0 mg/L	96.8	75	119
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3728118)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1.0 mg/L	102	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3724038)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	93.0	83	119
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3728117)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	87	119
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3728156)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	5 mg/L	102	66	119
				<0.1	10 mg/L	91.4	66	114
				----	1.0 mg/L	103	66	126
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3728157)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	88.6	67	117
				----	0.442 mg/L	95.2	63	123
				----	1.0 mg/L	99.1	66	124
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3724039)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	101	82	122
EP005: Total Organic Carbon (TOC) (QCLot: 3726618)								
EP005: Total Organic Carbon	----	1	mg/L	<1	10 mg/L	93.2	76	120
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3726748)								
EP033: Methane	74-82-8	10	µg/L	<10	27.92 µg/L	110	86	114
EP033: Ethene	74-85-1	10	µg/L	<10	51.76 µg/L	95.8	87	111
EP033: Ethane	74-84-0	10	µg/L	<10	57.05 µg/L	95.0	87	111

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3726748) - continued								
EP033: Propene	115-07-1	10	µg/L	<10	74.71 µg/L	101	85	113
EP033: Propane	74-98-6	10	µg/L	<10	77.52 µg/L	104	84	112
EP033: Butene	25167-67-3	20	µg/L	<20	99.61 µg/L	111	83	115
EP033: Butane	106-97-8	20	µg/L	<20	103.19 µg/L	112	85	115
EP074A: Monocyclic Aromatic Hydrocarbons (QCLot: 3726507)								
EP074: Styrene	100-42-5	5	µg/L	<5	10 µg/L	104	74	118
EP074: Isopropylbenzene	98-82-8	5	µg/L	<5	10 µg/L	106	75	121
EP074: n-Propylbenzene	103-65-1	5	µg/L	<5	10 µg/L	106	67	123
EP074: 1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	10 µg/L	108	70	122
EP074: sec-Butylbenzene	135-98-8	5	µg/L	<5	10 µg/L	108	69	123
EP074: 1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	10 µg/L	108	71	121
EP074: tert-Butylbenzene	98-06-6	5	µg/L	<5	10 µg/L	108	70	122
EP074: p-Isopropyltoluene	99-87-6	5	µg/L	<5	10 µg/L	102	67	123
EP074: n-Butylbenzene	104-51-8	5	µg/L	<5	10 µg/L	99.7	62	126
EP074B: Oxygenated Compounds (QCLot: 3726507)								
EP074: Vinyl Acetate	108-05-4	50	µg/L	<50	100 µg/L	70.4	61.4	134
EP074: 2-Butanone (MEK)	78-93-3	50	µg/L	<50	100 µg/L	115	73.6	130
EP074: 4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	100 µg/L	105	61	139
EP074: 2-Hexanone (MBK)	591-78-6	50	µg/L	<50	100 µg/L	106	65	137
EP074C: Sulfonated Compounds (QCLot: 3726507)								
EP074: Carbon disulfide	75-15-0	5	µg/L	<5	10 µg/L	110	72.8	127
EP074D: Fumigants (QCLot: 3726507)								
EP074: 2.2-Dichloropropane	594-20-7	5	µg/L	<5	10 µg/L	111	61	119
EP074: 1.2-Dichloropropane	78-87-5	5	µg/L	<5	10 µg/L	106	76	120
EP074: cis-1.3-Dichloropropylene	10061-01-5	10	µg/L	<10	10 µg/L	109	62	120
EP074: trans-1.3-Dichloropropylene	10061-02-6	10	µg/L	<10	10 µg/L	114	61	119
EP074: 1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	10 µg/L	106	69	117
EP074E: Halogenated Aliphatic Compounds (QCLot: 3726507)								
EP074: Dichlorodifluoromethane	75-71-8	50	µg/L	<50	100 µg/L	98.6	60.6	138
EP074: Chloromethane	74-87-3	50	µg/L	<50	100 µg/L	97.9	67.4	130
EP074: Vinyl chloride	75-01-4	50	µg/L	<50	100 µg/L	108	69.4	129
EP074: Bromomethane	74-83-9	50	µg/L	<50	100 µg/L	109	56	140
EP074: Chloroethane	75-00-3	50	µg/L	<50	100 µg/L	107	63	135
EP074: Trichlorofluoromethane	75-69-4	50	µg/L	<50	100 µg/L	106	65	131
EP074: 1.1-Dichloroethene	75-35-4	5	µg/L	<5	10 µg/L	107	69	123
EP074: Iodomethane	74-88-4	5	µg/L	<5	10 µg/L	91.7	70.2	128
EP074: trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	10 µg/L	105	71	119
EP074: 1.1-Dichloroethane	75-34-3	5	µg/L	<5	10 µg/L	108	75	119

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP074E: Halogenated Aliphatic Compounds (QCLot: 3726507) - continued								
EP074: cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	10 µg/L	106	77	117
EP074: 1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	10 µg/L	112	61	119
EP074: 1.1-Dichloropropylene	563-58-6	5	µg/L	<5	10 µg/L	104	73	119
EP074: Carbon Tetrachloride	56-23-5	5	µg/L	<5	10 µg/L	111	63	121
EP074: 1.2-Dichloroethane	107-06-2	5	µg/L	<5	10 µg/L	107	78	122
EP074: Trichloroethene	79-01-6	5	µg/L	<5	10 µg/L	106	74	120
EP074: Dibromomethane	74-95-3	5	µg/L	<5	10 µg/L	107	74	118
EP074: 1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	10 µg/L	109	75	123
EP074: 1.3-Dichloropropane	142-28-9	5	µg/L	<5	10 µg/L	106	79	121
EP074: Tetrachloroethene	127-18-4	5	µg/L	<5	10 µg/L	115	72	124
EP074: 1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	10 µg/L	104	66	114
EP074: trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	10 µg/L	99.2	60	120
EP074: cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	10 µg/L	102	70.6	128
EP074: 1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	10 µg/L	97.1	70	124
EP074: 1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	10 µg/L	94.9	74	128
EP074: Pentachloroethane	76-01-7	5	µg/L	<5	10 µg/L	97.1	71.8	126
EP074: 1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	10 µg/L	108	66.4	136
EP074: Hexachlorobutadiene	87-68-3	5	µg/L	<5	10 µg/L	103	58	132
EP074F: Halogenated Aromatic Compounds (QCLot: 3726507)								
EP074: Chlorobenzene	108-90-7	5	µg/L	<5	10 µg/L	107	80	118
EP074: Bromobenzene	108-86-1	5	µg/L	<5	10 µg/L	107	76	116
EP074: 2-Chlorotoluene	95-49-8	5	µg/L	<5	10 µg/L	107	71	121
EP074: 4-Chlorotoluene	106-43-4	5	µg/L	<5	10 µg/L	105	71	121
EP074: 1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	10 µg/L	106	74	120
EP074: 1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	10 µg/L	102	72	120
EP074: 1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	10 µg/L	105	77	117
EP074: 1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	10 µg/L	97.4	60	126
EP074: 1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	10 µg/L	104	67	125
EP074G: Trihalomethanes (QCLot: 3726507)								
EP074: Chloroform	67-66-3	5	µg/L	<5	10 µg/L	101	76	118
EP074: Bromodichloromethane	75-27-4	5	µg/L	<5	10 µg/L	112	64	118
EP074: Dibromochloromethane	124-48-1	5	µg/L	<5	10 µg/L	110	65	115
EP074: Bromoform	75-25-2	5	µg/L	<5	10 µg/L	101	73.5	126
EP075(SIM)A: Phenolic Compounds (QCLot: 3724255)								
EP075(SIM): Phenol	108-95-2	0.2	µg/L	<1.0	5 µg/L	32.8	24.5	61.9
EP075(SIM): 2-Chlorophenol	95-57-8	0.2	µg/L	<1.0	5 µg/L	66.7	63.8	110
EP075(SIM): 2-Methylphenol	95-48-7	0.2	µg/L	<1.0	5 µg/L	71.0	55.9	112
EP075(SIM): 3- & 4-Methylphenol	1319-77-3	0.4	µg/L	<2.0	10 µg/L	57.6	42.5	114
EP075(SIM): 2-Nitrophenol	88-75-5	0.2	µg/L	<1.0	5 µg/L	73.7	62.7	117

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)A: Phenolic Compounds (QCLot: 3724255) - continued								
EP075(SIM): 2.4-Dimethylphenol	105-67-9	0.2	µg/L	<1.0	5 µg/L	69.6	59.9	112
EP075(SIM): 2.4-Dichlorophenol	120-83-2	0.2	µg/L	<1.0	5 µg/L	64.6	59.3	122
EP075(SIM): 2.6-Dichlorophenol	87-65-0	0.2	µg/L	<1.0	5 µg/L	82.3	64.3	118
EP075(SIM): 4-Chloro-3-Methylphenol	59-50-7	0.2	µg/L	<1.0	5 µg/L	69.4	63	119
EP075(SIM): 2.4.6-Trichlorophenol	88-06-2	0.2	µg/L	<1.0	5 µg/L	77.3	58.7	118
EP075(SIM): 2.4.5-Trichlorophenol	95-95-4	0.2	µg/L	<1.0	5 µg/L	77.2	50	108
EP075(SIM): Pentachlorophenol	87-86-5	0.4	µg/L	<2.0	10 µg/L	66.9	10	95
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3724255)								
EP075(SIM): Naphthalene	91-20-3	0.2	µg/L	<1.0	5 µg/L	74.6	58.6	119
EP075(SIM): Acenaphthylene	208-96-8	0.2	µg/L	<1.0	5 µg/L	84.9	63.6	114
EP075(SIM): Acenaphthene	83-32-9	0.2	µg/L	<1.0	5 µg/L	73.6	62.2	113
EP075(SIM): Fluorene	86-73-7	0.2	µg/L	<1.0	5 µg/L	83.2	63.9	115
EP075(SIM): Phenanthrene	85-01-8	0.2	µg/L	<1.0	5 µg/L	84.3	62.6	116
EP075(SIM): Anthracene	120-12-7	0.2	µg/L	<1.0	5 µg/L	81.7	64.3	116
EP075(SIM): Fluoranthene	206-44-0	0.2	µg/L	<1.0	5 µg/L	90.2	63.6	118
EP075(SIM): Pyrene	129-00-0	0.2	µg/L	<1.0	5 µg/L	87.2	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	0.2	µg/L	<1.0	5 µg/L	85.6	64.1	117
EP075(SIM): Chrysene	218-01-9	0.2	µg/L	<1.0	5 µg/L	83.0	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.2	µg/L	<1.0	5 µg/L	73.8	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.2	µg/L	<1.0	5 µg/L	92.3	61.7	117
EP075(SIM): Benzo(a)pyrene	50-32-8	0.2	µg/L	<0.5	5 µg/L	85.6	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.2	µg/L	<1.0	5 µg/L	71.1	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.2	µg/L	<1.0	5 µg/L	81.5	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.2	µg/L	<1.0	5 µg/L	80.7	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3724254)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	93.0	59	129
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	102	71	131
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	102	62	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3726508)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	93.2	75	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3724254)								
EP071: >C10 - C16 Fraction	>C10_C16	100	µg/L	<100	2500 µg/L	100	58.9	131
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	101	73.9	138
EP071: >C34 - C40 Fraction	----	50	µg/L	<100	1500 µg/L	101	67	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3726508)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	89.5	75	127
EP080: BTEXN (QCLot: 3726508)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080: BTEXN (QCLot: 3726508) - continued								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	104	70	124
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	107	65	129
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	93.4	70	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	92.4	69	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	94.2	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	95.8	70	124
EP262: Ethanolamines (QCLot: 3726229)								
EP262: Ethanolamine	141-43-5	1	µg/L	<1	10 µg/L	123	50	130
EP262: Diethanolamine	111-42-2	1	µg/L	<1	10 µg/L	117	50	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED009: Anions (QCLot: 3724170)							
ES1425544-001	WKMB06B	ED009-X: Chloride	16887-00-6	4 mg/L	# Not Determined	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3724041)							
ES1425544-001	WKMB06B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
ED045G: Chloride Discrete analyser (QCLot: 3724040)							
ES1425544-001	WKMB06B	ED045G: Chloride	16887-00-6	250 mg/L	98.7	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726679)							
ES1425488-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	119	70	130
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	92.4	70	130
		EG020A-F: Barium	7440-39-3	0.2 mg/L	103	70	130
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	91.1	70	130
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	87.7	70	130
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	123	70	130
		EG020A-F: Copper	7440-50-8	0.2 mg/L	112	70	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	96.2	70	130
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	89.4	70	130
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	114	70	130
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	90.9	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726679) - continued							
ES1425488-001	Anonymous	EG020A-F: Zinc	7440-66-6	0.2 mg/L	101	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 3726680)							
ES1425544-001	WKMB06B	EG035F: Mercury	7439-97-6	0.0100 mg/L	101	70	130
EG052G: Silica by Discrete Analyser (QCLot: 3724043)							
ES1425544-001	WKMB06B	EG052G: Reactive Silica	----	5 mg/L	88.9	70	130
EK040P: Fluoride by PC Titrator (QCLot: 3724051)							
ES1425544-001	WKMB06B	EK040P: Fluoride	16984-48-8	5.0 mg/L	112	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3728118)							
ES1425544-001	WKMB06B	EK055G: Ammonia as N	7664-41-7	1 mg/L	88.4	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3724038)							
ES1425544-001	WKMB06B	EK057G: Nitrite as N	----	0.5 mg/L	94.8	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3728117)							
ES1425544-001	WKMB06B	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	106	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3728156)							
ES1425638-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	101	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3728157)							
ES1425638-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	102	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3724039)							
ES1425544-001	WKMB06B	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	122	70	130
EP005: Total Organic Carbon (TOC) (QCLot: 3726618)							
ES1425542-004	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	87.9	70	130
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3726748)							
ES1425545-001	Anonymous	EP033: Methane	74-82-8	27.92 µg/L	# Not Determined	70	130
		EP033: Ethene	74-85-1	51.76 µg/L	104	70	130
		EP033: Ethane	74-84-0	57.05 µg/L	102	70	130
		EP033: Propene	115-07-1	74.71 µg/L	102	70	130
		EP033: Propane	74-98-6	77.52 µg/L	104	70	130
		EP033: Butene	25167-67-3	99.61 µg/L	102	70	130
		EP033: Butane	106-97-8	103.19 µg/L	99.2	70	130
EP074E: Halogenated Aliphatic Compounds (QCLot: 3726507)							
ES1425544-001	WKMB06B	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	74.2	70	130
		EP074: Trichloroethene	79-01-6	25 µg/L	99.5	70	130
EP074F: Halogenated Aromatic Compounds (QCLot: 3726507)							
ES1425544-001	WKMB06B	EP074: Chlorobenzene	108-90-7	25 µg/L	116	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3726508)							
ES1425544-001	WKMB06B	EP080: C6 - C9 Fraction	----	325 µg/L	116	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3726508)							
ES1425544-001	WKMB06B	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	111	70	130
EP080: BTEXN (QCLot: 3726508)							
ES1425544-001	WKMB06B	EP080: Benzene	71-43-2	25 µg/L	96.6	70	130
		EP080: Toluene	108-88-3	25 µg/L	103	70	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	97.9	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	98.2	70	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	102	70	130
		EP080: Naphthalene	91-20-3	25 µg/L	103	70	130
EP262: Ethanolamines (QCLot: 3726229)							
ES1425544-001	WKMB06B	EP262: Ethanolamine	141-43-5	10 µg/L	68.4	50	130
		EP262: Diethanolamine	111-42-2	10 µg/L	126	50	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3724038)										
ES1425544-001	WKMB06B	EK057G: Nitrite as N	----	0.5 mg/L	94.8	----	70	130	----	----
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 3724039)										
ES1425544-001	WKMB06B	EK071G: Reactive Phosphorus as P	14265-44-2	0.5 mg/L	122	----	70	130	----	----
ED045G: Chloride Discrete analyser (QCLot: 3724040)										
ES1425544-001	WKMB06B	ED045G: Chloride	16887-00-6	250 mg/L	98.7	----	70	130	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3724041)										
ES1425544-001	WKMB06B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	----	70	130	----	----
EG052G: Silica by Discrete Analyser (QCLot: 3724043)										
ES1425544-001	WKMB06B	EG052G: Reactive Silica	----	5 mg/L	88.9	----	70	130	----	----
EK040P: Fluoride by PC Titrator (QCLot: 3724051)										
ES1425544-001	WKMB06B	EK040P: Fluoride	16984-48-8	5.0 mg/L	112	----	70	130	----	----
ED009: Anions (QCLot: 3724170)										
ES1425544-001	WKMB06B									

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED009: Anions (QCLot: 3724170) - continued										
ES1425544-001	WKMB06B	ED009-X: Chloride	16887-00-6	4 mg/L	# Not Determined	----	70	130	----	----
EP262: Ethanolamines (QCLot: 3726229)										
ES1425544-001	WKMB06B	EP262: Ethanolamine	141-43-5	10 µg/L	68.4	----	50	130	----	----
		EP262: Diethanolamine	111-42-2	10 µg/L	126	----	50	130	----	----
EP074E: Halogenated Aliphatic Compounds (QCLot: 3726507)										
ES1425544-001	WKMB06B	EP074: 1.1-Dichloroethene	75-35-4	25 µg/L	74.2	----	70	130	----	----
		EP074: Trichloroethene	79-01-6	25 µg/L	99.5	----	70	130	----	----
EP074F: Halogenated Aromatic Compounds (QCLot: 3726507)										
ES1425544-001	WKMB06B	EP074: Chlorobenzene	108-90-7	25 µg/L	116	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3726508)										
ES1425544-001	WKMB06B	EP080: C6 - C9 Fraction	----	325 µg/L	116	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3726508)										
ES1425544-001	WKMB06B	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	111	----	70	130	----	----
EP080: BTEXN (QCLot: 3726508)										
ES1425544-001	WKMB06B	EP080: Benzene	71-43-2	25 µg/L	96.6	----	70	130	----	----
		EP080: Toluene	108-88-3	25 µg/L	103	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	25 µg/L	97.9	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	98.2	----	70	130	----	----
		EP080: ortho-Xylene	95-47-6	25 µg/L	102	----	70	130	----	----
		EP080: Naphthalene	91-20-3	25 µg/L	103	----	70	130	----	----
EP005: Total Organic Carbon (TOC) (QCLot: 3726618)										
ES1425542-004	Anonymous	EP005: Total Organic Carbon	----	100 mg/L	87.9	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 3726679)										
ES1425488-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	119	----	70	130	----	----
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	92.4	----	70	130	----	----
		EG020A-F: Barium	7440-39-3	0.2 mg/L	103	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	91.1	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	87.7	----	70	130	----	----
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	123	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.2 mg/L	112	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.2 mg/L	96.2	----	70	130	----	----
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	89.4	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	114	----	70	130	----	----
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	90.9	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	101	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 3726680)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EG035F: Dissolved Mercury by FIMS (QCLot: 3726680) - continued										
ES1425544-001	WKMB06B	EG035F: Mercury	7439-97-6	0.0100 mg/L	101	----	70	130	----	----
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3726748)										
ES1425545-001	Anonymous	EP033: Methane	74-82-8	27.92 µg/L	# Not Determined	----	70	130	----	----
		EP033: Ethene	74-85-1	51.76 µg/L	104	----	70	130	----	----
		EP033: Ethane	74-84-0	57.05 µg/L	102	----	70	130	----	----
		EP033: Propene	115-07-1	74.71 µg/L	102	----	70	130	----	----
		EP033: Propane	74-98-6	77.52 µg/L	104	----	70	130	----	----
		EP033: Butene	25167-67-3	99.61 µg/L	102	----	70	130	----	----
		EP033: Butane	106-97-8	103.19 µg/L	99.2	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3728117)										
ES1425544-001	WKMB06B	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	106	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3728118)										
ES1425544-001	WKMB06B	EK055G: Ammonia as N	7664-41-7	1 mg/L	88.4	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3728156)										
ES1425638-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	101	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3728157)										
ES1425638-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	102	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **ES1425544**	Page	: 1 of 11
Amendment	: **1**		
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
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Project	: 2268522A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 20-NOV-2014
Sampler	: ----	Issue Date	: 21-JAN-2015
Order number	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
WKMB06B	**19-NOV-2014**	**---**	19-NOV-2014	----	**21-NOV-2014**	19-NOV-2014	×
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P)							
WKMB06B	**19-NOV-2014**	**---**	17-DEC-2014	----	**21-NOV-2014**	17-DEC-2014	✓
EA015: Total Dissolved Solids							
Clear Plastic Bottle - Natural (EA015H)							
WKMB06B	**19-NOV-2014**	**---**	26-NOV-2014	----	**24-NOV-2014**	26-NOV-2014	✓
EA025: Suspended Solids							
Clear Plastic Bottle - Natural (EA025H)							
WKMB06B	**19-NOV-2014**	**---**	26-NOV-2014	----	**24-NOV-2014**	26-NOV-2014	✓
ED009: Anions							
Clear Plastic Bottle - Natural (ED009-X)							
WKMB06B	**19-NOV-2014**	**----**	----	----	**25-NOV-2014**	17-DEC-2014	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
WKMB06B	**19-NOV-2014**	**---**	03-DEC-2014	----	**21-NOV-2014**	03-DEC-2014	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
WKMB06B	**19-NOV-2014**	**---**	17-DEC-2014	----	**21-NOV-2014**	17-DEC-2014	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
WKMB06B	**19-NOV-2014**	**---**	17-DEC-2014	----	**21-NOV-2014**	17-DEC-2014	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
WKMB06B	**19-NOV-2014**	**---**	26-NOV-2014	----	**21-NOV-2014**	26-NOV-2014	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
WKMB06B	**19-NOV-2014**	**---**	18-MAY-2015	----	**24-NOV-2014**	18-MAY-2015	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)							
WKMB06B	**19-NOV-2014**	**---**	18-MAY-2015	----	**24-NOV-2014**	18-MAY-2015	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
WKMB06B	**19-NOV-2014**	---	17-DEC-2014	----	**26-NOV-2014**	17-DEC-2014	✓
EG052G: Silica by Discrete Analyser							
Clear Plastic Bottle - Natural (EG052G)							
WKMB06B	**19-NOV-2014**	---	17-DEC-2014	----	**21-NOV-2014**	17-DEC-2014	✓
EK010/011: Chlorine							
Clear Plastic Bottle - Natural (EK010)							
WKMB06B	**19-NOV-2014**	----	----	----	**21-NOV-2014**	19-NOV-2014	×
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P)							
WKMB06B	**19-NOV-2014**	---	17-DEC-2014	----	**21-NOV-2014**	17-DEC-2014	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
WKMB06B	**19-NOV-2014**	---	17-DEC-2014	----	**25-NOV-2014**	17-DEC-2014	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
WKMB06B	**19-NOV-2014**	---	21-NOV-2014	----	**21-NOV-2014**	21-NOV-2014	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
WKMB06B	**19-NOV-2014**	---	17-DEC-2014	----	**25-NOV-2014**	17-DEC-2014	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
WKMB06B	**19-NOV-2014**	**25-NOV-2014**	17-DEC-2014	✓	**25-NOV-2014**	17-DEC-2014	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
WKMB06B	**19-NOV-2014**	**25-NOV-2014**	17-DEC-2014	✓	**25-NOV-2014**	17-DEC-2014	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G)							
WKMB06B	**19-NOV-2014**	---	21-NOV-2014	----	**21-NOV-2014**	21-NOV-2014	✓
EP005: Total Organic Carbon (TOC)							
Amber TOC Vial - Sulfuric Acid (EP005)							
WKMB06B	**19-NOV-2014**	----	----	----	**24-NOV-2014**	17-DEC-2014	✓
EP033: C1 - C4 Hydrocarbon Gases							
Amber VOC Vial - Sulfuric Acid (EP033)							
WKMB06B	**19-NOV-2014**	----	----	----	**24-NOV-2014**	03-DEC-2014	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
WKMB06B	**19-NOV-2014**	**21-NOV-2014**	26-NOV-2014	✓	**26-NOV-2014**	31-DEC-2014	✓
EP074D: Fumigants							
Amber VOC Vial - Sulfuric Acid (EP074)							
WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP074E: Halogenated Aliphatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP074F: Halogenated Aromatic Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP074A: Monocyclic Aromatic Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP074B: Oxygenated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP074C: Sulfonated Compounds							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP074G: Trihalomethanes							
Amber VOC Vial - Sulfuric Acid (EP074) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP075(SIM)A: Phenolic Compounds							
Amber Glass Bottle - Unpreserved (EP075(SIM)) WKMB06B	**19-NOV-2014**	**21-NOV-2014**	26-NOV-2014	✓	**26-NOV-2014**	31-DEC-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) WKMB06B	**19-NOV-2014**	**21-NOV-2014**	26-NOV-2014	✓	**26-NOV-2014**	31-DEC-2014	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP080) WKMB06B	**19-NOV-2014**	**25-NOV-2014**	03-DEC-2014	✓	**25-NOV-2014**	03-DEC-2014	✓
EP262: Ethanolamines							
Amber Glass Bottle - Unpreserved (EP262) WKMB06B	**19-NOV-2014**	**----**	----	----	**26-NOV-2014**	26-NOV-2014	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	15	**13.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chlorine	EK010	2	10	**20.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	15	**13.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	6	**16.7**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.5**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	2	11	**18.2**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	7	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
pH by PC Titrator	EA005-P	2	10	**20.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	14	**14.3**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	6	**16.7**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.7**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	2	17	**11.8**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	2	18	**11.1**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	15	**6.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	15	**6.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	20	**10.0**	**10.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.0**	**15.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.0**	**15.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chlorine	EK010	1	10	**10.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	15	**6.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C1 - C4 Gases	EP033	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	8	**12.5**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ethanolamines by LCMSMS	EP262	1	11	**9.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	7	**14.3**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	14	**7.1**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Silica (Reactive) by Discrete Analyser	EG052G	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Standard Anions -by IC (Extended Method)	ED009-X	1	6	**16.7**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP005	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	17	**5.9**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Volatile Organic Compounds	EP074	1	18	**5.6**	**5.0**	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Conductivity by PC Titrator	EA010-P	WATER	In house: Referenced to APHA 21st ed., 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 21st ed., 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 21st ed., 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Standard Anions -by IC (Extended Method)	ED009-X	WATER	In house: Referenced to APHA 21st ed., 4110. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 21st ed., 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	In house: Referenced to APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Silica (Reactive) by Discrete Analyser	EG052G	WATER	In house: Referenced to APHA 21st ed. 4500-SiO2 D: Under Acdic conditions reactive silicon combines with ammonium molybdate to form a yellow molybdosilicic acid complex. This is reduced by 1-amino-2-naphthol-4-sulfonic acid to a silicomolybdenum blue complex which is measured by discrete analyser at 670 nm. This method is compliant with NEPM (2013) Schedule B(3)
Chlorine	EK010	WATER	In-house (DPD colourimetry)
Fluoride by PC Titrator	EK040P	WATER	In house: Referenced to APHA 21st ed., 4500 F--C CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ammonium as N	EK055G-NH4	WATER	Ammonium in the sample is reported as the ionised / unionised fractions by the use of a nomograph and the initial pH and Temperature. Ammonia is determined by direct colorimetry by Discrete Analyser according to APHA 21st ed., 4500-NH3 G. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 21st ed., 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 21st ed., 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 21st Ed. 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP005	WATER	In house: Referenced to APHA 21st ed., 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3)
C1 - C4 Gases	EP033	WATER	Technical Guidance for the Natural Attenuation Indicators: Methane, Ethane, and Ethene, US EPA - Region 1, EPA New England, July 2001. Automated static headspace, dual column GC/FID. A 12 mL sample is pipetted into a 20 mL headspace vial containing 3g of sodium chloride and sealed. Each sample is equilibrated with shaking at 40 degrees C for 10 minutes prior to analysis by GC/FID using a pair of PLOT columns of different polarity.
TRH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Volatile Organic Compounds	EP074	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Ethanolamines by LCMSMS	EP262	WATER	In-house LC-MSMS: Benzoyl derivatives of target compounds are analysed by LC/MSMS in ESI Positive Mode.

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED009: Anions	ES1425544-001	WKMB06B	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	ES1425544-001	WKMB06B	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP033: C1 - C4 Hydrocarbon Gases	ES1425545-001	Anonymous	**Methane**	74-82-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
WKMB06B	----	----	----	21-NOV-2014	19-NOV-2014	**2**
EK010/011: Chlorine						
Clear Plastic Bottle - Natural						
WKMB06B	----	----	----	21-NOV-2014	19-NOV-2014	**2**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 119760

Client:

Parsons Brinckerhoff Aust. Pty Ltd
GPO Box 5394
Sydney
NSW 2001

Attention: Sean Daykin

Sample log in details:

Your Reference:	**2268523A**		
No. of samples:	2 WATERS		
Date samples received / completed instructions received	21/11/14	/	19/12/14

This report supersedes the previous report R00 due to the removal of results (ELS #1-13, 16-25).

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	31/12/14	/	14/05/15
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorganics			
Our Reference:	UNITS	119760-14	119760-15
Your Reference	----------	WKMB06a	WKMB06b
Date Sampled	----------	18/11/2014	19/11/2014
Type of sample		Water	Water
Date prepared	-	24/12/2014	24/12/2014
Date analysed	-	24/12/2014	24/12/2014
THPS in Water by uHPLC*	µg/L	<50	<50
Sulphate, SO4	mg/L	36	29

Metals in Waters - Acid extractable			
Our Reference:	UNITS	119760-14	119760-15
Your Reference	----------	WKMB06a	WKMB06b
Date Sampled	----------	18/11/2014	19/11/2014
Type of sample		Water	Water
Date prepared	-	24/12/2014	24/12/2014
Date analysed	-	24/12/2014	24/12/2014
Phosphorus - Total	mg/L	0.08	0.6

Method ID	Methodology Summary
AT-021	Determination of Bis[Tetrakis(Hydroxymethyl)Phosphonium Sulfate (THPS) in waters by conversion to formaldehyde, derivatisation and analysis using ultra high performance liquid chromatography-diode array detection.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			24/12/2014	[NT]	[NT]	LCS-1	24/12/2014
Date analysed	-			24/12/2014	[NT]	[NT]	LCS-1	24/12/2014
THPS in Water by uHPLC*	µg/L	50	AT-021	<50	[NT]	[NT]	LCS-1	100%
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-1	115%

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			24/12/2014	[NT]	[NT]	LCS-W2	24/12/2014
Date analysed	-			24/12/2014	[NT]	[NT]	LCS-W2	24/12/2014
Phosphorus - Total	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	LCS-W2	100%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	LCS-W1	24/12/2014
Date analysed	-	[NT]	[NT]	LCS-W1	24/12/2014
THPS in Water by uHPLC*	µg/L	[NT]	[NT]	LCS-W1	101%
Sulphate, SO4	mg/L	[NT]	[NT]	LCS-W1	93%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

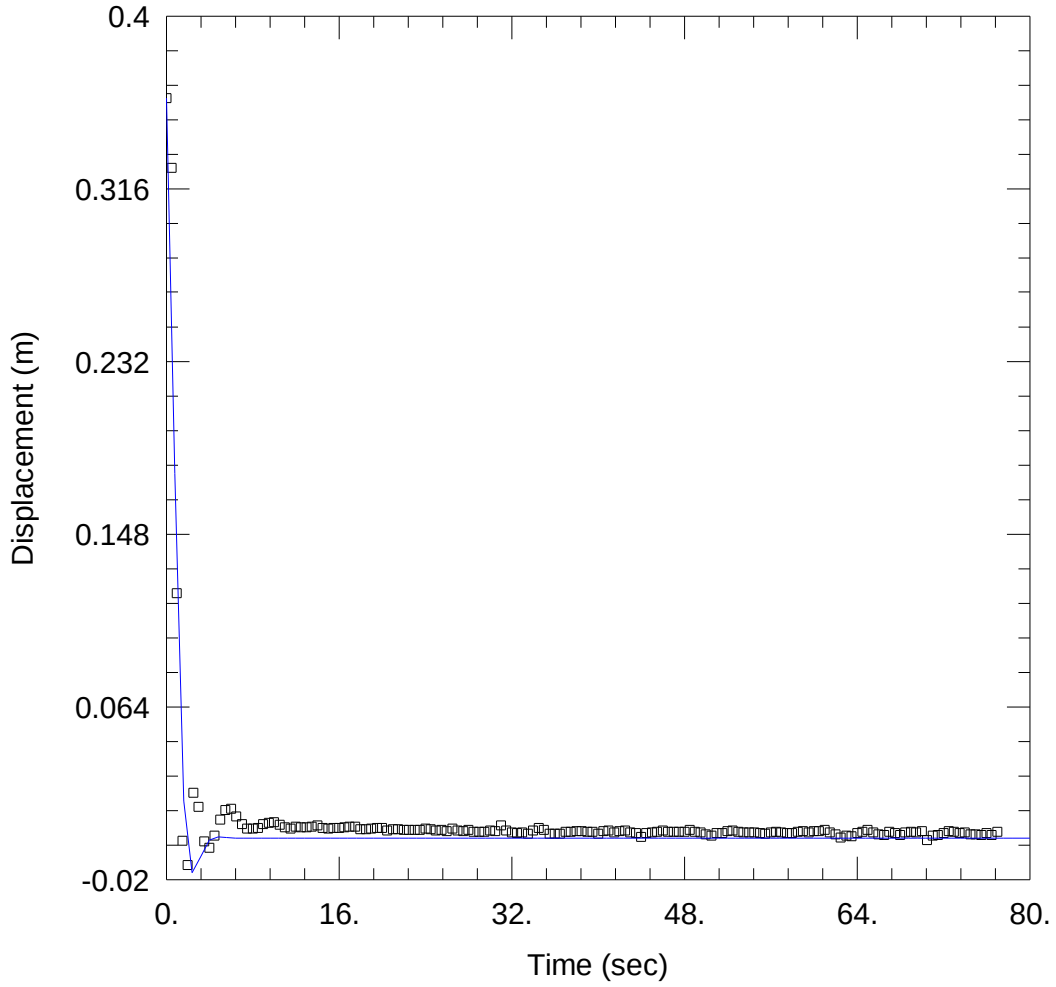
Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Appendix E

Hydraulic conductivity analysis



FALLING 1

Data Set: \...\WKMB06A Falling test 1_DW.aqt
Date: 05/12/15 Time: 08:40:32

PROJECT INFORMATION

Company: Parsons Brinckerhoff
Client: AGL
Project: 2268522A
Test Well: WKMB06A
Test Date: 18/11/14

AQUIFER DATA

Saturated Thickness: 12.35 m Anisotropy Ratio (Kz/Kr): 1.

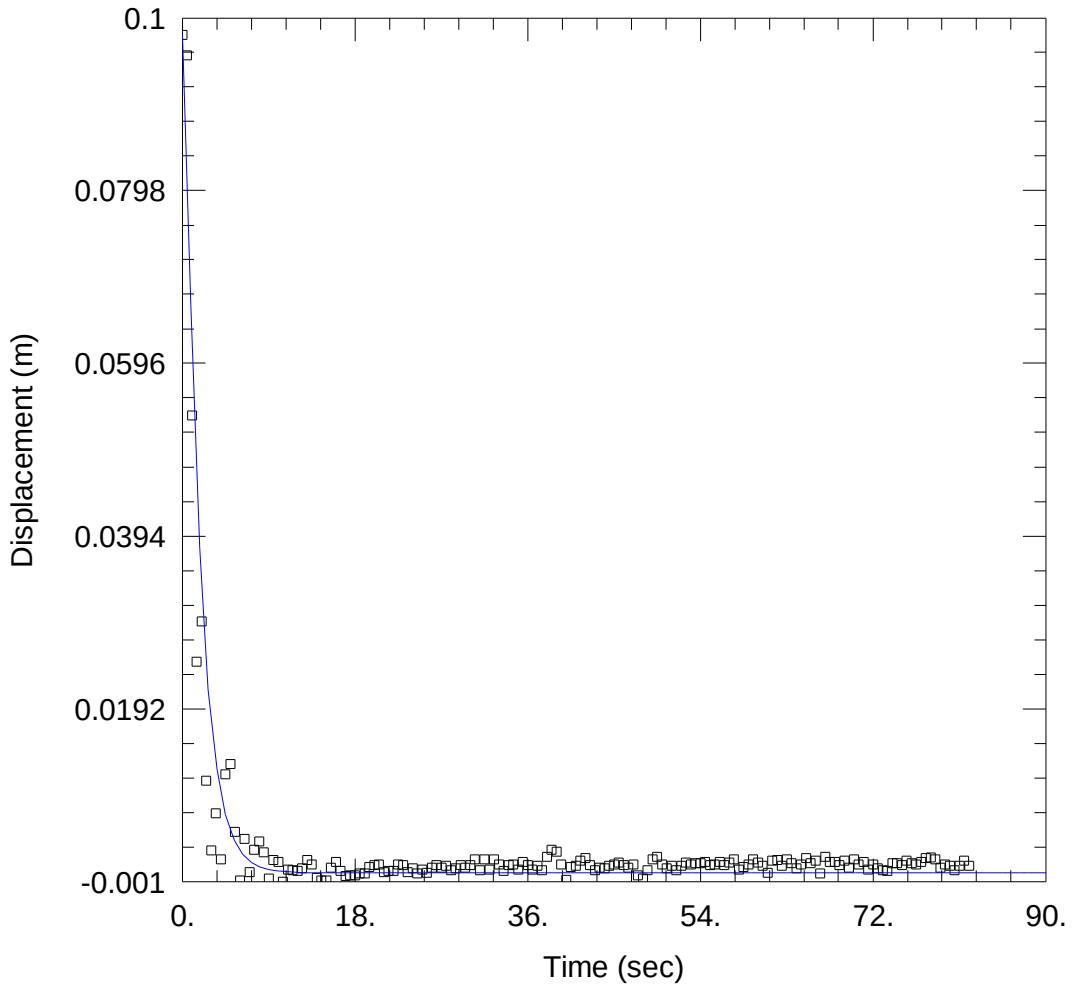
WELL DATA (WKMB06A)

Initial Displacement: 0.36 m Static Water Column Height: 9.754 m
Total Well Penetration Depth: 12.35 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Springer-Gelhar

K = 28.19 m/day Le = 3.012 m



FALLING 1

Data Set: \...\WKMB06A Rising test 1_DW.aqt
Date: 05/12/15 Time: 08:42:09

PROJECT INFORMATION

Company: Parsons Brinckerhoff
Client: AGL
Project: 2268522A
Test Well: WKMB06A
Test Date: 18/11/14

AQUIFER DATA

Saturated Thickness: 12.35 m Anisotropy Ratio (Kz/Kr): 1.

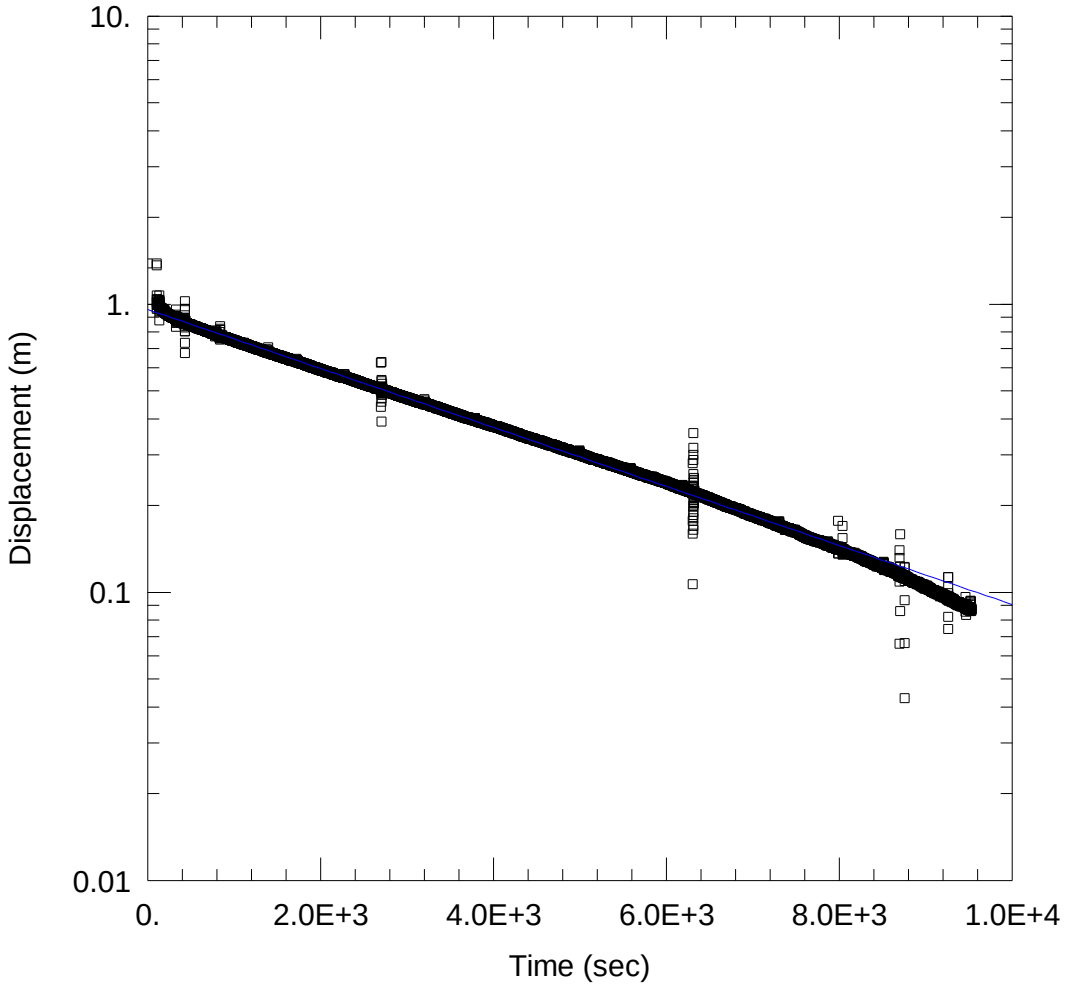
WELL DATA (WKMB06A)

Initial Displacement: 0.098 m Static Water Column Height: 9.754 m
Total Well Penetration Depth: 12.35 m Screen Length: 6. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Springer-Gelhar

K = 11.67 m/day Le = 4.323 m



WELL TEST ANALYSIS

Data Set: \...\WKMB06B Falling test 1.aqt
Date: 01/21/15 Time: 10:53:28

PROJECT INFORMATION

Company: Parsons Brinckerhoff
Client: AGL
Project: 2268522A
Test Well: WKMB06B
Test Date: 18/11/14

AQUIFER DATA

Saturated Thickness: 51. m Anisotropy Ratio (Kz/Kr): 1.

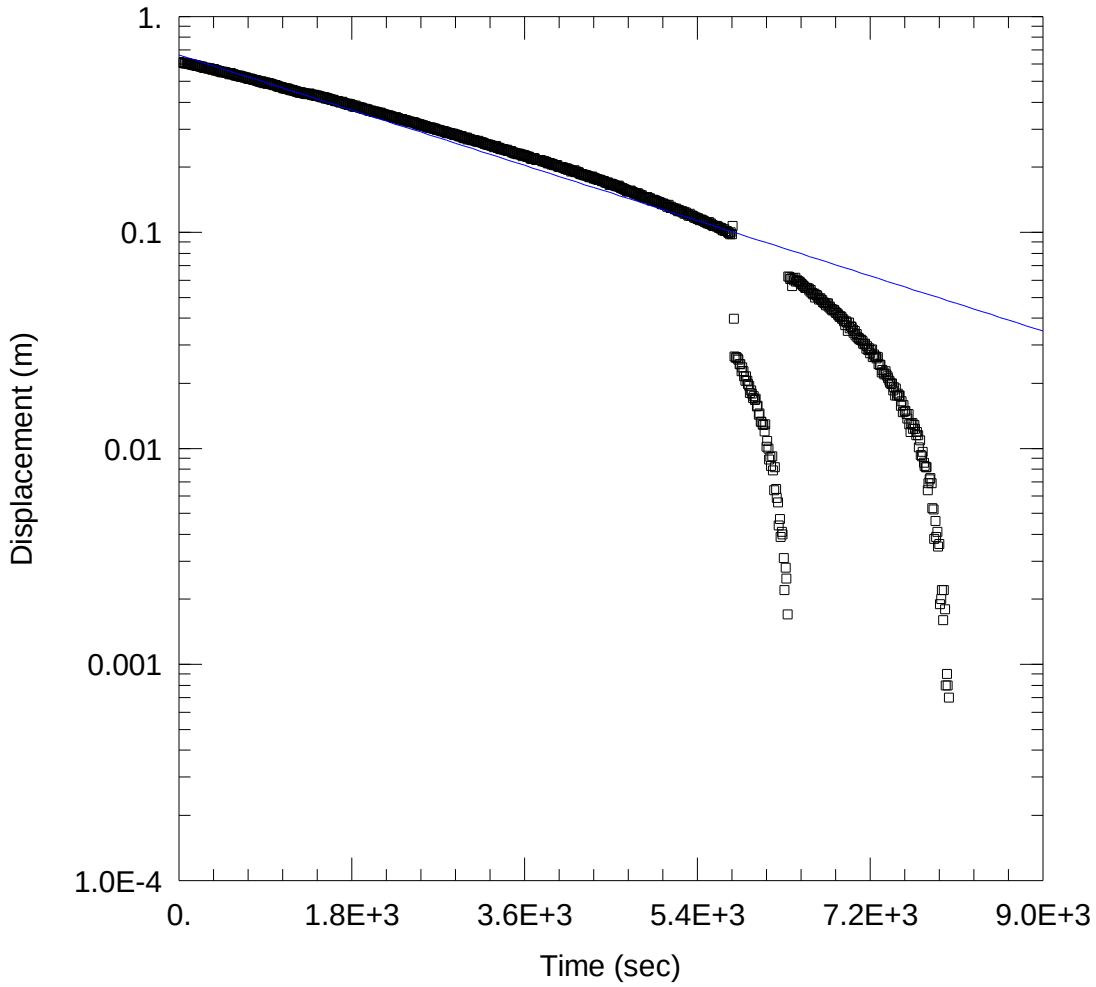
WELL DATA (WKMB6B)

Initial Displacement: 1.382 m Static Water Column Height: 58.77 m
Total Well Penetration Depth: 61. m Screen Length: 9. m
Casing Radius: 0.025 m Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 0.004652 m/day y0 = 0.9574 m



WELL TEST ANALYSIS

Data Set: \...\WKMB06B Rising test 1_SB_Hvorslev.aqt
Date: 05/12/15 Time: 16:47:32

PROJECT INFORMATION

Company: Parsons Brinckerhoff
Client: AGL
Project: 2268522A
Test Well: WKMB06B
Test Date: 18/11/14

AQUIFER DATA

Saturated Thickness: 51. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (WKMB6B)

Initial Displacement: 1.382 m
Total Well Penetration Depth: 61. m
Casing Radius: 0.025 m
Static Water Column Height: 58.77 m
Screen Length: 9. m
Well Radius: 0.025 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 0.006459 m/day y0 = 0.6636 m

Appendix F

Water quality results

WATER QUALITY RESULTS - WKMB06 monitoring bores

Analyte	Units	LOR	WKMB06A	WKMB06B
Sample date			18/11/2014	19/11/2014
Screened formation			**Alluvium**	**Lleloma Formation**
General parameters				
pH (field)	pH units	0.01	6.37	8.44
pH (lab)			6.90	8.26
Electrical conductivity (field)	µS/cm	1	2,926	1,278
Electrical conductivity (lab)			3020	1,290
Temperature	ºC	0.01	19.41	25.50
Dissolved oxygen	% sat	0.01	13.2	9
Total dissolved solids (field)	mg/L	1	1,902	831
Total dissolved solids (lab)			1600	767
Redox	mV	-	-48.7	75.0
Laboratory analytes				
Hydroxide alkalinity as $CaCO_3$	mg/L	1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	1	240	262
Total alkalinity as $CaCO_3$	mg/L	1	240	262
Sulfate as SO_4^{2-}	mg/L	1	71	57
Chloride	mg/L	1	769	233
Calcium	mg/L	1	90	6
Magnesium	mg/L	1	52	2
Sodium	mg/L	1	407	282
Potassium	mg/L	1	2	2
Silicon as SiO_2	mg/L	0.1	32.9	15.2
Fluoride	mg/L	0.1	0.2	0.6
Dissolved metals				
Aluminium	mg/L	0.01	0.12	0.89
Arsenic	mg/L	0.001	0.008	0.011
Barium	mg/L	0.001	0.444	0.242
Beryllium	mg/L	0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	0.0004	<0.0001
Cobalt	mg/L	0.001	0.004	<0.001
Copper	mg/L	0.001	0.003	0.01
Lead	mg/L	0.001	0.001	0.004
Molybdenum	mg/L	0.001	<0.001	0.003
Nickel	mg/L	0.001	<0.001	0.002
Selenium	mg/L	0.01	<0.01	<0.01
Strontium	mg/L	0.001	1.72	0.56
Tin	mg/L	0.001	<0.001	<0.001
Uranium	mg/L	0.001	<0.001	0.003
Vanadium	mg/L	0.01	<0.01	<0.01
Zinc	mg/L	0.005	0.077	0.054
Boron	mg/L	0.05	<0.05	0.05
Iron	mg/L	0.05	5.27	2.97
Bromine	mg/L	0.1	1.8	0.7
Nutrients				
Ammonia as N	mg/L	0.01	0.21	0.37
Nitrite as N	mg/L	0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	<0.01	0.02
Nitrite + Nitrate as N	mg/L	0.01	<0.01	0.02
Total phosphorous	mg/L	0.01	0.06	0.63
Reactive phosphorous	mg/L	0.01	<0.01	0.56
Total organic carbon	mg/L	1	3	<1
Dissolved gases				
Methane	µg/L	10	12	10,300
Ethene	µg/L	10	<10	<10
Ethane	µg/L	10	<10	<10
Propene	µg/L	10	<10	<10
Propane	µg/L	10	<10	<10
Butene	µg/L	10	<10	<10
Butane	µg/L	10	<10	<10
Phenolic compounds				
Phenol	µg/L	1	<1.0	<1.0
2-Chlorophenol	µg/L	1	<1.0	<1.0
2-Methylphenol	µg/L	1	<1.0	<1.0
3-&4-Methylphenol	µg/L	2	<2.0	<2.0
2-Nitrophenol	µg/L	1	<1.0	<1.0
2.4-Dimethylphenol	µg/L	1	<1.0	<1.0
2.4-Dichlorophenol	µg/L	1	<1.0	<1.0
2.6-Dichlorophenol	µg/L	1	<1.0	<1.0
4-Chloro-3-Methylphenol	µg/L	1	<1.0	<1.0
2.4.6-Trichlorophenol	µg/L	1	<1.0	<1.0
2.4.5-Trichlorophenol	µg/L	1	<1.0	<1.0
Pentachlorophenol	µg/L	2	<2.0	<2.0
Polycyclic aromatic hydrocarbons				
Naphthalene	µg/L	1	3.4	<1.0
Acenaphthylene	µg/L	1	<1.0	<1.0
Acenaphthene	µg/L	1	5.4	<1.0
Fluorene	µg/L	1	4.6	<1.0
Phenanthrene	µg/L	1	7.5	<1.0
Anthracene	µg/L	1	<1.0	<1.0
Fluoranthene	µg/L	1	<1.0	<1.0
Pyrene	µg/L	1	<1.0	<1.0
Benz(a)anthracene	µg/L	1	<1.0	<1.0
Chrysene	µg/L	1	<1.0	<1.0
Benzo(b)fluoranthene	µg/L	1	<1.0	<1.0
Benzo(k)fluoranthene	µg/L	1	<1.0	<1.0
Benzo(a)pyrene	µg/L	0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	µg/L	1	<1.0	<1.0
Dibenz(a.h)anthracene	µg/L	1	<1.0	<1.0
Benzo(g.h.i)perylene	µg/L	1	<1.0	<1.0
Sum of PAHs	µg/L	0.5	20.9	<0.5
Aromatic hydrocarbons				
Benzene	µg/L	1	<1	<1
Toluene	µg/L	2	<2	27
Ethylbenzene	µg/L	2	<2	<2
m&p-Xylenes	µg/L	2	<2	<2
o-Xylenes	µg/L	2	<2	<2
Total xlyenes	µg/L	2	<2	<2
Sum of BTEX	µg/L	1	<1	27
Naphthalene	µg/L	5	<5	<5
Total petroleum hydrocarbons				
C_6-C_9 Fraction	µg/L	20	<20	40
C_{10}-C_{14} Fraction	µg/L	50	170	<50
C_{15}-C_{28} Fraction	µg/L	100	100	<100
C_{29}-C_{36} Fraction	µg/L	50	<50	<50
C_{10}-C_{36} Fraction (sum)	µg/L	50	270	<50

PARSONS BRINCKERHOFF

Appendix G

Laboratory reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1425362**	Page	: 1 of 10
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: S DAYKIN	Contact	: Loren Schiavon
Address	: PO Box 5394 SYDNEY NSW 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sdaykin@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: ----	Telephone	: +61 2 8784 8503
Facsimile	: ----	Facsimile	: +61 2 8784 8500
Project	: 2268523A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-NOV-2014
Sampler	: CS,BR,AM,SD	Issue Date	: 20-JAN-2015
Site	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.**
- **EG020: 'Bromine/Iodine' quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics
Lana Nguyen	Senior LCMS Chemist	Sydney Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06A	----	----	----	----
				Client sampling date / time	18-NOV-2014 14:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425362-001	----	----	----	----
EA005: pH									
pH Value	----	0.01	pH Unit		6.90	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3020	----	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		1600	----	----	----	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		110	----	----	----	----
ED009: Anions									
Chloride	16887-00-6	0.100	mg/L		769	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		240	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		240	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		71	----	----	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		814	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		90	----	----	----	----
Magnesium	7439-95-4	1	mg/L		52	----	----	----	----
Sodium	7440-23-5	1	mg/L		407	----	----	----	----
Potassium	7440-09-7	1	mg/L		2	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.12	----	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		0.008	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		0.444	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		0.0004	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		0.003	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		0.004	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06A	----	----	----	----
				Client sampling date / time	18-NOV-2014 14:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425362-001	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.001**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.077**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.366**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**1.72**	----	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**5.27**	----	----	----	----
Bromine	7726-95-6	0.1	mg/L		**1.8**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**32.9**	----	----	----	----
EK010/011: Chlorine									
Chlorine - Free	----	0.2	mg/L		<0.2	----	----	----	----
Chlorine - Total Residual	----	0.2	mg/L		<0.2	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.21**	----	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	----	0.01	mg/L		**0.21**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06A	----	----	----	----
				Client sampling date / time	18-NOV-2014 14:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425362-001	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.4**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.4**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.06**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**29.2**	----	----	----	----
Total Cations	----	0.01	meq/L		**26.5**	----	----	----	----
Ionic Balance	----	0.01	%		**4.87**	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**3**	----	----	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**12**	----	----	----	----
Ethene	74-85-1	10	µg/L		<10	----	----	----	----
Ethane	74-84-0	10	µg/L		<10	----	----	----	----
Propene	115-07-1	10	µg/L		<10	----	----	----	----
Propane	74-98-6	10	µg/L		<10	----	----	----	----
Butene	25167-67-3	10	µg/L		<10	----	----	----	----
Butane	106-97-8	10	µg/L		<10	----	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons									
Styrene	100-42-5	5	µg/L		<5	----	----	----	----
Isopropylbenzene	98-82-8	5	µg/L		<5	----	----	----	----
n-Propylbenzene	103-65-1	5	µg/L		<5	----	----	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L		<5	----	----	----	----
sec-Butylbenzene	135-98-8	5	µg/L		<5	----	----	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L		<5	----	----	----	----
tert-Butylbenzene	98-06-6	5	µg/L		<5	----	----	----	----
p-Isopropyltoluene	99-87-6	5	µg/L		<5	----	----	----	----
n-Butylbenzene	104-51-8	5	µg/L		<5	----	----	----	----
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L		<50	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: WKMB06A	----	----	----	----
				Client sampling date / time: 18-NOV-2014 14:00	----	----	----	----
				ES1425362-001	----	----	----	----
EP074B: Oxygenated Compounds - Continued								
2-Butanone (MEK)	78-93-3	50	µg/L	<50	----	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	----	----	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	----	----	----	----
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	----	----	----	----
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	----	----	----	----
1.2-Dichloropropane	78-87-5	5	µg/L	<5	----	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	----	----	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	----	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	----	----	----	----
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	----	----	----	----
Chloromethane	74-87-3	50	µg/L	<50	----	----	----	----
Vinyl chloride	75-01-4	50	µg/L	<50	----	----	----	----
Bromomethane	74-83-9	50	µg/L	<50	----	----	----	----
Chloroethane	75-00-3	50	µg/L	<50	----	----	----	----
Trichlorofluoromethane	75-69-4	50	µg/L	<50	----	----	----	----
1.1-Dichloroethene	75-35-4	5	µg/L	<5	----	----	----	----
Iodomethane	74-88-4	5	µg/L	<5	----	----	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	----	----	----	----
1.1-Dichloroethane	75-34-3	5	µg/L	<5	----	----	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	----	----	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	----	----	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	----	----	----	----
Carbon Tetrachloride	56-23-5	5	µg/L	<5	----	----	----	----
1.2-Dichloroethane	107-06-2	5	µg/L	<5	----	----	----	----
Trichloroethene	79-01-6	5	µg/L	<5	----	----	----	----
Dibromomethane	74-95-3	5	µg/L	<5	----	----	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	----	----	----	----
1.3-Dichloropropane	142-28-9	5	µg/L	<5	----	----	----	----
Tetrachloroethene	127-18-4	5	µg/L	<5	----	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: WKMB06A	----	----	----	----
				Client sampling date / time: 18-NOV-2014 14:00	----	----	----	----
				ES1425362-001	----	----	----	----
EP074E: Halogenated Aliphatic Compounds - Continued								
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L	<5	----	----	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L	<5	----	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L	<5	----	----	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L	<5	----	----	----	----
Pentachloroethane	76-01-7	5	µg/L	<5	----	----	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L	<5	----	----	----	----
Hexachlorobutadiene	87-68-3	5	µg/L	<5	----	----	----	----
EP074F: Halogenated Aromatic Compounds								
Chlorobenzene	108-90-7	5	µg/L	<5	----	----	----	----
Bromobenzene	108-86-1	5	µg/L	<5	----	----	----	----
2-Chlorotoluene	95-49-8	5	µg/L	<5	----	----	----	----
4-Chlorotoluene	106-43-4	5	µg/L	<5	----	----	----	----
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	----	----	----	----
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	----	----	----	----
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	----	----	----	----
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	----	----	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	----	----	----	----
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	<5	----	----	----	----
Bromodichloromethane	75-27-4	5	µg/L	<5	----	----	----	----
Dibromochloromethane	124-48-1	5	µg/L	<5	----	----	----	----
Bromoform	75-25-2	5	µg/L	<5	----	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: WKMB06A	----	----	----	----
				Client sampling date / time: 18-NOV-2014 14:00	----	----	----	----
				ES1425362-001	----	----	----	----
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	----	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	**3.4**	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	**5.4**	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	**4.6**	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	**7.5**	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	**20.9**	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	**170**	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	**100**	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	**270**	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	**160**	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06A	----	----	----	----
				Client sampling date / time	18-NOV-2014 14:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425362-001	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^ >C10 - C40 Fraction (sum)	----	100	µg/L		160	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		160	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP262: Ethanolamines									
Ethanolamine	141-43-5	1	µg/L		<1	----	----	----	----
Diethanolamine	111-42-2	1	µg/L		<1	----	----	----	----
Methyl diethanolamine (MDEA)	105-59-9	1	µg/L		<1	----	----	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		111	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		108	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		103	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		37.0	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		86.8	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		92.3	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		82.5	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%		98.7	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		103	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		114	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		101	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		107	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78.3	133.2
Toluene-D8	2037-26-5	79.1	128.9
4-Bromofluorobenzene	460-00-4	80.8	123.7
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1425544**	Page	: 1 of 10
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: S DAYKIN	Contact	: Loren Schiavon
Address	: PO Box 5394 SYDNEY NSW 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: sdaykin@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: ----	Telephone	: +61 2 8784 8503
Facsimile	: ----	Facsimile	: +61 2 8784 8500
Project	: 2268522A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 20-NOV-2014
Sampler	: ----	Issue Date	: 21-JAN-2015
Site	: ----		
		No. of samples received	: 1
Quote number	: SY/933/14	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Phalak Inthakesone	Laboratory Manager - Organics	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06B	----	----	----	----
				Client sampling date / time	19-NOV-2014 16:30	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425544-001	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**8.26**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**1290**	----	----	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		**767**	----	----	----	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		**124**	----	----	----	----
ED009: Anions									
Chloride	16887-00-6	0.100	mg/L		**233**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**262**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**262**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**57**	----	----	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**254**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**6**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**2**	----	----	----	----
Sodium	7440-23-5	1	mg/L		**282**	----	----	----	----
Potassium	7440-09-7	1	mg/L		**2**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.89**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L		**0.003**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.011**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.242**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.010**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06B	----	----	----	----
				Client sampling date / time	19-NOV-2014 16:30	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425544-001	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		**0.002**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.004**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.054**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.032**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.003**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L		**0.563**	----	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.003**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Boron	7440-42-8	0.05	mg/L		**0.05**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**2.97**	----	----	----	----
Bromine	7726-95-6	0.1	mg/L		**0.7**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**15.2**	----	----	----	----
EK010/011: Chlorine									
Chlorine - Free	----	0.2	mg/L		<0.2	----	----	----	----
Chlorine - Total Residual	----	0.2	mg/L		<0.2	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.6**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.37**	----	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	----	0.01	mg/L		**0.32**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	WKMB06B	----	----	----	----
			Client sampling date / time	19-NOV-2014 16:30	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1425544-001	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.1**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.1**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.63**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.56**	----	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**13.6**	----	----	----	----
Total Cations	----	0.01	meq/L	**12.8**	----	----	----	----
Ionic Balance	----	0.01	%	**3.09**	----	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	----	----	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	**10300**	----	----	----	----
Ethene	74-85-1	10	µg/L	<10	----	----	----	----
Ethane	74-84-0	10	µg/L	<10	----	----	----	----
Propene	115-07-1	10	µg/L	<10	----	----	----	----
Propane	74-98-6	10	µg/L	<10	----	----	----	----
Butene	25167-67-3	10	µg/L	<10	----	----	----	----
Butane	106-97-8	10	µg/L	<10	----	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons								
Styrene	100-42-5	5	µg/L	<5	----	----	----	----
Isopropylbenzene	98-82-8	5	µg/L	<5	----	----	----	----
n-Propylbenzene	103-65-1	5	µg/L	<5	----	----	----	----
1.3.5-Trimethylbenzene	108-67-8	5	µg/L	<5	----	----	----	----
sec-Butylbenzene	135-98-8	5	µg/L	<5	----	----	----	----
1.2.4-Trimethylbenzene	95-63-6	5	µg/L	<5	----	----	----	----
tert-Butylbenzene	98-06-6	5	µg/L	<5	----	----	----	----
p-Isopropyltoluene	99-87-6	5	µg/L	<5	----	----	----	----
n-Butylbenzene	104-51-8	5	µg/L	<5	----	----	----	----
EP074B: Oxygenated Compounds								
Vinyl Acetate	108-05-4	50	µg/L	<50	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: WKMB06B	----	----	----	----
				Client sampling date / time: 19-NOV-2014 16:30	----	----	----	----
				ES1425544-001	----	----	----	----
EP074B: Oxygenated Compounds - Continued								
2-Butanone (MEK)	78-93-3	50	µg/L	**240**	----	----	----	----
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	----	----	----	----
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	----	----	----	----
EP074C: Sulfonated Compounds								
Carbon disulfide	75-15-0	5	µg/L	<5	----	----	----	----
EP074D: Fumigants								
2.2-Dichloropropane	594-20-7	5	µg/L	<5	----	----	----	----
1.2-Dichloropropane	78-87-5	5	µg/L	<5	----	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L	<5	----	----	----	----
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L	<5	----	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L	<5	----	----	----	----
EP074E: Halogenated Aliphatic Compounds								
Dichlorodifluoromethane	75-71-8	50	µg/L	<50	----	----	----	----
Chloromethane	74-87-3	50	µg/L	<50	----	----	----	----
Vinyl chloride	75-01-4	50	µg/L	<50	----	----	----	----
Bromomethane	74-83-9	50	µg/L	<50	----	----	----	----
Chloroethane	75-00-3	50	µg/L	<50	----	----	----	----
Trichlorofluoromethane	75-69-4	50	µg/L	<50	----	----	----	----
1.1-Dichloroethene	75-35-4	5	µg/L	<5	----	----	----	----
Iodomethane	74-88-4	5	µg/L	<5	----	----	----	----
trans-1.2-Dichloroethene	156-60-5	5	µg/L	<5	----	----	----	----
1.1-Dichloroethane	75-34-3	5	µg/L	<5	----	----	----	----
cis-1.2-Dichloroethene	156-59-2	5	µg/L	<5	----	----	----	----
1.1.1-Trichloroethane	71-55-6	5	µg/L	<5	----	----	----	----
1.1-Dichloropropylene	563-58-6	5	µg/L	<5	----	----	----	----
Carbon Tetrachloride	56-23-5	5	µg/L	<5	----	----	----	----
1.2-Dichloroethane	107-06-2	5	µg/L	<5	----	----	----	----
Trichloroethene	79-01-6	5	µg/L	<5	----	----	----	----
Dibromomethane	74-95-3	5	µg/L	<5	----	----	----	----
1.1.2-Trichloroethane	79-00-5	5	µg/L	<5	----	----	----	----
1.3-Dichloropropane	142-28-9	5	µg/L	<5	----	----	----	----
Tetrachloroethene	127-18-4	5	µg/L	<5	----	----	----	----
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L	<5	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06B	----	----	----	----
				Client sampling date / time	19-NOV-2014 16:30	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425544-001	----	----	----	----
EP074E: Halogenated Aliphatic Compounds - Continued									
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	----	----	----	----
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	----	----	----	----
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	----	----	----	----
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	----	----	----	----
Pentachloroethane	76-01-7	5	µg/L		<5	----	----	----	----
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	----	----	----	----
Hexachlorobutadiene	87-68-3	5	µg/L		<5	----	----	----	----
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	----	----	----	----
Bromobenzene	108-86-1	5	µg/L		<5	----	----	----	----
2-Chlorotoluene	95-49-8	5	µg/L		<5	----	----	----	----
4-Chlorotoluene	106-43-4	5	µg/L		<5	----	----	----	----
1.3-Dichlorobenzene	541-73-1	5	µg/L		<5	----	----	----	----
1.4-Dichlorobenzene	106-46-7	5	µg/L		<5	----	----	----	----
1.2-Dichlorobenzene	95-50-1	5	µg/L		<5	----	----	----	----
1.2.4-Trichlorobenzene	120-82-1	5	µg/L		<5	----	----	----	----
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	----	----	----	----
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	----	----	----	----
Bromodichloromethane	75-27-4	5	µg/L		<5	----	----	----	----
Dibromochloromethane	124-48-1	5	µg/L		<5	----	----	----	----
Bromoform	75-25-2	5	µg/L		<5	----	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: WKMB06B	----	----	----	----
				Client sampling date / time: 19-NOV-2014 16:30	----	----	----	----
				ES1425544-001	----	----	----	----
EP075(SIM)A: Phenolic Compounds - Continued								
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	----	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**40**	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	**40**	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	WKMB06B	----	----	----	----
				Client sampling date / time	19-NOV-2014 16:30	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1425544-001	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		**27**	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L		**27**	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP262: Ethanolamines									
Ethanolamine	141-43-5	1	µg/L		<1	----	----	----	----
Diethanolamine	111-42-2	1	µg/L		**7**	----	----	----	----
Methyl diethanolamine (MDEA)	105-59-9	1	µg/L		<1	----	----	----	----
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**112**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		**118**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**104**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**24.8**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**45.9**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**52.9**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**76.7**	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%		**93.4**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**80.9**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**118**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		**112**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**102**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP074S: VOC Surrogates			
1.2-Dichloroethane-D4	17060-07-0	78.3	133.2
Toluene-D8	2037-26-5	79.1	128.9
4-Bromofluorobenzene	460-00-4	80.8	123.7
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
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CERTIFICATE OF ANALYSIS 119760

Client:

Parsons Brinckerhoff Aust. Pty Ltd
GPO Box 5394
Sydney
NSW 2001

Attention: Sean Daykin

Sample log in details:

Your Reference:	**2268523A**		
No. of samples:	2 WATERS		
Date samples received / completed instructions received	21/11/14	/	19/12/14

This report supersedes the previous report R00 due to the removal of results (ELS #1-13, 16-25).

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	31/12/14	/	14/05/15
Date of Preliminary Report:	Not Issued		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Miscellaneous Inorganics			
Our Reference:	UNITS	119760-14	119760-15
Your Reference	----------	WKMB06a	WKMB06b
Date Sampled	----------	18/11/2014	19/11/2014
Type of sample		Water	Water
Date prepared	-	24/12/2014	24/12/2014
Date analysed	-	24/12/2014	24/12/2014
THPS in Water by uHPLC*	µg/L	<50	<50
Sulphate, SO4	mg/L	36	29

Metals in Waters - Acid extractable			
Our Reference:	UNITS	119760-14	119760-15
Your Reference	----------	WKMB06a	WKMB06b
Date Sampled	----------	18/11/2014	19/11/2014
Type of sample		Water	Water
Date prepared	-	24/12/2014	24/12/2014
Date analysed	-	24/12/2014	24/12/2014
Phosphorus - Total	mg/L	0.08	0.6

Method ID	Methodology Summary
AT-021	Determination of Bis[Tetrakis(Hydroxymethyl)Phosphonium Sulfate (THPS) in waters by conversion to formaldehyde, derivatisation and analysis using ultra high performance liquid chromatography-diode array detection.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			24/12/2014	[NT]	[NT]	LCS-1	24/12/2014
Date analysed	-			24/12/2014	[NT]	[NT]	LCS-1	24/12/2014
THPS in Water by uHPLC*	µg/L	50	AT-021	<50	[NT]	[NT]	LCS-1	100%
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	LCS-1	115%

QUALITY CONTROL Metals in Waters - Acid extractable	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			24/12/2014	[NT]	[NT]	LCS-W2	24/12/2014
Date analysed	-			24/12/2014	[NT]	[NT]	LCS-W2	24/12/2014
Phosphorus - Total	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	LCS-W2	100%

QUALITY CONTROL Miscellaneous Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	LCS-W1	24/12/2014
Date analysed	-	[NT]	[NT]	LCS-W1	24/12/2014
THPS in Water by uHPLC*	µg/L	[NT]	[NT]	LCS-W1	101%
Sulphate, SO4	mg/L	[NT]	[NT]	LCS-W1	93%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Appendix H

Isotope results

STABLE ISOTOPE RESULTS

National Isotope Centre
30 Gracefield Road
Lower Hutt 5010
PO Box 31 312
Lower Hutt 5040
New Zealand
T +64-4-570 1444
F +64-4-570 4657
www.gns.cri.nz

Parsons Brinckerhoff
Level 27, 680 George St
World Square, Sydney
NSW 2001
Australia

Project Title	2268522A	**Invoice**	**Parsons Brinckerhoff**
SIL Order No.:		**Attn:**	**Sean Daykin**
Client Ref.:			**Level 27, 680 George St**
Date Received:	1/12/2014		**World Square, Sydney**
Date Measured:			**NSW 2001**
Approved By:			**Australia**
Date Reported:	11/12/2014		

Sample Type: **water (H & O)**

SIL ID	External ID	δD Value	δ18O Value	Analysis Type	Overseas or NZ	State or Province	Country Code	Collection Date/Time (Start)	Other Info
W-1401822	WKMB06A	-26.4	-4.77	D, O18	OS	New South Wales	AS	18/11/2014 14:05	Groundwater
W-1401823	WKMB06B	-26.4	-4.89	D, O18	OS	New South Wales	AS	19/11/2014 16:40	Groundwater

Data of 17 February 2015

Sample	Run date	87Sr/86Sr	2SE (in-run error)	85Rb/86Sr	2SE (in-run error)
WKMB-06A	17-Feb-15	0.073530	0.000011	-3.33E-06	4.58E-06
WKMB-06B	17-Feb-15	0.706612	0.000010	3.53E-04	1.96E-05

Rafter Radiocarbon

Accelerator Mass Spectrometry Results

Date reported	Client name	TW	Date analysed	Sample ID	Description	Fraction dated	Rafter ID	NZA	CRA	CRA error	$\delta^{13}C$	$\delta^{13}C$ error	$\delta^{13}C$ Source	F	F error	Lab Number	Pretreatment	$\Delta^{14}C$	$\Delta^{14}C$ error	Collection Date	pMC	pMC error	$\delta^{14}C$	$\delta^{14}C$ error	D14C	D14C Error
									[yBP]	[ ]	[‰]	error	Source	[ ]	[ ]		Description	[‰]	[ ]	Date	[‰]	[ ]	[‰]	[ ]		
02/02/2015	Carolina Sardella Parsons Brinckerhoff	2986	26/01/2015	WKMB06A	2268523A	Groundwater	40669/1	58369	831	20	-9.94	0.2	IRMS	0.9017	0.0023		Sample was submitted in: a clear nalgene bottle, tightly capped with no head space. Sample was colourless and odourless with a small amount of orange precipitate at the bottom. CO2 was generated by phosphoric acid evolution, and carbonate content was 87mgC/kgH2O, total dissolved inorganic carbon (TDIC) 7.2mmol/kgH2O. Sample carbon dioxide was converted to graphite by reduction with hydrogen over iron catalyst	-105.3	2.26	18/11/2014	89.47	0.23	-94.26	2.29	-98.26	2.28
02/02/2015	Carolina Sardella Parsons Brinckerhoff	2986	26/01/2015	WKMB06B	2268523A	Groundwater	40669/2	58370	9578	63	-15.5	0.2	IRMS	0.3035	0.0024		Sample was submitted in: a clear nalgene bottle, tightly capped with no head space. Sample was colourless and odourless with a small amount of grey precipitate at the bottom. CO2 was generated by phosphoric acid evolution, and carbonate content was 62.5mgC/kgH2O, total dissolved inorganic carbon (TDIC) 5.2mmol/kgH2O. Sample carbon dioxide was converted to graphite by reduction with hydrogen over iron catalyst	-698.8	2.36	19/11/2014	30.12	0.24	-695.1	2.39	-696.5	2.38

Conventional Radiocarbon Age and $\Delta^{14}C$ are reported as defined by Stuiver and Polach, (*Radiocarbon 19*:355-363, 1977). $\Delta^{14}C$ is reported only if collection date was supplied and is decay corrected to that date.
Fraction modern (F) is the blank corrected fraction modern normalized to $\delta^{13}C$ of -25‰, defined by Donahue et al. (*Radiocarbon, 32* (2):135-142, 1990).
$\delta^{13}C$ normalization is always performed using δ13C measured by AMS, thus accounting for AMS fractionation. Although not used in the ^{14}C age calculations, the environmental δ13C measured offline by IRMS is reported if sufficient material was available. The reported errors comprise statistical errors in sample and standard determinations, combined in quadrature with a system error based on the analysis of an ongoing series of measurements on an oxalic acid standard. Further analysis details of pretreatment and analysis are available on request.

National Isotope Centre, GNS Science
PO Box 31-312 Lower Hutt, New Zealand Fax +64 4 570 4657 Phone +64 4 570 4644
Email radiocarbon@gns.cri.nz Website www.RafterRadiocarbon.co.nz

CD4 120214 120514 **University of California, Davis | Stable Isotope Facility**

Sample	δ^2H_{VSMOW}	ppmv	Comments
WKMB06A	-57.0	4.8	Below LOQ (< 5ppm)
WKMB06B	-209.6	4983.3	

concentration based on 5-ml headspace in 12-ml Exetainer

CHECK STD (10 ppm tank)	MEASURED	KNOWN
UCDM4	-159.9	-158.0
UCDM4	-155.9	-158.0
UCDM4	-159.1	-158.0
UCDM4	-158.9	-158.0
UCDM4	-159.3	-158.0
UCDM4	-157.7	-158.0
UCDM4	-158.0	-158.0
UCDM4	-158.7	-158.0
avg	-158.4	
sd	1.2	

CALIBRATION STDS	MEASURED	KNOWN
NG1	-185.5	-185.1
NG1	-186.4	-185.1
NG2	-236.1	-237.0
NG2	-237.4	-237.0
NG3	-165.9	-167.6
NG3	-168.0	-167.6

2nd CHECK STDS	MEASURED	KNOWN
Beecher	-222.5	-223.2
Beecher	-223.0	-223.2
043332T	-159.1	-160.3
043332T	-161.0	-160.3
AH024079	-173.8	-173.3
AH024079	-174.5	-173.3

CH4 120214 010614 **University of California, Davis | Stable Isotope Facility**

Sample	$\delta^{13}C_{VPDB}$	Comments
WKMB06A	-57.21	
WKMB06B	-75.13	

CHECK STD (10 ppm)	MEASURED	KNOWN
UCDM4	-37.32	-37.3
UCDM4	-37.47	-37.3
UCDM4	-37.54	-37.3
UCDM4	-37.27	-37.3
UCDM4	-37.37	-37.3
UCDM4	-37.47	-37.3
avg	-37.41	
sd	0.10	

CALIBRATION STDS	MEASURED	KNOWN
NG1	-34.25	-34.18
NG2	-68.44	-68.89
NG3	-43.57	-43.61
Beecher	-61.13	-60.81
043332T	-39.87	-39.82
AH024079	-49.60	-49.31

2nd check stds	MEASURED	KNOWN
Scotty	-42.70	-42.8
H iso	-23.67	-23.9
B iso	-54.31	-54.5
T iso	-38.11	-38.3

DIC 120214 012115 **University of California, Davis | Stable Isotope Facility**

Sample	$\delta^{13}C_{VPDB}$	µg C/mL	Comments
			CHECK STD
			0.2 ml 10mM Li2CO3 (Acros2)
			MEASURED KNOWN
Project: 2268522A			-3.51 -3.65
WKMB06A	-11.66	103.1	-3.62
WKMB06B	-10.56	58.2	-3.57 MEAN
			-3.62 -3.58
			SD
			0.05

		CALIBRATION STDS	
		MEASURED	KNOWN
		-46.51	-46.6 LSVEC
		0.67	0.7 SEA WATER
		Secondary check stds	
		-2.05	-2.2 NAU-1
		-26.73	-26.7 NAU-2
		-13.48	-13.4 Acros-1

Appendix I

Geophysical logging

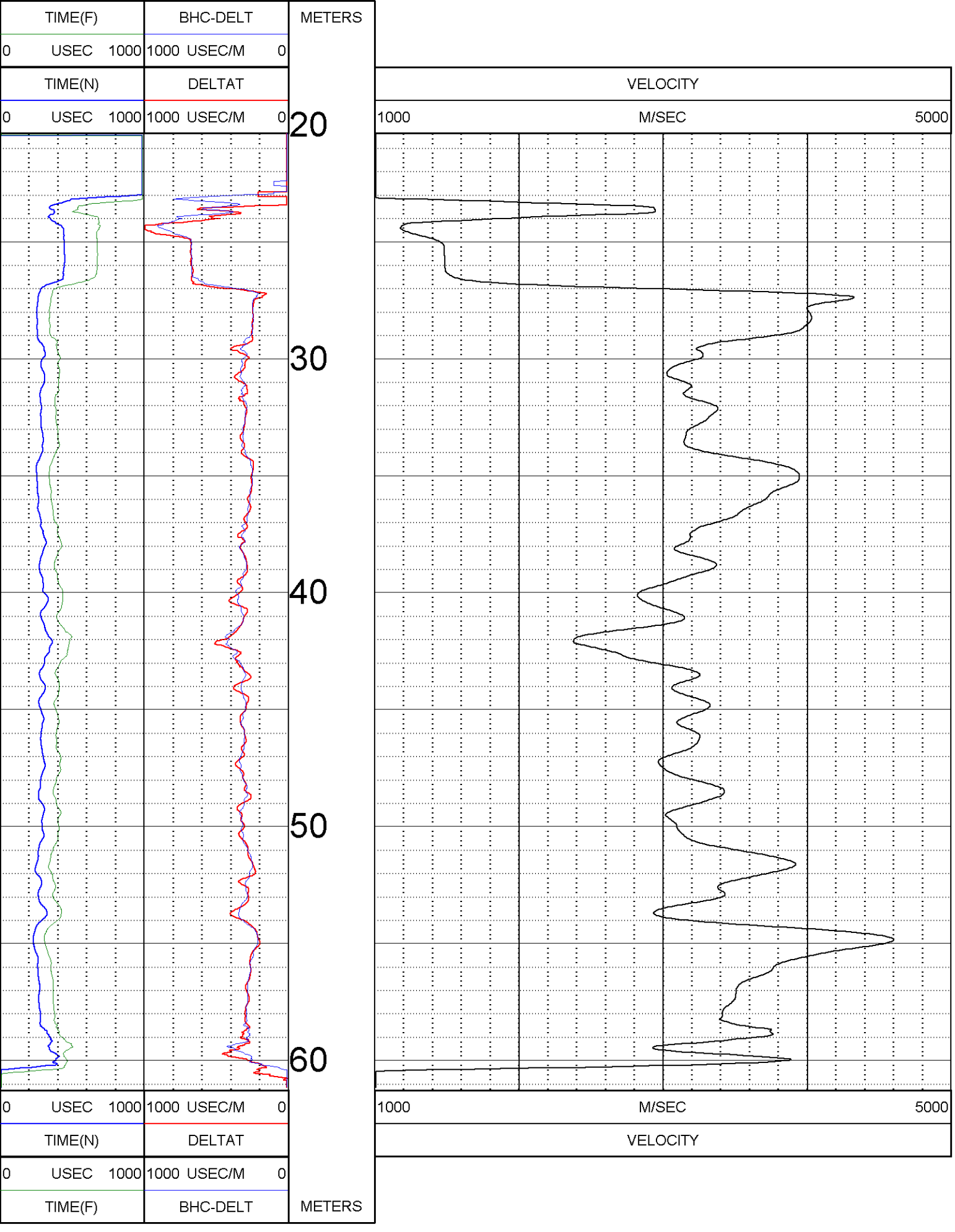
GROUNDSEARCH AUSTRALIA

(ABN 11 057 389 152)

WKMB06B VELOCITY 1:200

COMPANY	:	PARSONS BRINCKERHOFF					
WELL	:	WKMB06B VELOCITY 1:200					
LOCATION/FIELD	:						
COUNTY	:	AUST					
LOCATION	:	WKMB06B					
SECTION	:	NA	TOWNSHIP	:	NA	RANGE	: NA
DATE	:	11/12/14	PERMANENT DATUM	:	-1.20		
DEPTH DRILLER	:	64				KB	: NA
LOG BOTTOM	:	61.23	LOG MEASURED FROM:		GL	DF	: NA
LOG TOP	:	20.35	DRL MEASURED FROM:		GL	GL	: 0
CASING DIAMETER	:	10.	LOGGING UNIT	:	120		
CASING TYPE	:	PVC	FIELD OFFICE	:	RUTHERFORD		
CASING THICKNESS:		.5	RECORDED BY	:	A DAVIS		
BIT SIZE	:	14	BOREHOLE FLUID	:	0	FILE	: PROCESSED
MAGNETIC DECL.	:	0	RM	:	0	TYPE	: 9321A2
MATRIX DENSITY	:	2.65	RM TEMPERATURE	:	0	LGDATE	: 11/12/14
NEUTRON MATRIX	:	SANDSTONE	MATRIX DELTA T	:	177		
						THRESH	: 99999

OTHER SERVICES:
DEN NEU
SON TV
TEMP


TIME(F)
BHC-DELT
METERS
0 USEC 1000
1000 USEC/M 0
TIME(N)
DELTAT
0 USEC 1000
1000 USEC/M 0
VELOCITY
1000 M/SEC 5000
20
30
40
50
60
0 USEC 1000
1000 USEC/M 0
TIME(N)
DELTAT
0 USEC 1000
1000 USEC/M 0
TIME(F)
BHC-DELT
METERS
1000 M/SEC 5000
VELOCITY

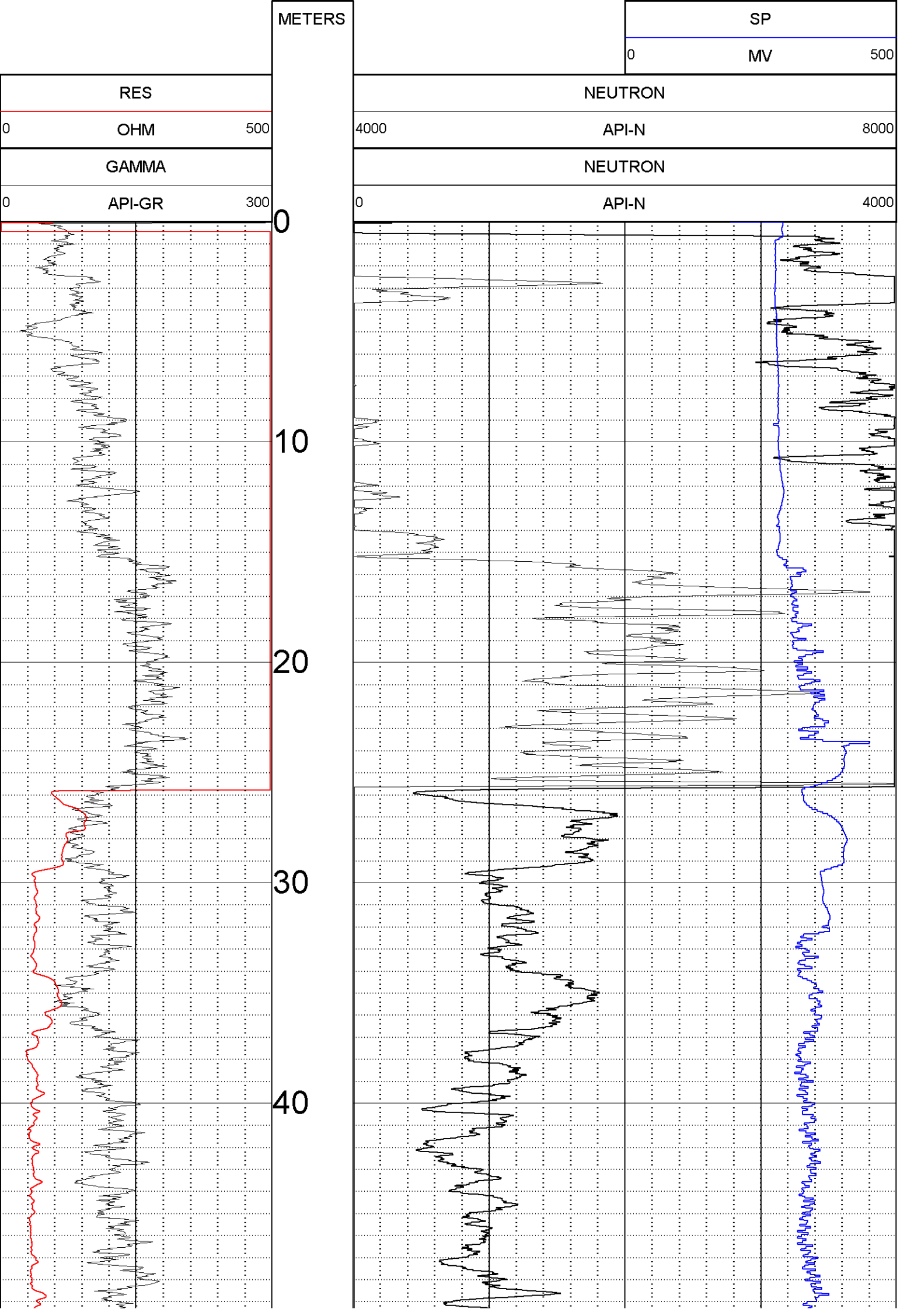
GROUNDSEARCH AUSTRALIA

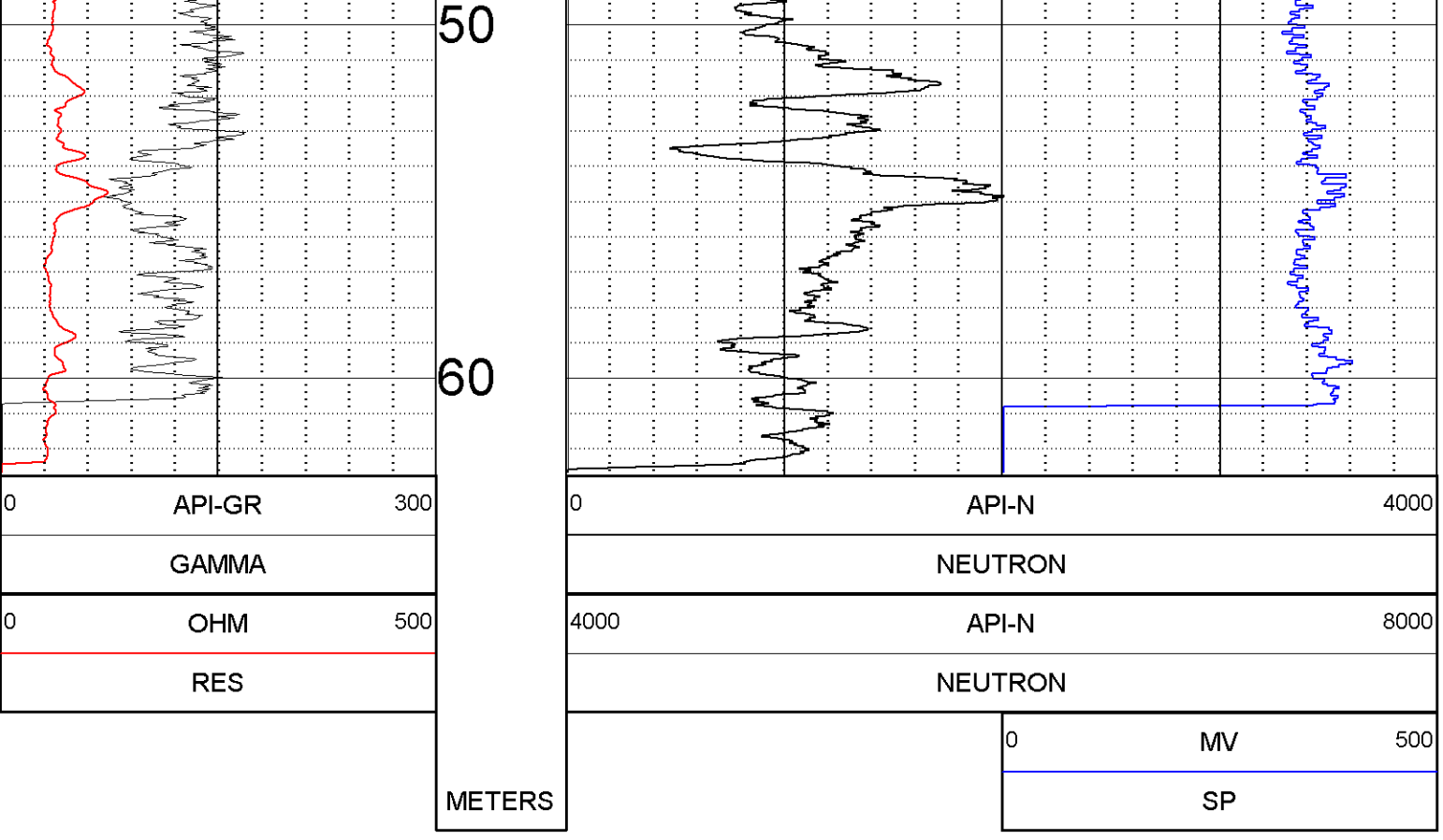
(ABN 11 057 389 152)

WKMB06B NEUTRON 1:200

COMPANY	:	PARSONS BRINCKERHOFF					
WELL	:	WKMB06B NEUTRON 1:200					
LOCATION/FIELD	:						
COUNTY	:	AUST					
LOCATION	:	WKMB06B					
SECTION	:	NA	TOWNSHIP	:	NA	RANGE	: NA
DATE	:	11/12/14	PERMANENT DATUM	:	-1.20		
DEPTH DRILLER	:	64				KB	: NA
LOG BOTTOM	:	62.73	LOG MEASURED FROM:		GL	DF	: NA
LOG TOP	:	0.00	DRL MEASURED FROM:		GL	GL	: 0
CASING DIAMETER	:	10.	LOGGING UNIT	:	120		
CASING TYPE	:	PVC	FIELD OFFICE	:	RUTHERFORD		
CASING THICKNESS:		.5	RECORDED BY	:	A DAVIS		
BIT SIZE	:	14	BOREHOLE FLUID	:	0	FILE	: PROCESSED
MAGNETIC DECL.	:	0	RM	:	0	TYPE	: 9057A
MATRIX DENSITY	:	2.65	RM TEMPERATURE	:	0	LGDATE	: 11/12/14
NEUTRON MATRIX	:	SANDSTONE	MATRIX DELTA T	:	177		
						THRESH	: 99999

OTHER SERVICES:
DEN NEU
SON TV
TEMP


METERS
SP
0
MV
500
RES
0
OHM
500
NEUTRON
4000
API-N
8000
GAMMA
0
API-GR
300
NEUTRON
0
API-N
4000
0
10
20
30
40


50
60
0
API-GR
300
GAMMA
0
OHM
500
RES
METERS
0
API-N
4000
NEUTRON
4000
API-N
8000
NEUTRON
0
MV
500
SP

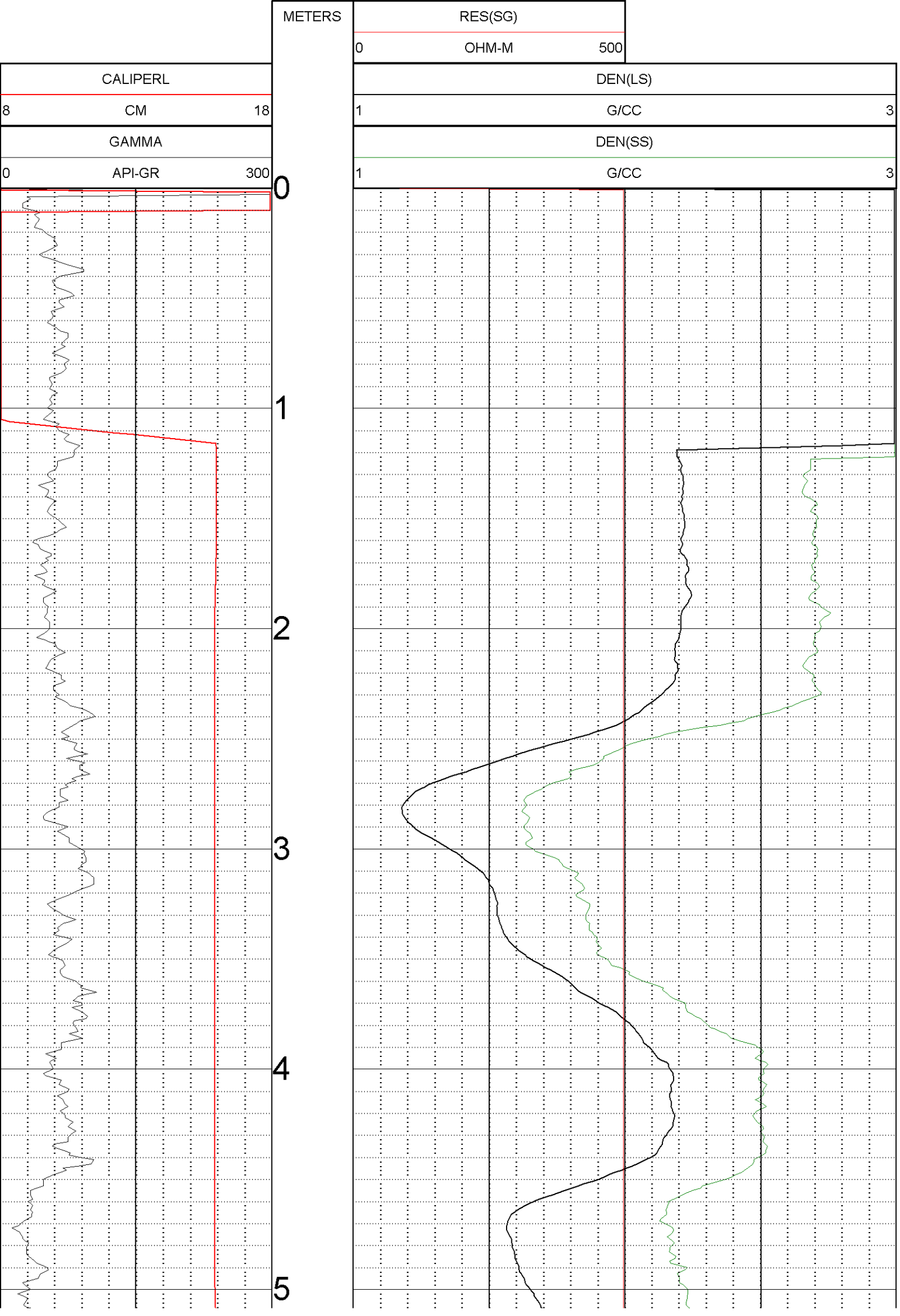
GROUNDSEARCH AUSTRALIA

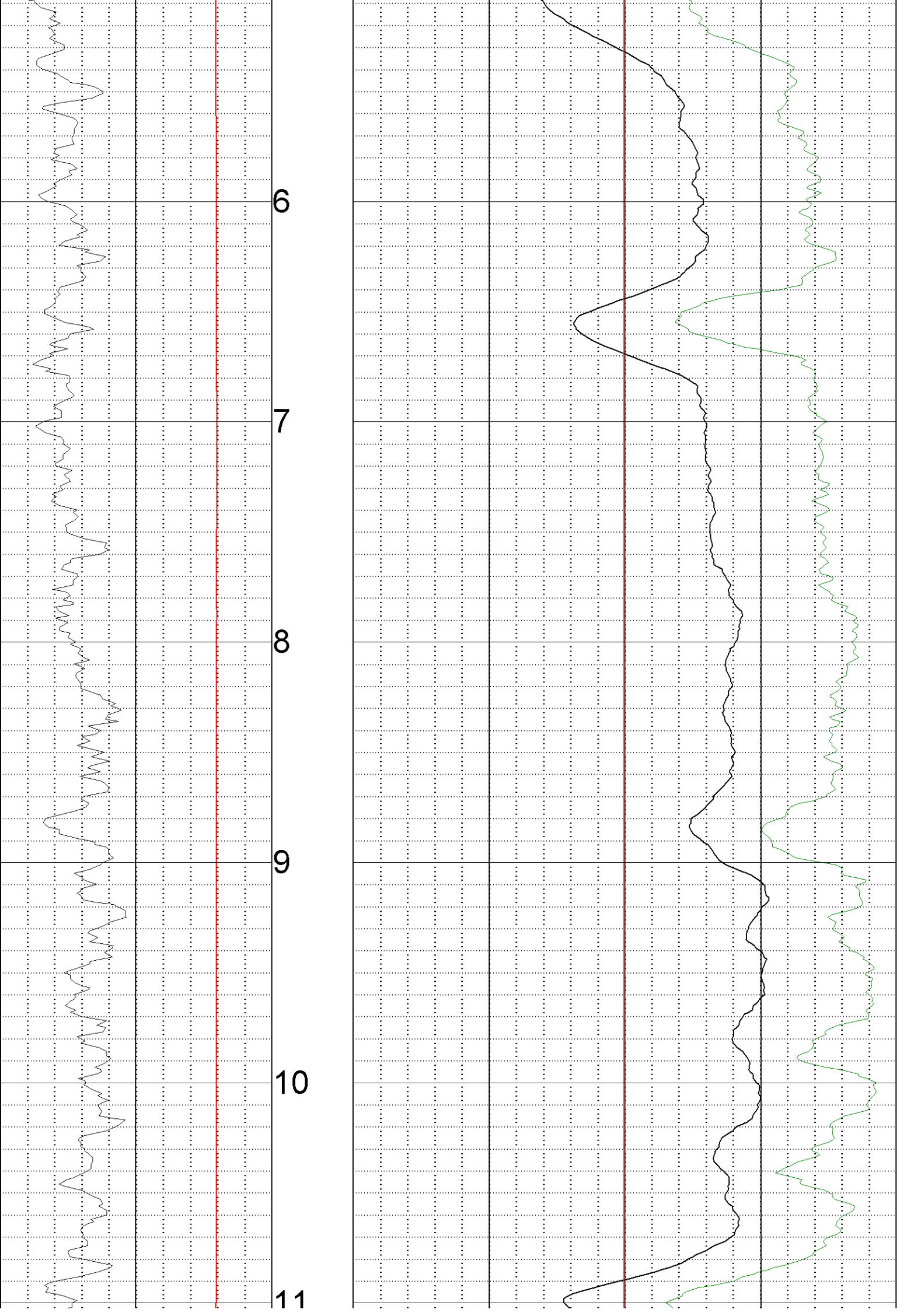
(ABN 11 057 389 152)

WKMB06B DENSITY 1:20

COMPANY	: PARSONS BRINCKERHOFF				
WELL	: WKMB06B DENSITY 1:20				
LOCATION/FIELD	:				
COUNTY	: AUST				
LOCATION	: WKMB06B				
SECTION	: NA	TOWNSHIP	: NA	RANGE	: NA
DATE	: 11/12/14	PERMANENT DATUM	: -1.20		
DEPTH DRILLER	: 64			KB	: NA
LOG BOTTOM	: 63.11	LOG MEASURED FROM:	GL	DF	: NA
LOG TOP	: 0.00	DRL MEASURED FROM:	GL	GL	: 0
CASING DIAMETER	: 10.	LOGGING UNIT	: 120		
CASING TYPE	: PVC	FIELD OFFICE	: RUTHERFORD		
CASING THICKNESS:	.5	RECORDED BY	: A DAVIS		
BIT SIZE	: 14.00	BOREHOLE FLUID	: 0	FILE	: PROCESSED
MAGNETIC DECL.	: 0	RM	: 0	TYPE	: 9239B1
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0	LGDATE:	11/12/14
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 177		
				THRESH:	99999

OTHER SERVICES:
DEN NEU
SON TV
TEMP


METERS
RES(SG)
0
OHM-M
500
CALIPERL
8
CM
18
DEN(LS)
1
G/CC
3
GAMMA
0
API-GR
300
DEN(SS)
1
G/CC
3
0
1
2
3
4
5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10
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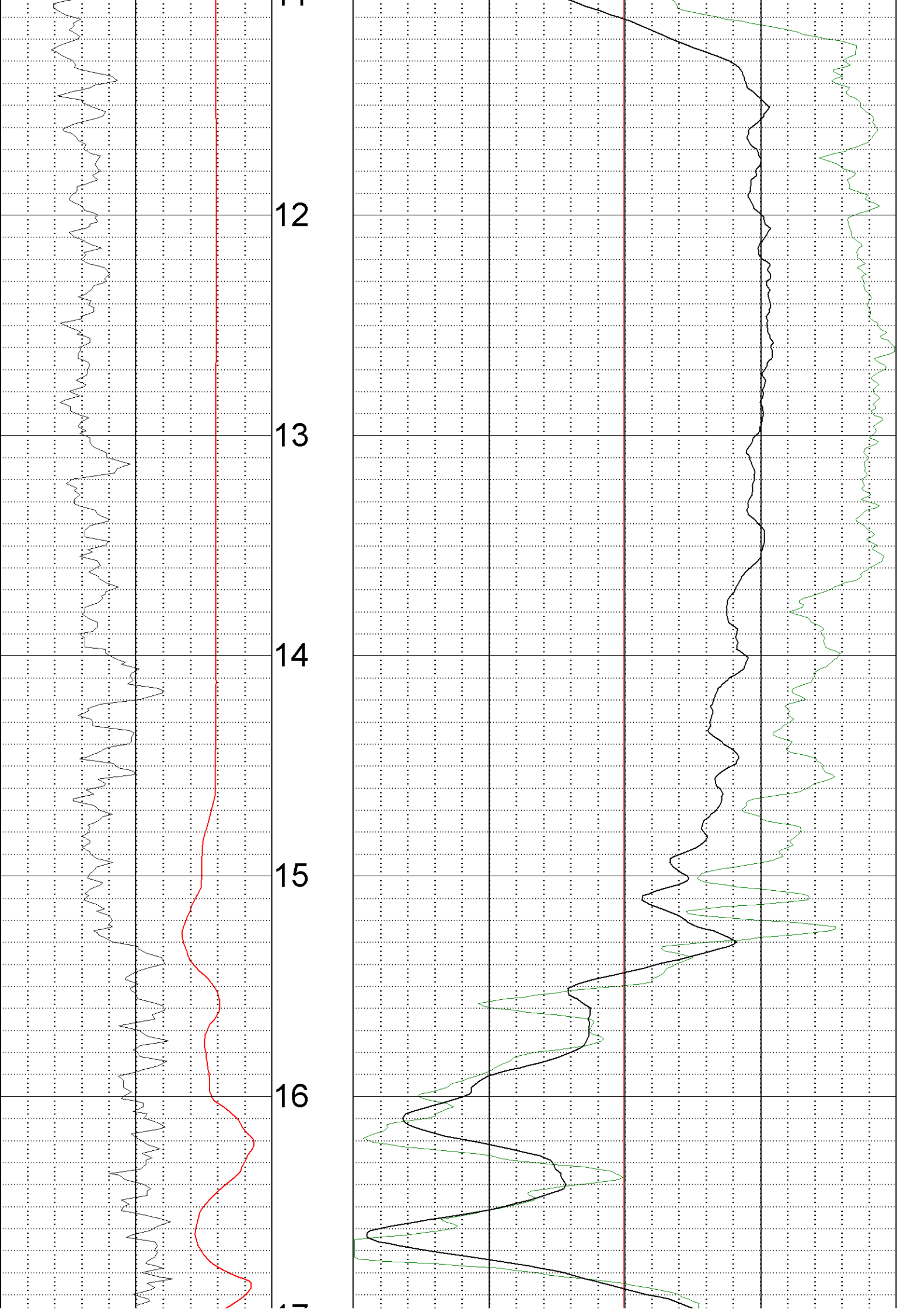
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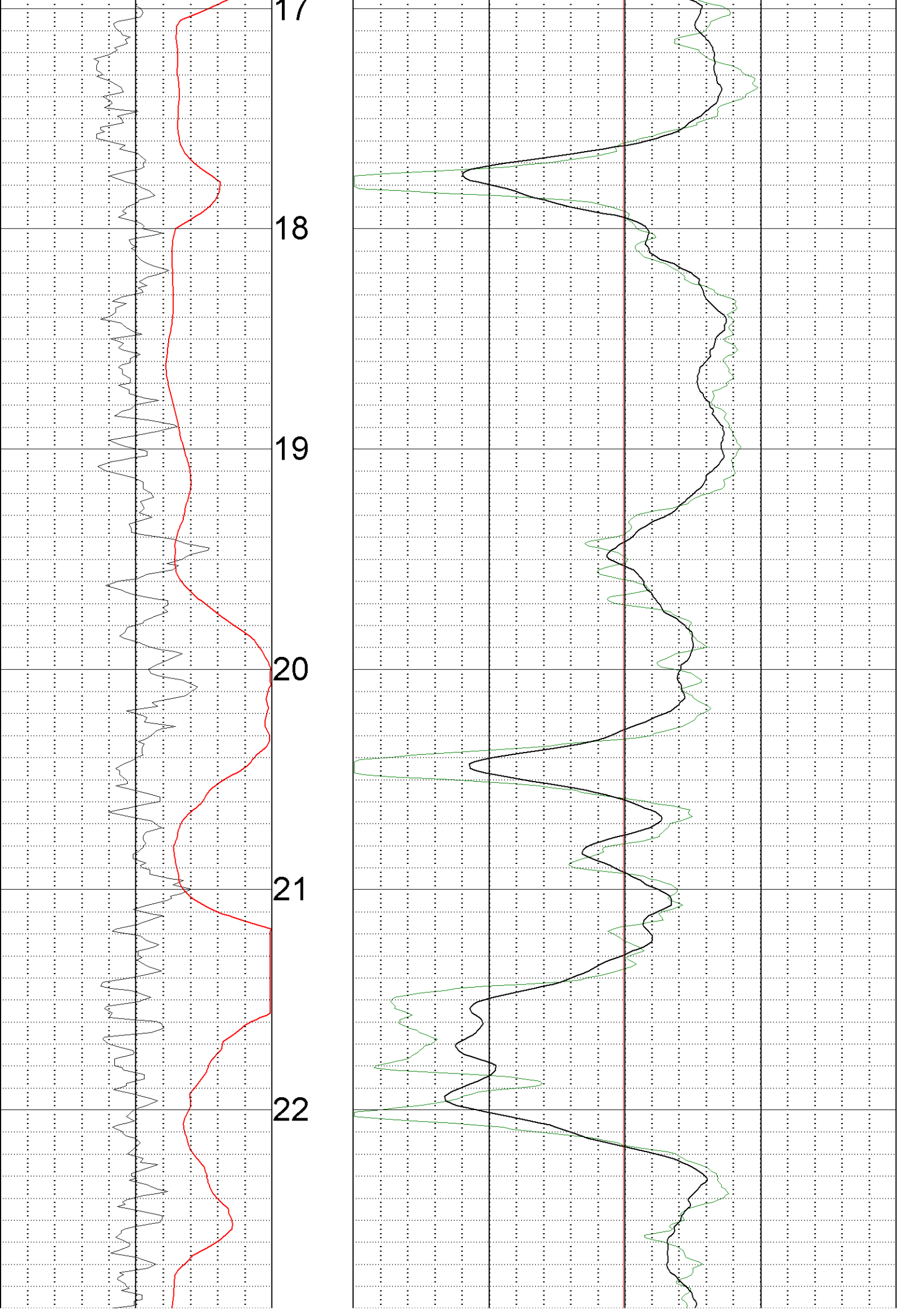
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19
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21
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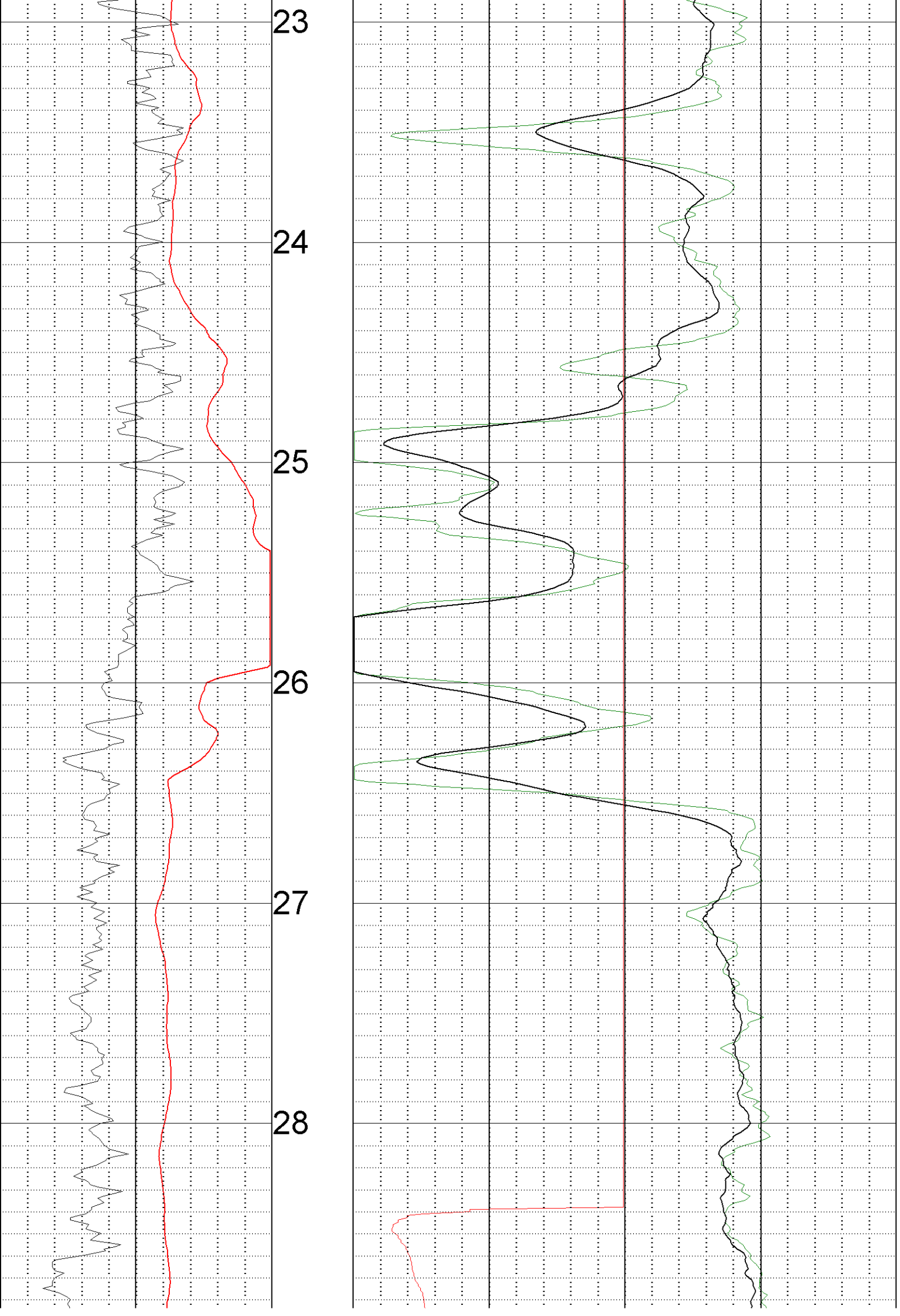
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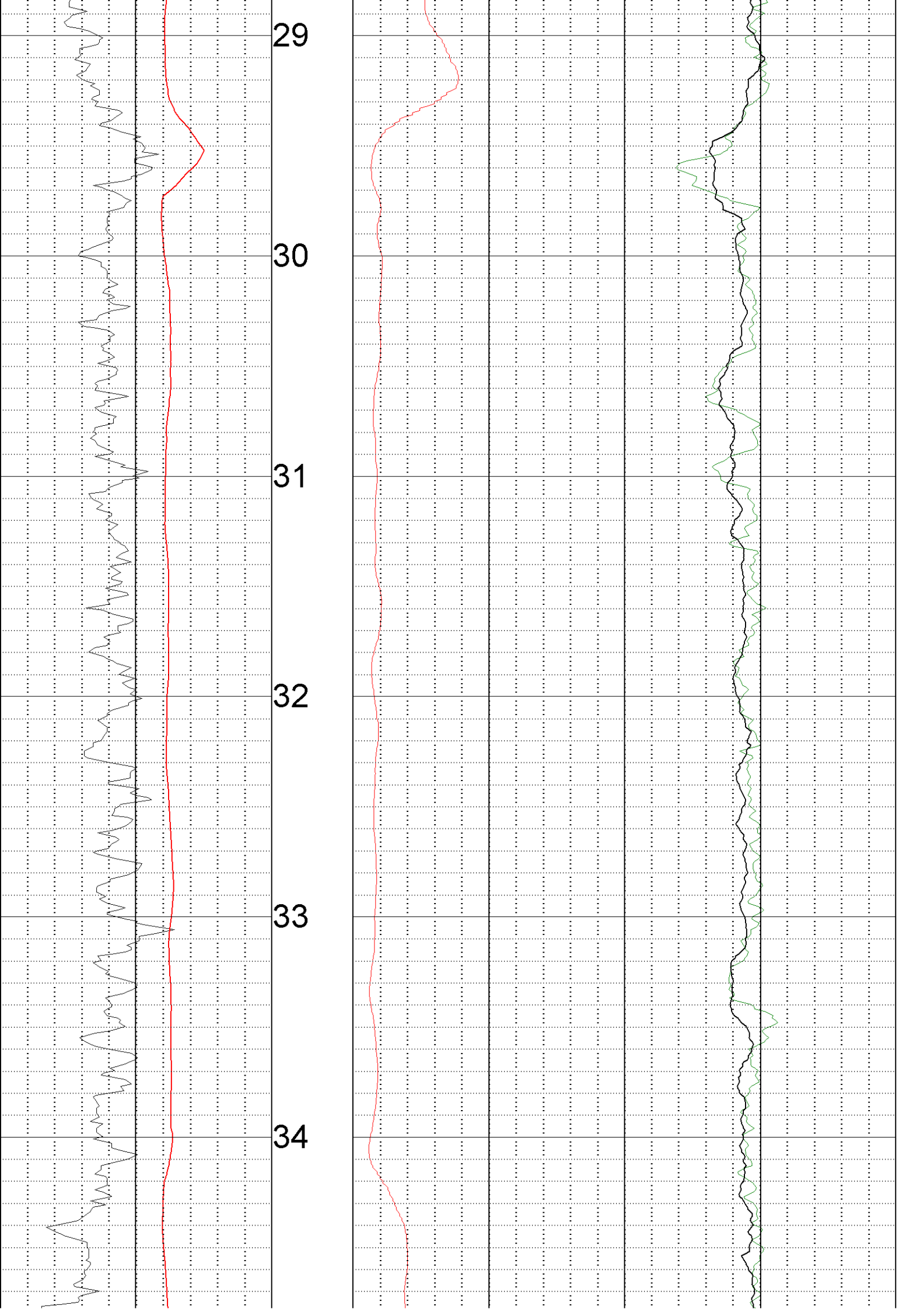
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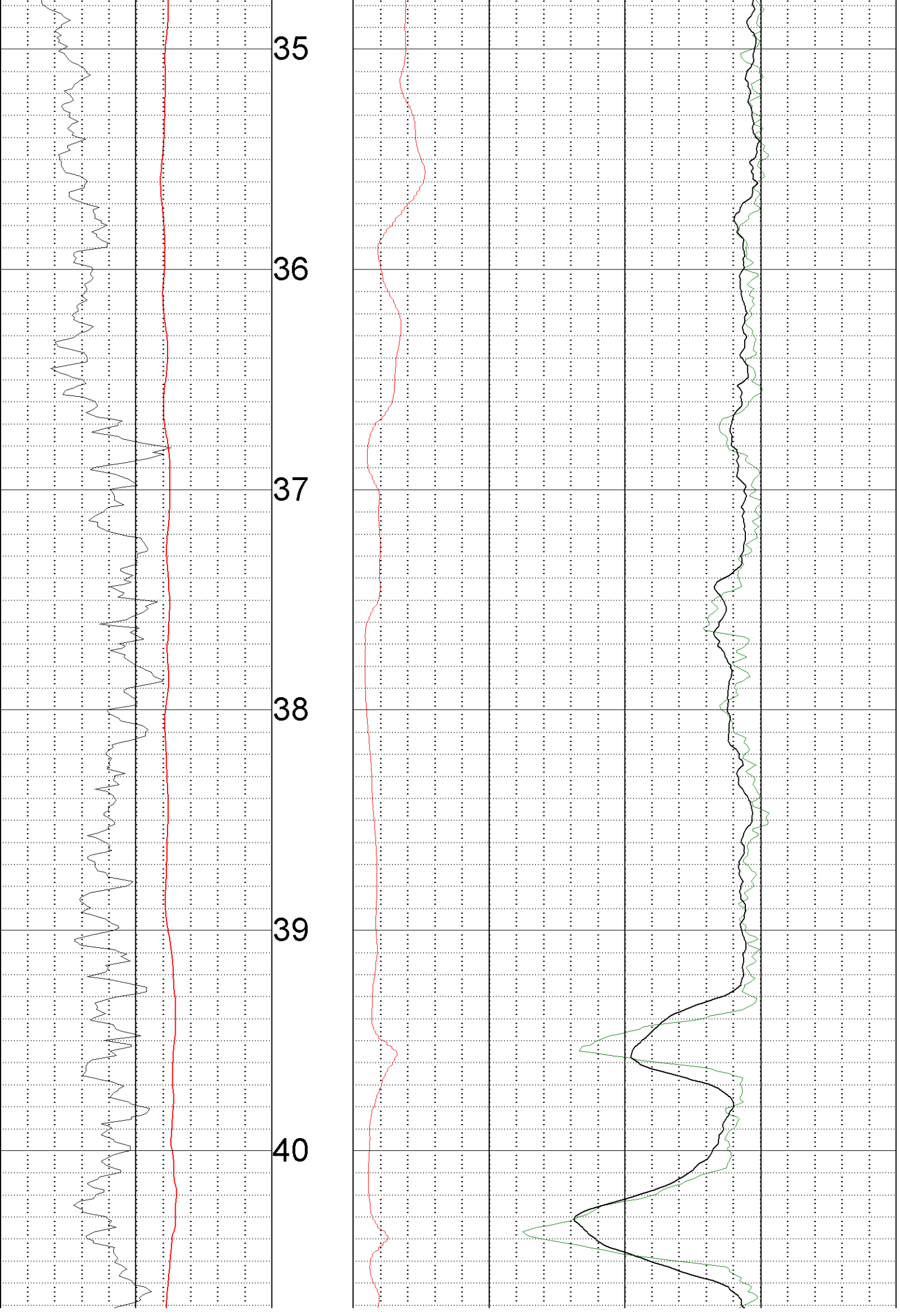
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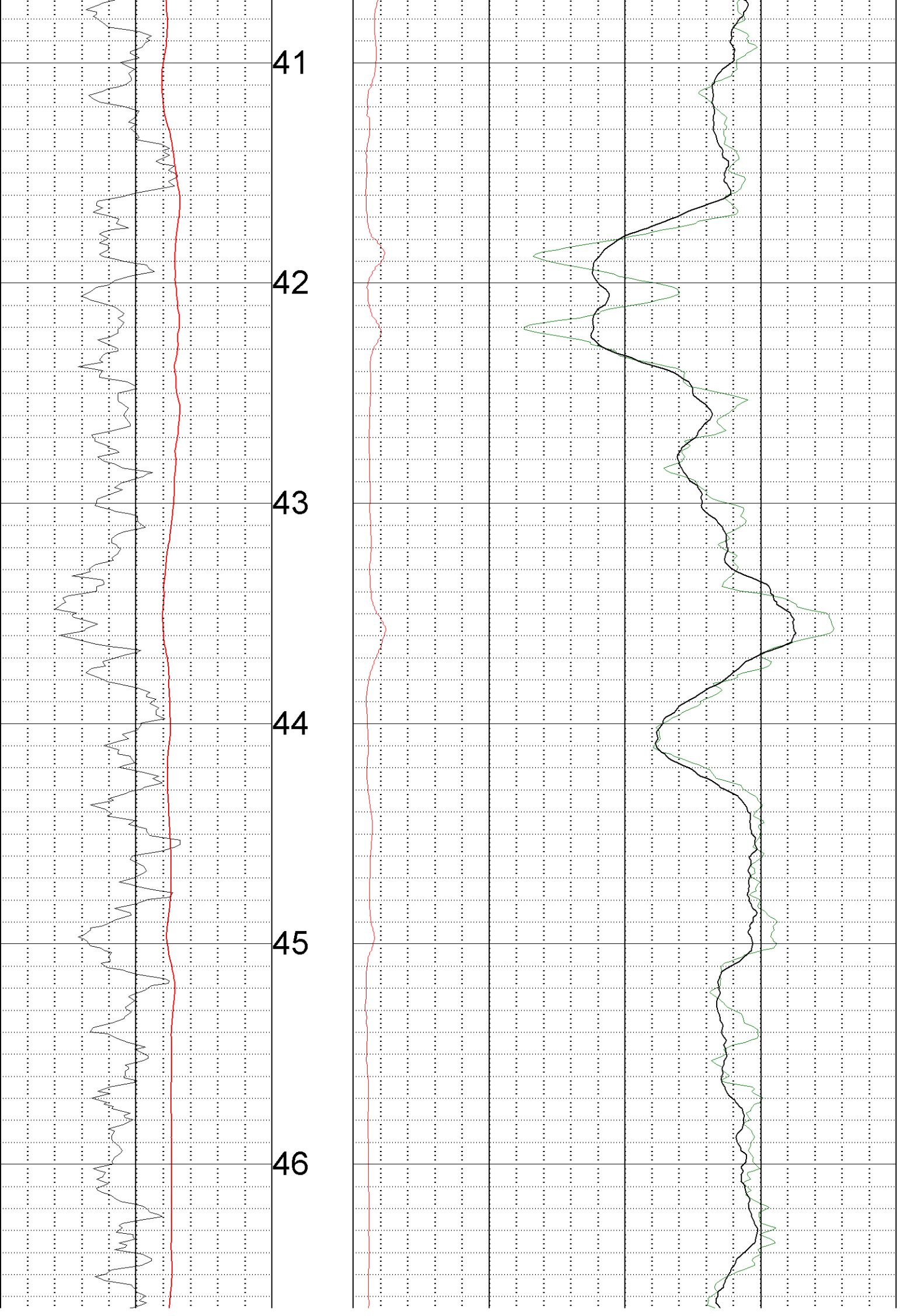
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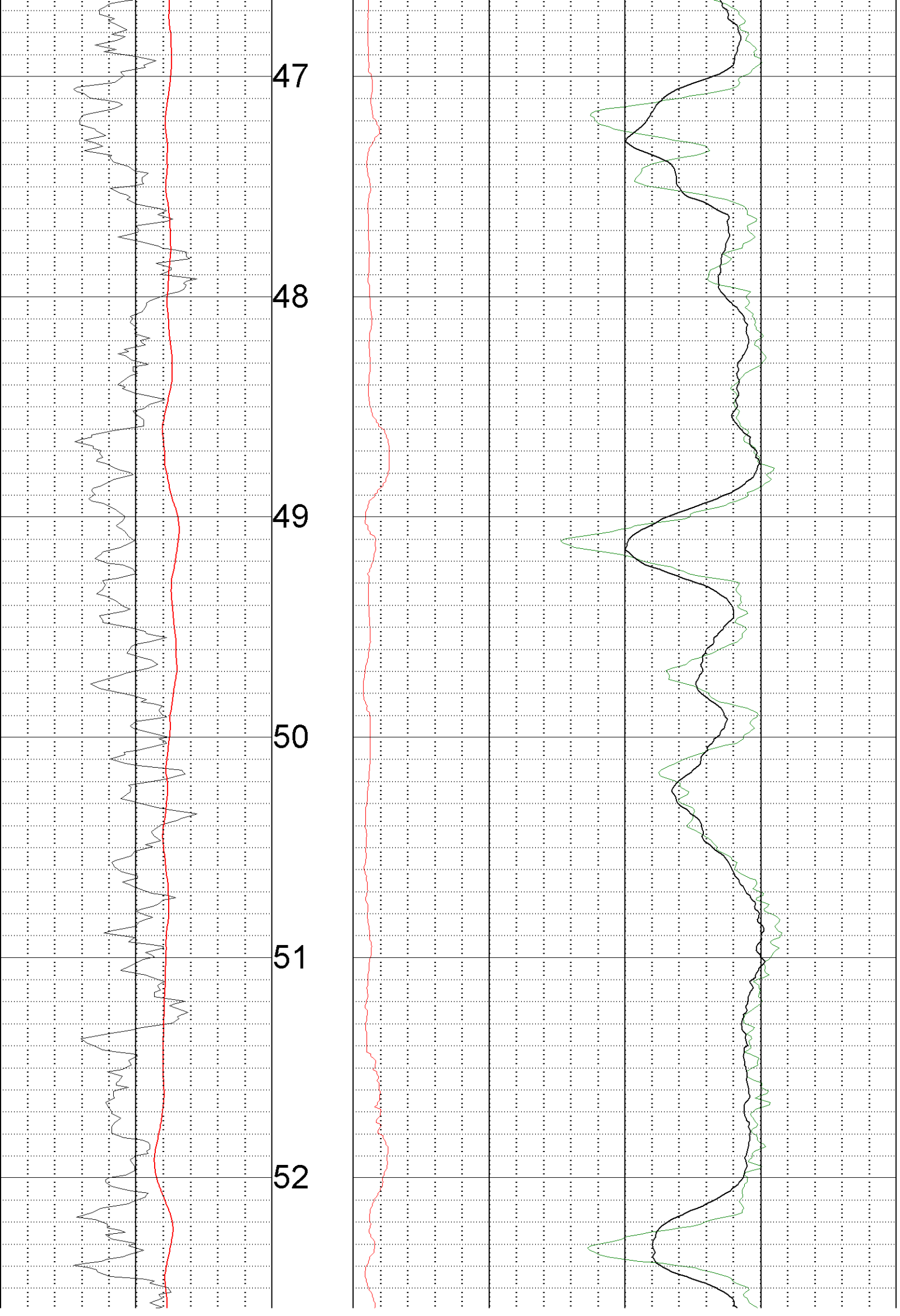
47
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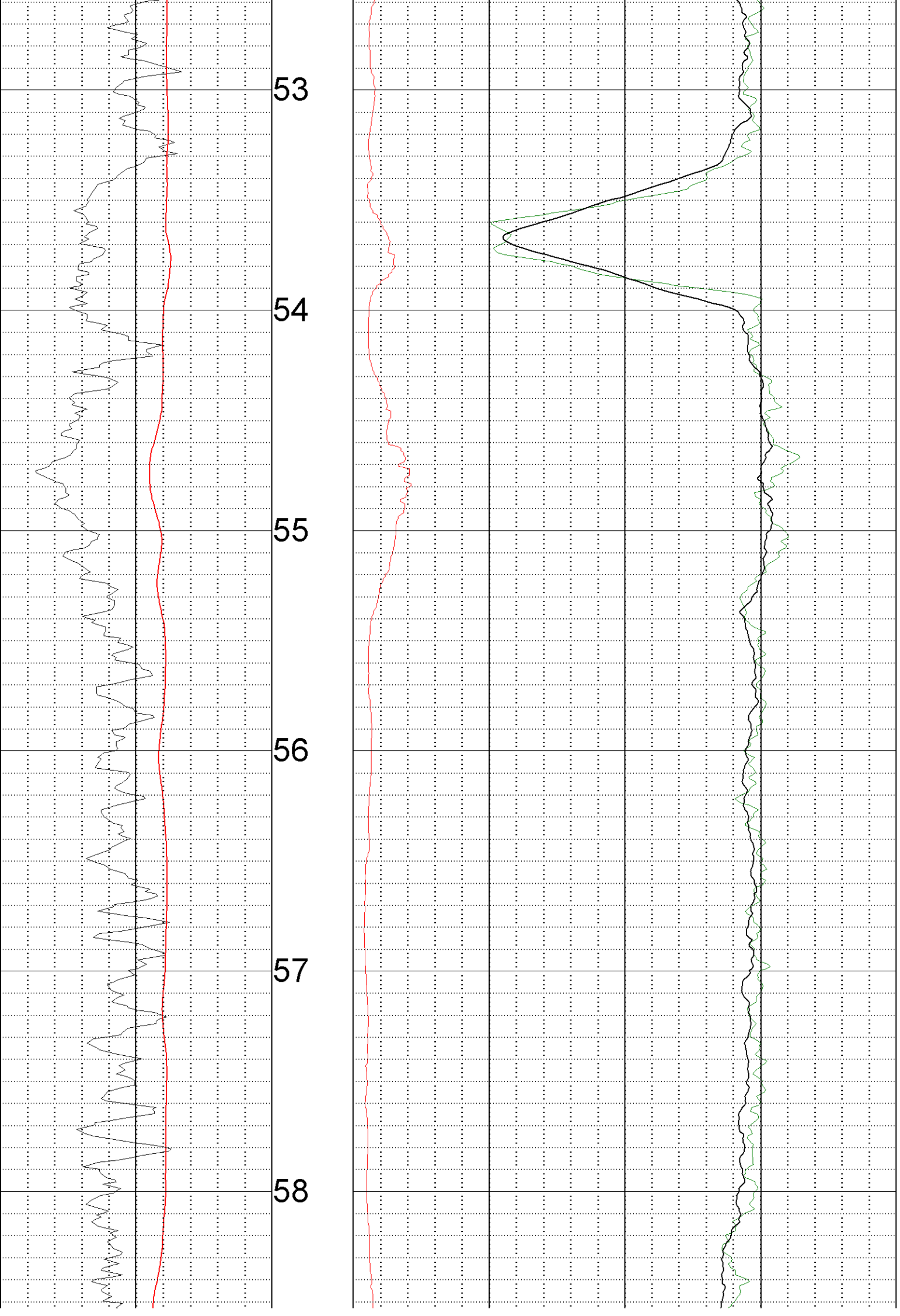
52


53
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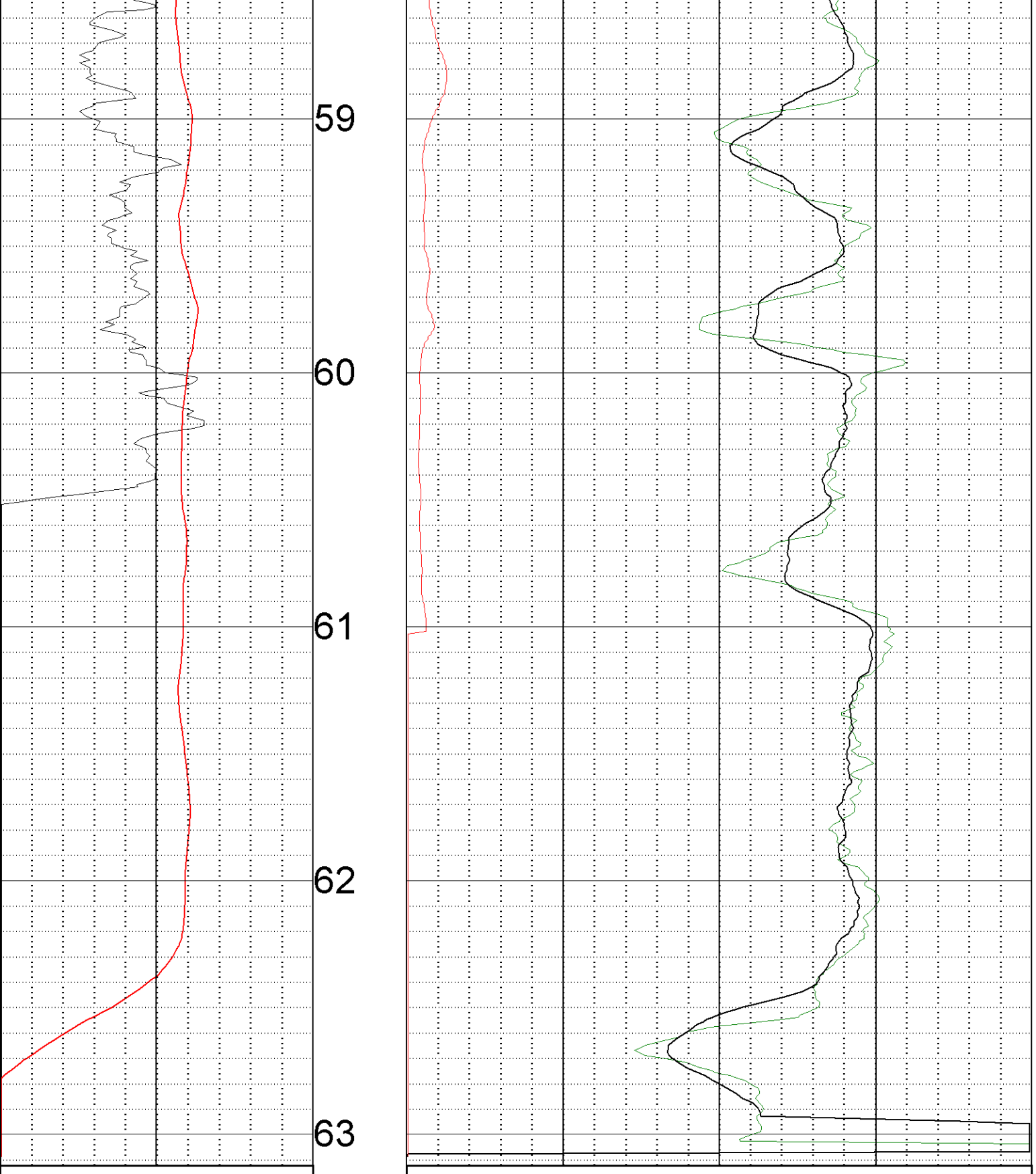
56
57
58



0	API-GR	300
GAMMA		
8	CM	18
CALIPERL		

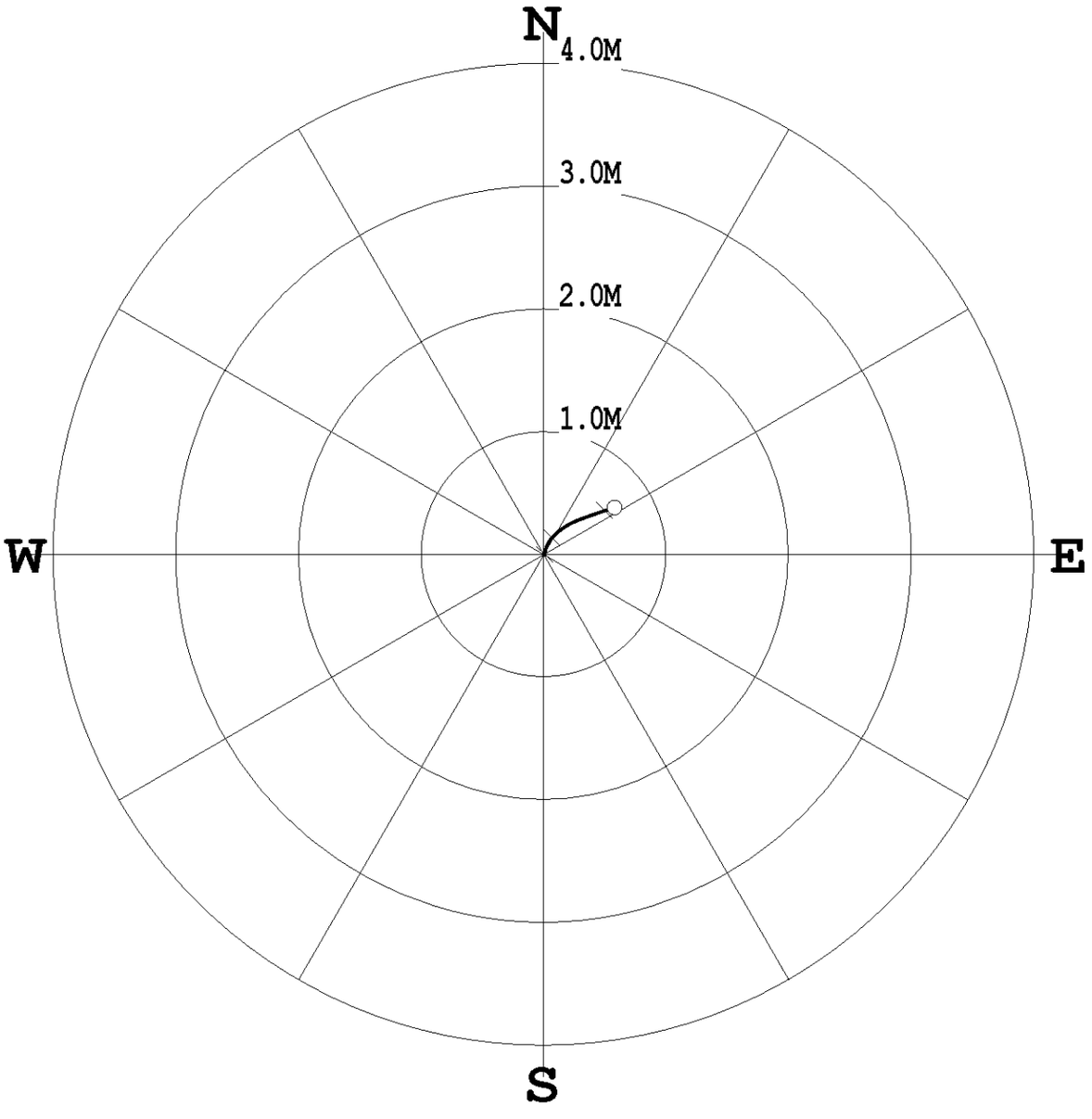
1	G/CC	3
DEN(SS)		
1	G/CC	3
DEN(LS)		
0	OHM-M	500
METERS	RES(SG)	

PLAN VIEW
COMPU-LOG DEVIATION

CLIENT: PARSONS BRINCKERHOFF
LOCATION:
HOLE ID: WKMB06B DEVIATION
DATE OF LOG: 11/12/14
PROBE: 9057A 2420

MAG DECL: 0.0

SCALE: 1 M/CM
TRUE DEPTH: 62.53 M
AZIMUTH: 56.6
DISTANCE: 0.7 M
+ = 20 M INCR
○ = BOTTOM OF HOLE



* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : PARSONS BRINCKERHOF HOLE ID. : WKMB06B DEVIA
FIELD OFFICE : RUTHERFORD DATE OF LOG : 11/12/14
DATA FROM : NA PROBE : 9057A , 2420
MAG. DECL. : 0.000 DEPTH UNITS : METERS
LOG: WKMB06BDEVIATION_11-12-14_10-36_9057A_.01_0.00_62.73_DEVI.log

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
0.61	0.61	-0.00	-0.00	0.0	250.0	0.1	250.0
10.00	10.00	-0.00	0.00	0.0	104.6	0.1	153.2
20.00	20.00	0.00	0.01	0.0	78.1	0.2	11.9
30.00	30.00	0.05	0.02	0.1	19.5	0.4	16.2
40.00	40.00	0.14	0.07	0.2	26.5	0.8	36.7
50.00	50.00	0.25	0.22	0.3	41.1	1.1	65.7
60.00	59.99	0.36	0.50	0.6	54.3	1.9	68.7
62.54	62.53	0.38	0.58	0.7	56.6	2.5	71.9