Attachment C14(a)

Proponent Phase I and Phase II Environmental Site Assessment (1/8)

Appendix L – Phase I and Phase II Environmental Site Assessment

AECOM Imagine it. Delivered.

Burrows Industrial Estate
Goodman Property Services (Aust) Pty Ltd
05-Mar-2020

Phase I & II ESA

1-3 Burrows Road, St Peters

Phase I & II ESA

1-3 Burrows Road, St Peters

Client: Goodman Property Services (Aust) Pty Ltd

ABN: 40 088 981 793

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Document Phase I & II ESA

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Prepared by Alex Latham

Reviewed by Brad Eismen

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			Name/Position	Signature
A	5-Mar-2020	Draft for comment	Alex Latham Associate Director	
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Glossary

General Terms			
ASC NEPM	Assessment of Site Contamination National Environment Protection Measure (2013)		
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene		
CoPC	Contaminants of Potential Concern		
CSM	Conceptual Site Model		
DQI	Data Quality Indicators		
DQO	Data Quality Objectives		
EPA	Environment Protection Authority		
GME	Groundwater Monitoring Event		
HIL	Health Investigation Level		
HSL	Health Screening Level		
LOR	Limit of Reporting		
LNAPL	Light Non-Aqueous Phase Liquid		
m bgs	Metres below ground surface		
m btoc	Metres Below Top of Casing		
NATA	National Association of Testing Authorities		
NEPC	National Environment Protection Council		
NEPM	National Environment Protection Measure		
OCP	Organochlorine Pesticides		
OPP	Organophosphorus Pesticides		
PAH	Polycyclic Aromatic Hydrocarbons		
PCB	Polychlorinated Biphenyls		
PID	Photoionisation detector		
QA/QC	Quality Assurance/Quality Control		
RPD	Relative Percent Difference		
SWL	Standing Water Level		
TCLP	Toxicity Characteristic Leachate Procedure		
TPH/TRH	Total Petroleum Hydrocarbons/Total Recoverable Hydrocarbons		
UPSS	Underground Petroleum Storage System		
UST	Underground Storage Tank		
VHC	Volatile Halogenated Compound (or Chlorinated Hydrocarbons [CHC])		
VOC	Volatile Organic Compound		
Units			
m	Metre	mg/L	milligrams/litre
mg/kg	milligrams/kilogram	µg/L	micrograms/litre

Executive Summary

AECOM Australia Pty Ltd (AECOM) was engaged by Goodman Property Services (Aust) Pty Ltd (GPSA) to complete a Phase I and II Environmental Site Assessment (ESA) of Burrows Industrial Estate, 1-3 Burrows Road, St Peters, NSW (the Site).

The Site has been assessed generally following the guidelines endorsed by the NSW EPA. The assessment included a review of Site history and background data (Phase I ESA in 2015) followed by intrusive investigation, sampling and analysis (Phase II ESA in 2015 and 2020).

The Phase I ESA data indicated that Site was extensively filled with materials and has been utilised since the 1940s for the production of packaging (hessian bags and then plastic containers and other plastic products) and then as a warehouse type estate. Historical use included above and below ground storage of petroleum hydrocarbons, inks, gases, adhesives and vehicle workshop(s). The Site has undergone many stages of building alterations, removals and additions over the years.

The Phase II ESA was completed in readily accessible areas across the Site. Thirty nine soil boreholes were completed and eight groundwater monitoring wells were installed and sampled. Fill materials were identified at each borehole and current data indicates that it extends on average, to approximately 3.5 m depth. The soil sampling density completed is just below the minimum rate recommended in the NSW EPA (1995) Sampling Design Guidelines, but given the encountered conditions, is considered adequate to assess Site suitability for continued commercial/industrial land use.

Groundwater is present in the fill materials and current data indicates it is present between 0.6 to 2.75 m depth. Groundwater elevation data indicated a difference (on average) of 0.6 m between the 2015 and 2020 groundwater monitoring events.

The fill materials have been identified to be contaminated with lead, asbestos, benzo(a)pyrene (B(a)P) and long chain-length total recoverable hydrocarbons (TRH). The volume of fill material is estimated to be in the order of 120 000 m^3. Contamination at concentrations exceeding the adopted assessment criteria has not been identified in natural soils underlying the fill however, acid sulfate soil conditions are likely to be present.

Groundwater has high concentrations of copper, zinc and nickel and to a lesser extent, lead. Given the high concentrations of lead in fill, it does not appear to be significantly leaching into groundwater. Similarly, B(a)P has not been detected in groundwater. Volatile compounds have not been identified in groundwater to date.

Based on the available data, the following conclusions are made:

- With respect to the proposed redevelopment, AECOM considers that the Site can be made suitable for commercial/industrial land use however, implementation of control/management mechanisms will be required.
- The control mechanisms would include the preparation and adherence to a Remedial Action Plan (RAP), Construction-phase Site Management Plan (CSMP) and after redevelopment, a Long Term Site Environmental Management Plan (LTSEMP).

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was engaged by Goodman Property Services (Aust) Pty Ltd (GPSA) to complete a Phase I and II Environmental Site Assessment (ESA) of Burrows Industrial Estate, 1-3 Burrows Road, St Peters, NSW (the Site).

The Site location is shown on **Figure 1** and the layout and sampling location plan is shown in **Figure 2** (**Appendix A**). Tables of results are provided in **Appendix B**.

It is understood that Tallina Pty Ltd, part of the Goodman Group, owns the Site. GPSA is contemplating demolition of existing buildings and construction of free-standing, slab-on-ground style, multi-storey warehouses. Indicative redevelopment plans are included in **Appendix C**.

AECOM completed the fieldwork for the ESA in 2015 and 2020. The Phase I ESA data were collected in 2015 and in some instances, were not up-dated in 2020, given that no significant changes in Site operations have occurred. This is not considered to compromise data integrity.

It is noted that the Site dimension and area changed between 2015 and 2020 due to a compulsory acquisition associated with the M5 motorway project. The northern portion of the 2015 Site was acquired.

1.1 Objectives

The project objectives were to:

- Obtain an understanding of soil and groundwater contamination conditions at the Site.
- Assess Site suitability for commercial/industrial land use.
- Support a Development Application (DA) for the Site redevelopment.

1.2 Scope of Work

To achieve the objectives, the following works were completed:

- Review of historical and background information relating to the Site, including:
  - Previous contamination assessment reports.
  - Council Section 149 planning certificate (now known as a 10.7 certificate).
  - Historical certificates of title and aerial photographs.
  - NSW EPA register of regulated contaminated sites.
  - Soil, geology and hydrogeological data.
- Site inspections to assess Site operations and to locate boreholes.
- Drilling of 39 soil boreholes (BH01 to BH22 [2015] and BH100 to BH117[1] [2020]) to a maximum depth of 6.3 metres below ground surface (m bgs). Soil samples were collected from the boreholes.
- Collection of four surface soil samples (SS01 to SS04) in 2015.
- Installation and development of eight groundwater monitoring wells (MW01, MW16, MW17, MW19, MW21, MW102, MW105 and MW115)[2].
- Surveying of the top of the monitoring well casings and all borehole locations to Australian Height Datum (AHD) and Map Grid Australia (MGA).
- Gauging, purging and sampling of the groundwater monitoring wells.

[1] Borehole BH112 was not completed (due to operational requirements of a tenant)
[2] Monitoring wells MW01, MW16, MW17, MW19 and MW21 were installed in 2015 and MW102, MW105 and MW115 were installed in 2020.

- Laboratory analysis of soil and groundwater samples using methods endorsed by the National Association of Testing Authority (NATA) to evaluate concentrations of Contaminants of Potential Concern (CoPC). The CoPC included:
  - Total recoverable hydrocarbons (TRH).
  - Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN).
  - Suite of eight metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc (M8).
  - Polycyclic aromatic hydrocarbons (PAH) and phenols.
  - Organochlorine and organophosphorus pesticides (OCP, OPP).
  - Polychlorinated biphenyls (PCB).
  - Asbestos.
  - Volatile halogenated compounds (VHC).
- Data evaluation and reporting.

1.3 Data Quality Objectives

The seven step Data Quality Objective (DQO) approach endorsed in NSW EPA (2017) was adopted. The DQOs have set quality assurance and quality control parameters for the field and laboratory programs, to ensure data of appropriate reliability have been used to assess the environmental condition of the Site.

The DQOs for this project are presented in **Appendix C**. Attainment of the DQOs has been assessed by reference to the data quality indicators (DQIs), also presented in **Appendix C**.

1.4 Guidelines

AECOM completed works with reference to the following guidelines:

- National Environment Protection Measure (NEPM), *Assessment of Site Contamination (ASC) (National Environment Protection Council [NEPC]*, *1999* as amended (2013) (the ASC NEPM).
- CRC CARE (2011). *Technical Report No.10 - Health Screening Levels* (HSLs*) for Petroleum Hydrocarbons in Soil and Groundwater*. Friebel, E. and Nadebaum, P. Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE).
- NSW EPA (2017). *Contaminated Land Management*, *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*.
- NSW DEC (2007). *Guidelines for the Assessment and Management of Groundwater Contamination*.
- NSW EPA (1995). *Sampling Design Guidelines*.
- NSW OEH (2011). *Guidelines for Consultants Reporting on Contaminated Sites*. NSW Government Office of Environment & Heritage (OEH).

2.0 Site Details

2.1 Identification

Site identification details are summarised on **Table 1**.

Table 1 Site Identification

Item	Description
Address[1]	1-3 Burrows Road, St Peters
Legal Description[1]	Lot 11, DP 606737 Lot 1, DP 1227450[3]
Site Area[2]	3.45 hectares (Ha). Lot 11: 3.27 Ha Lot 1: 0.186 Ha
Site Owner[1, 3]	Tallina Pty Ltd
Local Government[1]	City of Sydney
Zoning[1]	IN1 General Industrial
Elevation (m AHD)[2]	2.03 to 4.93 (based on survey data)

Notes: 1 = Section 149 Certificate. 2 = survey data. 3 = Certificate of Title

2.2 Current Land Use

The Site is used as a warehouse-type industrial estate. Site tenants during the AECOM fieldwork programs included:

Table 2 Site Tenants

Unit(s)	Tenants/Comment(s)
1	2015 & 2020: Vacant building
2	2015: AST Services: storage and distribution of electric motor cars 2020: Vacant building
3	2015: Jets (Qantas Freight): freight transport and distribution 2020: Vacant building
4	2015 & 2020: Coca Cola Amatil: freight storage (drink products), transport and distribution
5-6	2015 & 2020: Staging Rentals: manufacture and/or storage of ‘props’ for theatre productions/stage shows
7	2015: PCA Express: freight storage (including quarantine products), transport and distribution 2020: Vacant building
8-9	2015: Sealed Air Australia: freight storage, transport and distribution 2020: 4Cabling: equipment storage
9A	Office area. Not inspected in 2015 or 2020.

The Site was mostly sealed in concrete and bitumen hardstand surfaces. Small garden or lawn areas were present along the main access driveway from Burrows Road and near Unit 8. A small area of unpaved ground was present between Unit 9 and the north western Site boundary and multiple fragments of asbestos containing material (ACM) were observed in this area.

[3] Identified as Lot 12 DP606737 in 2015.

2.3 Surrounding Land Use

Land use surrounding the Site included:

- North and east: M5 motorway project, constructed on the Alexandria Landfill facility (former brick-pit).
- South: Burrows Road followed by commercial/industrial properties, then Alexandra Canal. The Canal is located approximately 75 m to the south east.
- West: Canal Road followed by commercial/industrial properties.

3.0 Background Information/Phase I ESA

The following sections summarise the Site history and background data reviewed by AECOM.

3.1 Section 149 Certificate

AECOM reviewed the Planning Certificate issued under Section 149 of the Environmental Planning and Assessment Act, 1979. The Certificate was dated 20 August 2015 and is summarised below:

- The Site was identified as Lots 11 and 12 in DP 606737 and owned by Tallina Pty Ltd.
- The Site was zoned IN1 General Industrial under the Sydney Local Environmental Plan 2012.
- There were no matters listed for the Site under the Contaminated Land Management Act, 1997.

A copy of the Certificate is included in **Appendix D**.

3.2 Previous Reports

3.2.1 Mahaffey Associates Pty Ltd 1994

AECOM reviewed a report dated 10 May 1994 (Report No. GR270, *Geotechnical Assessment of Possible Site Contamination at No. 1-3 Burrows Road, Alexandria*) prepared for Goodman Hardie Pty Ltd, as summarised below:

- The Site was noted to be located in an area reclaimed by the infilling of Sheas Creek and construction of Alexandra Canal. Fill materials were expected to be present at the Site to approximately 1 m bgs.
- Historical Site activities were noted to comprise a hessian bag manufacturer (Abrahams Pty Ltd) and warehousing by Australian Liquor Distributors Pty Ltd.
- In 1994, the Site was occupied by:
    - Premier VIP Stores Pty Ltd (Units 1 and 2). Warehousing and dispatch type-operation. The report noted there were no chemical manufacturing or chemical storage activities.
    - Croxley Collins Pty Ltd (Unit 3). The report noted there was a recharging location for battery operated equipment.
    - St Regis Bates Pty Ltd (Units 4 to 7). The report noted that operations included the manufacture of multi-layered heavy paper packaging and inks were used for printing.
    - Rheem Australia Pty Ltd (Units 8 to 11). The report noted there were a variety of manufacturing activities related to the production of strengthened plastic fabrics, packaging liners and finished packaging. A 9000 litre underground storage tank (UST) for the storage of solvents was present, as were two Liquified Petroleum Gas (LPG) tanks.
- The report concluded that the Site "*has not suffered significant contamination as a result of past developments*" and "*existing activities are not likely to involve a significant environmental risk*".

3.2.2 Hibbs & Associates Pty Ltd 2005

AECOM reviewed a report dated April 2005 (Reference No. S3933/130, *Hazardous Materials Survey, Burrows Industrial Estate, 1-3 Burrows Road, Alexandria*) prepared for Macquarie Goodman Property Services Pty Ltd, as summarised below. The report only assessed above ground hazardous materials.

- No friable asbestos containing materials were identified on the Site.
- Bonded asbestos materials were identified to include asbestos cement sheets lining the external soffits of Units 1 and 9a, lining a gas cabinet near the machinery area in Unit 7 and possible vinyl asbestos tiles in Unit 3.

3.2.3 AECOM 2011

AECOM completed an Underground Petroleum Storage System (UPSS) inspection and compliance report in 2011 (reference 60218857_Burrows IE_20111118). The report is included in Appendix D and identified the following:

- At least five USTs had been present. Three USTs were decommissioned by removal in 1997 and two USTs may have been abandoned in-situ in approximately 1990. Based on WorkCover[4] data, the USTs appeared to be:
  - 2 x 18 000 L (petrol): located in the south western portion of the Site, near Unit 1.
  - 1 x 20 000 L (petrol): located on the northern side of Unit 8.
  - 1 x 9000 L (solvent): located adjacent to Units 4 and 6.
  - 2 x 20 000 L (petrol): located adjacent to Units 4 and 6.
- No active USTs were identified by AECOM in 2011.
- WorkCover NSW Dangerous Goods records were obtained for the Site and these are included in the AECOM 2011 report. The Dangerous Goods records also noted the following:
  - Rheem Australia (occupier) and A. Abrahams & Sons (trading name) (1972 and 1975): two bunded storage areas of brick wall and concrete floors for the storage of solvent-based inks and waste solvents/inks. An above ground tank for 4 700 L of copper naphthenate (a wood preservative) located opposite Units 4 and 6.
  - Rheem Australia (1994): roofed package store, with toluene (800 L), black ink (300 L), reducer (100 L) and butyl rubber adhesive (4000 L). Two 7500 L above ground storage tanks (ASTs), for propane and butane and a 2000 L AST for LPG. A drum store for 15 000 L of 'Instapak Component A'.

The inferred locations of the USTs are provided on Figure 1 in the AECOM 2011 report (**Appendix D**).

3.2.4 PSM Consult Pty Ltd 2015

Pells Sullivan Meynink (PSM) completed a geotechnical investigation of the Site in September 2015 (Reference: PSM2808-005R. *Burrows Industrial Estate, 1-3 Burrows Road, Alexandria, Geotechnical Investigation*). Review of the report indicated the following:

- The 1:100 000 Sydney Geological map indicates the Site is underlain by Quaternary alluvium (peat, sandy peat and mud).
- Fieldwork was undertaken on 13 August 2015 and included the completion of six Cone Penetrometer Tests (CPTs) by truck mounted testing rig and three bulk samples were collected by hand auger. CPTs were completed to 12 to 14 m bgs. Bulk samples were collected from approximately 0.2 to 0.5 m bgs.
- Bulk samples were logged to comprise clayey sand.
- Based on CPT data, PSM inferred that subsurface Units at the Site included (depths are approximate):
  - Pavement: 0 to 0.2 m bgs.
  - Fill: 0.2 to 1 m bgs. Gravelly sand and clayey sand, medium to very dense.
  - Upper Sand: 1 to 3 m bgs. Silty sand, loose to dense. PSM inferred that groundwater was present between 1.4 and 2.5 m bgs.
  - Upper Clay: 3 to 5.8 m bgs. Clay to silty clay, soft to firm.
  - Lower Sand: 5.8 to 8.7 m bgs. Sand to silty sand, dense to very dense.
  - Lower Clay: 8.7 to 10.7 m bgs. Clay to silty clay, stiff to very stiff.

[4] Now known as SafeWork NSW

- Bedrock: 10.8 m bgs, inferred from CPT refusal.

3.3 Expected Subsurface Conditions

3.3.1 Geology

According the *Sydney 1:100,000 Geological Series Sheet 9130* (DMR, 1983), the Site is mapped to comprise Quaternary sediments consisting peat, sandy peat and mud. The Site is mapped to be situated adjacent to Ashfield Shale of the Wianamatta Group.

3.3.2 Soils

According to the *Sydney 1:100,000 Soil Landscape Series Sheet 9130* (DECCW, 2009), Site soil conditions are mapped to comprise 'Disturbed Terrain', which may comprise:

- Level to hummocky terrain extensively disturbed by human activity, including quarries, tips, areas of landfill.
- Original soils have been removed, greatly disturbed or buried and landfill including soil, rock, building and waste materials may have been added.

Based on the review of the City of Sydney Acid Sulfate Soil (ASS) Risk Map Sheet (**Appendix D**), Class 3 ASS are mapped to be present. Under the classification scheme, Class 3 means that any work greater than 1 m bgs or any works that would lower the water table by greater than 1 m bgs would require development consent.

AECOM notes that ASS are unlikely to manifest in fill materials however, would likely be present in the Quaternary sediments. Investigation and testing was beyond this project scope but would be required to confirm the presence of ASS.

3.3.3 Hydrogeology

AECOM notes that the Site is located in Zone 2 of the Botany Groundwater Management Zones. Groundwater use for domestic purposes (e.g. drinking water, watering gardens, washing, bathing etc.) is banned in Zone 2.

A search of the NSW Office of Water database of registered groundwater bores was undertaken by AECOM in July 2014 and March 2020 for an approximate 0.5 km radius of the Site. Bores identified in close proximity to the Site, on the western side of Alexandra Canal, are summarised below:

Table 3 Bore Search Summary

Bore	Total Depth	SWL	Distance & Direction from Site	Use	Other
GW109821	35	14.5	600 m N	Monitoring	2.2 m of fill, Alexandria Landfill
GW109822	10.45	3	100 m NE	Monitoring	2.6 m of fill, Alexandria Landfill
GW109823	29	12.5	100 m NE	Monitoring	3 m of fill, Alexandria Landfill
GW109824	20.7	4.5	250 m NW	Monitoring	4.5 m of fill, Alexandria Landfill
GW109825	22	14.9	600 m NNW	Monitoring	4.5 m of fill, Alexandria Landfill

Notes: depths are in metres. SWL = standing water level

The bore search data indicates that groundwater is expected to be present at the Site, from approximately 2 m bgs. Groundwater is expected to flow towards Alexandra Canal however, the following is noted:

- Due to proximity of Alexandra Canal, the depth to groundwater may be tidally influenced.
- The presence of the former brick-pit excavation (Alexandria Landfill) and the recent motorway construction works may cause a localised reversal in groundwater flow direction.

3.4 Certificates of Title

AECOM completed a review of historical certificates of title to gain an understanding of former Site owners and potential land use (**Appendix D**). In summary, the documentation indicated the following ownership history:

Table 4 Ownership History

Year(s)	Owner	Possible Use
2000 to date	Tallina Pty Ltd	Warehouse estate
1988 to 2000	Goodman Hardie Pty Ltd	Warehouse estate
1980 to 1988	Superannuation Fund Investment Trust	Warehouse estate
1951 to 1980 (Lot 12)	The Austral Brick Company Pty Ltd	Clay-shale extraction and associated activities
1924 to 1951 (Lot 12)	The central Brick and Tile Company Pty Ltd	As above
1972 to 1979	Rheem Australia Pty Ltd	Production of packaging materials
1949 to 1972	A. Abrahams & Sons Pty Ltd	Manufacturing of hessian bags
1915 to 1948	Council of Municipality of Alexandria	Unknown
Pre 1915	Various owners (e.g. administrators of Estate of James Collins, Gerald William Cooper, Frederick William Lynch [brickyard manager] and Walter George West [brickyard manager]	Brickyards

Review of documentation included in the certificate of title search indicated:

- The presence of a fuel bowser (off-site) near the south western corner of the Site.
- Unit 9 building was noted to be under construction in 1980.
- A brick and galvanised iron factory building was present along the Sites' north western boundary in 1980.

According to the Encyclopaedia of Australian Science (**Appendix D**), A Abrahams & Sons Pty Ltd produced sacks and bags and then flexible packaging.

3.5 Websites

3.5.1 NSW EPA

Review of the NSW EPA website was undertaken to evaluate if the Site or nearby properties were listed as a contaminated site under Section 58 of the Contaminated Land Management Act, 1997 (CLM Act). The subject Site was not listed in 2015 or 2020.

Listed sites in St Peters and Alexandria (in January 2020) included:

- The bed of Alexandra Canal, contaminated with chlorinated hydrocarbons, pesticides and metals.
- Sydney Park (Alexandria Road). Former landfill facility, located immediately adjacent to the Site. Potential to affect the Site through on-site migration of contaminants in groundwater, presence of 'legacy' fill materials or migration of landfill gases.

The former Tidyburn facility (53 Barwon Park Road/15 Campbell Road, St Peters), part of the former landfill facility, was regulated as a Remediation Site in 2015. The EPA considered that soil was contaminated with PAH, TRH and BTEX and groundwater was contaminated with naphthalene and

TRH. In January 2020, the EPA website advised that the contamination was formerly regulated under the CLM Act.

The Site was not listed on the NSW Government PFAS Investigation Program, accessed March 2020. The closest listed site was Alexandria Fire and Rescue located at 189 Wyndham Street, Alexandria.

The EPA website was reviewed for Licences issued under the Protection of the Environment Operations Act. No current licenses for the Site were identified however, Sealed Air Australia Pty Limited formerly held a license for 'hazardous, Industrial or Group A Waste generation or Storage'. Properties with licenses included:

- 6-10 Burrows Road South St Peters, Visy Paper Pty Ltd.
- 25 Burrows Road St Peters, Boral Recycling Pty Ltd.

EPA search records are presented in **Appendix D**.

3.5.2 UXO

Review of the Department of Defence unexploded ordnance (UXO) website on 22 September 2015 indicated that the Site was not listed (**Appendix D**).

3.5.3 Council

AECOM reviewed readily available information posted on the archive section of the City of Sydney website, as summarised below.

Maps

A town planning map from 1950 shows the A. Abrahams & Sons Pty Ltd facility, noted to be a bag and sack manufacturer. The property at 5/5A Canal Road is noted to be a metal merchant.

Photographs

Two photographs show the A. Abrahams & Sons Pty Ltd facility circa 1977 to 1980. The Site frontages to Burrows and Canal Roads are similar to the current layout.

Development & Building Applications

It is noted that the Development and Building Applications (DAs and BAs) may not have necessarily been approved by Council. Review of the data indicated the following:

Table 5 City of Sydney Archives

Item	Date/s	Comments
304(A62)/49	Start: 28 Nov' 1949 End: 29 Jun' 1950	Corner (Cnr) Canal St & Burrows Rd, Alexandria. A. Abrahams & Sons. Amenity Building.
16/50	Start: 14 Dec' 1949 End: 20 May 1953	Cnr Burrows Rd & Canal Rd Alexandria. Alterations & additions to connect two existing buildings to provide additional space for the manufacture of bags. A Abrahams & Sons P/L. Interim Development Application.
216/50	Start: 23 Mar' 1950 End: 14 Apr' 1950	Cnr Burrows Road & Canal Road, Alexandria. Alterations to Building (No.7) & use of portion for the sewing of bags & to house cleaning machines. A. Abrahams & Sons Pty. Ltd. Interim Development Application.
563/51	Start: 06 Jun' 1951 End: 27 Oct' 1952	Canal Rd Burrows Rd, Alexandria. Erection of public weighbridge & housing. A. Abrahams & Son Pty. Ltd.
4719/53	Start: 10 Nov' 1953 End: 13 Jan' 1954	Premises, Canal Rd., Alexandria, occupied by A. Abrahams & Sons P/L. Use of building No. 9 (Fronting Burrows Rd.) by Terazzo & Co. P/L for the purpose of vehicle maintenance and as a workshop
131/54	Start: 28 Jan' 1954 End: 26 May 1955	Cnr Burrows & Canal Rds, Alexandria - office block & septic tank [A Abrahams & Sons Pty Ltd]

Item	Date/s	Comments
5593/56	Start: 07 Nov' 1956 End: 20 Feb' 1957	Property, Burrows Rd. & Canal Rd., Alexandria. A. Abrahams & Sons Pty. Ltd. Subdivision.
1025/57	Start: 01 May 1957 End: 21 May 1958	Cnr. Canal Rd & Burrows Rd, Alexandria (A. Abrahams & Sons) Additions to existing factory. (Building No.4)
457/58	Start: 07 Jul' 1958 End: 01 Dec' 1961	Cnr Canal & Burrows Rd Alexandria. Construction of a Modern Service Station. (A. Abrahams & Sons)
708/60	Start: not specified End: 14 Jul' 1969	Cnr Canal Rd & Burrows Rd, Alexandria. Erection of a factory for use in the manufacture of containers. A Abrahams & Sons P/L.
796/60	Start: 01 Apr' 1960 End: 16 May 1961	Cnr Burrows & Canal Rds, Alexandria - new building (factory) [A Abrahams & Sons]
0594/61	Start: 17 Mar' 1961 End: 29 May 1964	Cnr. Canal Road & Burrows Road, Alexandria. Office Extension. A. Abrahams & Sons Pty. Ltd.
1943/61	Start: 13 Sep' 1961 End: 26 Feb' 1962	Cnr Canal & Burrows Rds., Alexandria. (A. Abrahams & Sons) Factory additions
0001/62	Start: 21 Dec' 1961 End: 02 May 1962	Burrows Rd Alexandria. (Abrahams). Proposed erection of a sub-station. A. Abrahams & Sons P/L
121/62	Start: 12 Dec' 1967 End: 29 May 1968	Premises, Canal Rd & Burrows Rd, Alexandria. A. Abrahams & Sons Pty Ltd. To erect a single-storey building for use as a substation.
2805/63	Start: 04 Dec' 1963 End: 06 Mar' 1970	Cnr Canal & Burrows Rds Alexandria. Plastic Factory. Abrahams & Sons P/L.
6824/67	Start: 12 Dec' 1967 End: 29 May 1968	Premises, N.W. Cnr. Canal Rd. & Burrows Rd.,Alexandria. A Abrahams & Sons Pty Ltd. D.A.(Erection of extension)
80/C/072	Start: 17 Mar' 1961 End: 14 Jun' 1974	Premises Canal Rd, Burrows Rd Alexandria. A Abrahams & Sons Pty Ltd. To erect a single storey addition to a single storey office building. For Council's comment
241/74	Start: 26 Jun' 1974 End: 20 Jan' 1975	Cnr Canal & Burrows Rds, Alexandria. Ink & solvent store (Plastics Dept) A. Abrahams & Sons
35/77	Start: 16 Feb' 1977 End: 14 Jan' 1982	Cnr Canal & Burrows Rd Alexandria. Creation of Factory Units. (Rheem Aust Ltd)
37/79	Start: 20 Jan' 1979 End: 22 Nov' 1979	Cnr Burrows & Canal Rds, Alexandria. Fume exhaust stack & cold air exhaust stack. Rheem Aust Ltd.
44 83 2459	Start: 21 Dec' 1983 End: 04 Oct' 1984	1-3 Burrows Rd. Alexandria. Erect building & use as inflammable liquids store. Rheem Australia Ltd.
45 83 5516	Start: 30 Nov' 1983 End: 27 Mar' 1986	Factory unit 8, No 1 Burrows Rd Alexandria. New Structure. Rheem Aust.
45 86 0070	Start: 07 Jan' 1986 End: 03 Mar' 1987	1 Burrows Rd Alexandria. Erect a hot room, factory unit 9 Eastern wall. Rheem Australia Ltd.

Based on the DA and BA information, historical Site activities are inferred to have included:

- Manufacturing of bags and then plastic containers.
- Workshop and vehicle maintenance workshop(s).
- Below-ground storage of petroleum hydrocarbons and solvent-based inks. AECOM notes that one DA/BA was for the erection of a service station however, the WorkCover records did not contain any information related to this. It is assumed that the petrol station was not constructed.
- Above-ground storage of solvent-based inks and waste inks, toluene, adhesive and copper naphthenate.

3.6 Aerial Photographs

The following information was derived from reviewing historical aerial photographs for the Site and surrounding area. Copies of aerial photographs are included as Figures 3 to 11 (**Appendix A**).

Table 6 Aerial Photographs

Year	Comments
1930 (Figure 3)	**Site**: no obvious development noted however, surface of the site appears to be disturbed land. An access track runs into the Site, to the area of 'disturbed' ground. **Surrounds**: brick-pit excavations are present to the north and north west of the Site. Burrows and Canal Roads are present and there is minimal commercial/industrial development.
1943 (Figure 4)	**Site**: is undeveloped. The Site surface appears 'mottled' and 'hummocky', suggestive of filling activities. **Surrounds**: brick-pit excavations are present to the north and north west of the Site. Cluster of buildings noted at 5/5A Canal Road. A plume of smoke is visible emanating from a chimney at 5/5A Canal Road. Expansion of industrial activities along Burrows and Canal Roads.
1951 (Figure 5)	**Site**: Eight buildings, parallel to each other and on a south-east to north-west alignment are present, fronting Burrows Road and four buildings are present along the north western boundary area. **Surrounds**: Expansion of industrial activities along Burrows and Canal Roads. Expansion of brick-pit excavations, towards the Site. Cluster of buildings noted at 5/5A Canal Road, possibly representing the metal smelter. A dark area is present immediately to the north of the Site, representing a possible excavation pit.
1961 (Figure 6)	**Site**: eight buildings fronting Burrows Road are still present. There appears to have been additions to the buildings at the north western boundary area. Unit 1 appears to be present. The northern portion of the Site is undeveloped. **Surrounds**: Expansion of brick-pit excavations, towards the Site. Cluster of buildings noted at 5/5A Canal Road, possibly representing the metal smelter. The dark area noted to the north of the Site in the 1943 photograph is not visible and appears to be 'filled' ground.
1978 (Figure 7)	**Site**: eight buildings fronting Burrows road have been replaced by a large warehouse type building. Buildings along the north western boundary area are present and appear to have been extended to the east (i.e. current Units 8 and 9). **Surrounds**: Expansion of brick-pit excavations and/or landfill operations, towards the Site. Cluster of buildings noted at 5/5A Canal Road.
1986 (Figure 8)	**Site**: layout generally as per current. The large building fronting Burrows Road has been modified (i.e. part removed) and the access driveway from Burrows Road is present. Buildings along the western boundary area have been removed and replaced by asphalt paved car park. **Surrounds**: disturbed land associated with the brick-pits/landfill appear to extend to the western and northern Site boundaries.
1991	**Site & Surrounds**: generally as per 1986 photograph.
1999 (Figure 9)	**Site & Surrounds**: generally as per 1986 photograph.
2004 (Figure 10)	**Site**: generally as per 1986 photograph. The rooves on Units 2 to 9 appear to have been modified, possibly changed from corrugated asbestos cement to metal. **Surrounds**: generally as per 1986 photograph.
2014 (Figure 11)	**Site**: as per current layout. **Surrounds**: one shed structure noted at 5/5A Canal Road.

In summary, the aerial photographs indicate:

- The Site was first developed in the mid to late 1940s. Prior to this, the Site appears to have been filled with materials associated with construction of Alexandra Canal and/or waste materials associated with the brick-pits/landfills and/or wastes of unknown origin.
- The Site has undergone extensions to the original buildings and additions of new buildings.
- The original buildings have mostly been removed and replaced.
- Quarrying and landfilling operations have been undertaken on the adjacent property, as well as operation of a metal merchant/smelter at 5/5A Canal Road.
- A high potential for contamination to exist.

3.7 Site Inspection

Inspections of the Site were completed by AECOM prior to and during completion of intrusive investigation activities. Inspection of the internal area of Unit 1 was not undertaken (no access). Observations are summarised below and selected photographs are included in **Appendix E**:

- A high point exists near the central portion of the Site, near Units 5 and 9. The Site surface slopes down to the south and to the north of this high point.
- No visible signs of the presence of USTs were observed, consistent with the AECOM 2011 observations.
- The Site surface was mostly paved. The asphalt paved car park was considered to be in an average to poor condition. Concrete floor slabs in Units 2 to 6, 8 and 9 were generally in good condition.
- A fire pump housing unit was present between Units 1 and 2. The pumps appeared to be electric-powered and no signs of fuel storage were observed.
- In 2015, some minor production of plastics (moulds) was observed in Unit 8 and 9 as well as some storage of pre-packaged chemical containers. Storage activities appeared to be well maintained. In 2020, Units 8 and 9 were used for storing solid, inert goods.
- Unit 4 was utilised for the storage of packaged drink products.
- Units 5 and 6 were used for the storage and manufacture of ‘set-designs’. Manufacturing was observed to include the sawing, cutting and painting of wood products. Based on the presence of the concrete floor slab, the potential for these activities to contaminate the subsurface is considered to be low. A purpose-built and self contained spray booth was present in the south eastern portion of Unit 6. The booth was located on concrete hardstand, noted to be in good condition. Borehole BH112 was to be completed adjacent to the spray booth but was not completed due to the operational requirements of the tenant.
- In 2015 Unit 7 appeared to be used for storage of packaged goods on shelving. Observation made from the main access doorway indicated a well maintained facility. In 2020, Unit 7 was vacant and not inspected.
- In 2015, numerous fragments of ACM were observed on the ground surface in a small unpaved area between Unit 9 and the Site north western boundary. Other observed anthropogenic materials included nodules of slag, pieces of glass, ash/coke and metal waste. Fragments of probable ACM and slag were also observed on the ground surface on the northern side of Unit 9.
- Pieces of slag were observed in fill materials beneath the concrete slab for the car-park area of Unit 7.
- A small plant room was present on the southern side of Unit 8. Access was not obtained however, it appeared that compressors were present on a concrete slab. No exhaust pipes or vent pipes were observed.

- A flammable liquids store sign was present on the external northern wall of Unit 8 and a fenced compound was present adjacent to this. The compound was empty but based on the presence of residual steel pipework on the external wall of the building, appeared to formerly store gas cylinders and/or ASTs. Borehole BH19 was completed outside the store area. Two brick bund areas with concrete bases were also present with no storage activities. The bunds appeared to be in reasonable condition with no obvious indications of leaks or spills.
- In 2015, a large mound of material was present off-site, near the Site north western boundary area. In 2020, lands to the west and north of the Site were undergoing M5 motorway works and the mound of material was not evident.

4.0 Investigation Rationale and Methodology

4.1 Contaminants of Potential Concern

Based on the data reviewed, Contaminants of Potential Concern (CoPC) at the Site are considered to include:

- Suite of eight metals (M8): can be present in fill materials of unknown origin and quality, in foundry/casting sands and can be associated with workshop and mechanical repair and maintenance activities. Some metals (e.g. arsenic) have been used for insect (termite) control. Common metal contaminants include arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.
- Benzene, toluene, ethylbenzene xylenes and naphthalene (BTEXN): typically associated with petrol and to a lesser extent, diesel. Can occur in fill materials of unknown origin and quality and can be associated with workshop and maintenance/repair activities. Naphthalene may be associated with the former copper naphthenate storage.
- Total Recoverable Hydrocarbons (TRH): occur in petrol and diesel fuels, oils, solvents and can be present in fill materials of unknown origin and quality.
- Polycyclic aromatic hydrocarbons (PAH): can be present in petrol and diesel fuel, oil, waste oil, creosote, tar, bitumen/asphalt, ash and slag. Can be present in fill materials of unknown origin and quality.
- Phenols: typically associated with waste oils.
- Organochlorine pesticides (OCP): typically related to insect control (termiticides). Typically applied immediately beneath building slabs and/or around timber structures in contact with the ground. Can be present in fill materials of unknown origin and quality.
- Organophosphorus pesticides (OPP): typically related to insect (e.g. termite) control.
- Polychlorinated biphenyls (PCB): historically present in electrical equipment such as transformers and capacitors. Can be present in fill materials of unknown origin and quality.
- Asbestos: can be present in fill materials of unknown origin and quality and with the deterioration/damage/weathering of asbestos building structures.
- Volatile halogenated compounds (VHC): related to solvents such as degreasers, lubricants, and thinners. VHC can be associated with workshop and maintenance/repair activities and are commonly present in groundwater in the Botany Sands.
- Landfill gas: potentially related to the former landfill facilities located near the Site. Gases investigated were hydrogen sulphide (H_2S), methane (CH_4), carbon dioxide (CO_2), carbon monoxide (CO) and oxygen (O_2).

4.2 Investigation Locations

The Site is approximately 3.45 Ha. The NSW EPA (1995) Sampling Design Guidelines recommend approximately 44 sample locations as a minimum number of sampling points for the characterisation of a 3.45 Ha Site.

A total of 39 soil boreholes and four surface samples were completed on a broad grid and in readily accessible areas. Six boreholes (BH01, BH04, BH16, BH17, BH20 and BH21) were positioned in proximity to the inferred locations of the former USTs.

Given that 43 sampling locations have been completed, AECOM considers that the investigation density is sufficient to assess Site suitability for commercial/industrial land use.

Sample locations are shown on **Figure 2** in **Appendix A** and the rationale is presented in **Table 7**.

Table 7 Sample location rationale

Location(s)	Rationale
BH01/MW01	Vicinity of former USTs.
BH02, BH03	Vicinity of former buildings and general Site coverage.
BH04	Vicinity of former USTs.
BH05 to BH15	Vicinity of former buildings and general Site coverage.
BH16/MW16, BH17/MW17	Vicinity of former USTs.
BH18	General Site coverage.
BH19	General Site coverage and vicinity former flammable liquids store area.
BH20	Vicinity of former USTs.
BH21/MW21	Vicinity of former USTs and general Site coverage.
BH22	General Site coverage.
SS01 to SS04	Assess for asbestos in exposed surface soils.
BH100, BH101	Site coverage, based on 2015 analysis results.
BH102/MW102	As above and to better understand groundwater elevation/gradient.
BH103, BH104	Site coverage, based on 2015 analysis results.
BH105/MW105	As above and to better understand groundwater elevation/gradient.
BH106 to BH114	Site coverage, based on 2015 analysis results.
BH115/MW115	As above and to better understand groundwater elevation/gradient.
BH116, BH117	Site coverage, based on 2015 analysis results.

Positions of boreholes were also influenced by Site operational concerns and the presence of underground utilities. Three attempts were made at borehole BH07 and as a result, soil sample identifiers include BH07, BH07A and BH07B. All three locations were located within a one metre radius and the data is considered representative of one borehole location.

4.3 Soil Assessment Methodology

The soil assessment was completed in August 2015 and January and February 2020 and the methodology is summarised below:

Table 8 Soil Assessment Methodology

Activity	Details
Service Clearance	Prior to the drilling, borehole locations were checked for underground services by a Telstra accredited service locator using radio-detection and with reference to utility plans obtained through the Dial-Before-You-Dig service.
Surface Samples	Surface samples were collected by stainless steel hand-trowel and placed into snap-lock plastic bags.

Activity	Details
Drilling Method & Soil Sample Collection	Boreholes were initially drilled by hand auger to approximately 1 m bgs to reduce the risk of contact with underground services. A Geoprobe™ drill rig was used to complete the boreholes by continuous push tube methodology. This enables the collection of relatively undisturbed soil cores within clear, polyethylene (PET) tubes. Samples are collected from the PET tube. Where possible, the push tubes were completed into natural soils. Four boreholes (BH06, BH15, BH113 and BH116) met refusal or were terminated in fill material due to obstructions (e.g. buried concrete slabs) or the potential presence of services. There was minimal to no push tube sample recovery in granular/gravelly fill material in seven boreholes (BH17, BH105, BH106, BH107, BH109, BH110 and BH115), likely due to larger diameter objects obstructing the PET tube. In multiple instances, solid stem auger (SSA) drilling was required to penetrate blocky fill materials. Soil samples were collected directly from the hand auger cutting head, push tube cores and the leading flight of the SSA, near the cutting head. Borehole advancement methodology is provided on the logs in **Appendix F**.
Soil logging	Soil logging was in general accordance with the Unified Soil Classification System.
Soil Sample Collection For Analysis	The soil samples were collected into laboratory-prepared glass jars with Teflon-lined lids, which were filled to minimise headspace and placed in an insulated cooler containing crushed ice. Soil samples for asbestos analyses were collected into snap-lock plastic bags. All soil samples were collected by gloved hand. A new pair of nitrile gloves was worn for each sample collection event.
Field Screening	Soil sub-samples were placed in snap-lock plastic bags and the headspace screened in the field for volatile organic compounds (VOCs) using a calibrated Photoionisation Detector (PID) equipped with a 10.6 eV lamp. The PID screening results are provided on **Table 1** and the borehole logs. Calibration details are provided in **Appendix C**.
Decontamination	Sampling equipment was decontaminated between boreholes by brushing away extraneous materials, washing with phosphate free detergent, followed by a rinse with potable water.
Quality Control (QC) samples	QC samples included the collection and analysis of field duplicate, equipment rinsate blank and trip blank samples (refer to **Appendix C**).
Spoil Disposal	Drilling spoil (from the monitoring wells) was placed into 205 litre drums and appropriately disposed off-site.

4.4 Groundwater Assessment Methodology

The groundwater assessment methodology is summarised below:

Table 9 Groundwater Assessment Methodology

Activity	Details
Well Construction and Installation	Monitoring wells were constructed from Class 18 uPVC 50 mm outside diameter machine threaded riser and slotted (0.5 mm) casing. After completion of the push tube borehole and logging of encountered conditions, including measurement of the water level in the borehole, the borehole was re-drilled with hollow stem augers (in 2015) and SSA (in 2020). The monitoring well materials were then assembled and placed into the annulus of the hollow flight auger. Graded filter sand was added to approximately 0.5 m above the top of the screened interval and a minimum 0.5 m layer of hydrated bentonite seal was added above the filter sand. The hollow flight augers were carefully removed as the sand and bentonite were added to the construction. For the SSA boreholes, monitoring well materials were placed in the reamed borehole. The wells were typically installed with 3 m long screens, targeting the first encountered groundwater strike. The wells were finished with steel road box covers. Well construction details are provided in **Appendix F**.
Well Development	The wells were developed as soon as practicable after installation using low-flow pumping (2015) and high flow pumping (2020), to promote connectivity with the aquifer. Geochemical parameters (temperature, electrical conductivity, redox potential, dissolved oxygen and pH) were measured by a calibrated water quality meter (WQM) during development. Development continued until the geochemical parameters stabilised and the water became clear (refer to **Table 2** in **Appendix B**). Field worksheets and calibration records for the WQM are provided in **Appendix C**.
Survey	Monitoring well locations and the elevation of the top of the casings were recorded by appropriately qualified surveyors (refer **Appendix C)**. The survey also captured all the borehole locations.
Well gauging	The standing water level (SWL) in all monitoring wells was measured using an electronic water/oil interface meter, which was also suitable for detecting light non-aqueous phase liquid (LNAPL). The measurements were taken on the same day and in as close succession as possible to minimise temporal variation. Gauging was completed prior to purging and the data is presented on **Table T2** in **Appendix B**.
Well purging	Monitoring wells were purged using low flow sampling equipment. Geochemical parameters were measured by a calibrated WQM and the SWLs were measured by the interface probe during purging. Purging continued until the geochemical parameters and SWL stabilised. The stabilised geochemical parameters are provided on **Table 3** in **Appendix B**. Field worksheets and calibration records for the WQM are provided in **Appendix C**. The field measurements in the 2020 sampling event were recorded on an electronic tablet and the data output is provided.
Groundwater sampling	Monitoring wells were sampled using low flow sampling equipment. The groundwater samples were collected after the geochemical parameters had stabilised to within approximately 10% in three successive readings.

Activity	Details
Decontamination	Decontamination of the interface meter probe and sampling pump was undertaken using a phosphate free detergent solution followed by a double rinse with laboratory supplied deionised water. Dedicated sampling tubing was used to reduce the risk of cross contamination. Two rinsate blank samples were collected from the interface meter probe head following decontamination procedures. Two field prepared trip blanks (TB) were utilised during sample holding and transport, to assess for potential cross-contamination.
Purge Water Disposal	Purged water was appropriately disposed off-site.

4.5 Landfill Gas Screening Methodology

Screening for landfill ground gases was undertaken with a calibrated landfill gas meter. The methodology included:

- Measurements were taken above each monitoring well before removing the expandable cap and then at the top of the pipe immediately after removing the expandable cap. Measurements at each monitoring well were taken for a minimum of four minutes.
- Ambient air measurements were taken within Units 2, 3, 7 and 9 for a minimum of three minutes. The units had been closed overnight and were accessed via a small fire door. The measurements were taken approximately 250 mm above the concrete floor in the (approximate) centre of each unit, as soon as possible after opening the building.

Field screening results are discussed in **Section 7.2**. Field worksheets are included in **Appendix C**. Screened gases included methane (CH_4), hydrogen sulphide (H_2S), carbon dioxide (CO_2), carbon monoxide (CO) and oxygen (O_2).

4.6 Laboratory Analysis

ALS Environmental (ALS) was the primary laboratory. Envirolab Services Pty Ltd (Envirolab) was the secondary (or 'check') laboratory.

Soil samples selected for analysis was primarily based on:

- The different types of fill materials encountered.
- Material immediately beneath building slabs.
- The presence of odours and/or unusual colouration and/or elevated PID readings.
- The depth to encountered groundwater during drilling.
- Site features (e.g. decommissioned UST).
- In the 2020 program, fill materials to approximately 2 m bgs were targeted, representing an inferred depth of excavation works during Site redevelopment. Wherever possible, PET tube samples were selected for chemical analyses.

Groundwater samples were analysed for TRH, BTEXN, PAH, metals and VHC in 2015. Based on the 2015 results, no PAH analyses were completed in the 2020 groundwater monitoring event (GME).

Table 1 in **Appendix B** provides a summary of the soil and groundwater and quality control samples analysed and the rationale for sample selections for analysis. Laboratory certificates are provided in **Appendix G**.

5.0 Quality Assurance and Quality Control

5.1 QA/QC Data Validation

The QA/QC program implemented for the investigation was completed in accordance with the seven-step DQO process, as described in **Appendix C**. The achievement of the project DQOs was demonstrated by reference to the DQIs.

5.2 Data Useability

The data validation procedure employed in the assessment of the field and laboratory QA/QC data indicated that the reported analytical results are representative of the soil and groundwater conditions at the sample locations and that the overall quality of the analytical data produced is acceptably reliable for the purpose of this investigation.

6.0 Assessment Criteria

6.1 Soil

The following guidelines were adopted for evaluation of the soil analysis results:

- NEPC, 1999. *National Environment Protection (Assessment of Site Contamination) Measure (as amended 2013)* (ASC NEPM 2013).
- CRC CARE (2011). *Health Screening Levels for petroleum hydrocarbons in soil and groundwater.* Technical report series No. 10. Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE). Friebel, E. and Nadebaum, P., 2011.

Application of these guidelines is summarised below.

6.1.1 Health Investigation Levels (HILs)

The HILs described in the ASC NEPM 2013 are scientifically based, generic assessment criteria designed to be used in the first stage of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use settings, as summarised below:

Table 10 Health Investigation Level Summary

HIL	Land Use
HIL-A	Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools and primary schools.
HIL-B	Residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats.
HIL-C	Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools. and footpaths.
HIL-D	Commercial/industrial such as shops, offices, factories and industrial sites.

6.1.2 Health Screening Levels (HSLs)

The HSLs presented in the ASC NEPM 2013 and CRC CARE 2011 were developed to be protective of human health by determining the reasonable maximum concentration from site sources for a range of situations commonly encountered on contaminated sites. The HSLs apply to the same land use settings as for the HILs, although the values for residential A and B are combined and include consideration of soil texture and depth to source to determine the appropriate soil, groundwater and soil vapour criteria for the exposure scenario. The HSLs are summarised on the following table:

Table 11 Health Screening Level Summary

HSL	Land Use	Soil Depths	Soil Types (all land uses)
HSL-A HSL-B HSL-C HSL-D	See **Table 10**	0 m to <1 m 1 m to <2 m 2 m to <4 m 4 m +	**Sand** (sand, sandy clay, sandy clay loam, sandy loam, loamy sand, loam, sandy silt and silty sand) **Silt** (silt, silty clay and silty clay loam) **Clay** (clay, clay loam and silt loam)
Shallow Trench Worker	Utility/intrusive maintenance workers involved in shallow trenches (to a maximum depth of 1 m)	0 m to <2 m 2 m to <4 m 4 m +	

6.1.3 Aesthetics

The ASC NEPM 2013 and CRC CARE 2011 do not provide numeric aesthetic guidelines however, the ASC NEPM states that "*site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity*".

Aesthetic issues generally relate to the presence of low-concern or non-hazardous inert foreign material (refuse) in soil or fill resulting from human activity. Issues that may require further assessment could include:

- Highly malodorous soils or extracted groundwater.
- Hydrocarbon sheen on surface water.
- Discoloured chemical deposits or soil staining with chemical waste.
- Presence of putrescible refuse materials that may generate hazardous levels of methane.

6.1.4 Ecological Investigation Levels (EILs)

The EILs presented in the ASC NEPM have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and land use scenarios, generally apply to the top 2 m of soil and apply to three generic land use settings:

- Areas of ecological significance (e.g. National and State Parks, wilderness areas and designated conservation areas). A 99% level of species protection.
- Urban residential areas and public open space, which is broadly consistent with HIL A, HIL B and HIL C land use scenarios. An 80% level of species protection.
- Commercial and industrial. A 60% level of species protection.

Generic EILs are available for arsenic, DDT (an OCP compound) and naphthalene. Site specific EILs can be calculated (via the background concentration plus the added contaminant limit method) for chromium, copper, nickel and zinc.

Fill material with variable concentrations of metals has been identified across the Site to an approximate average depth of 3.5 m, therefore background concentrations would be near impossible to calculate. As the Site will continue to be a commercial/industrial facility and it is expected that fill material will be capped and future landscape areas will comprise imported soil, Site-specific and generic EILs have not been considered by AECOM to assess the fill material.

6.1.5 Ecological Screening Levels (ESLs)

The ESLs presented in the ASC NEPM are based on a review of Canadian 'risk-based' guidance for petroleum hydrocarbons in coarse and fine grained soils. AECOM notes that the ASC NEPM derived values are moderate to low reliability and that:

- ESLs apply from the surface to 2 m depth, corresponding to the root zone and habitation zone of many species.
- ESLs only apply to coarse and fine grained soils. Where soil texture is not known, a conservative approach should be adopted (i.e. assume coarse soils). AECOM notes that Fill materials may comprise both coarse and fine grained soils and non-soil material.
- Consideration should be given to the risk of material being excavated and causing an exposure risk.

6.1.6 Management Limits (MLs)

The MLs presented in the ASC NEPM reflect the nature and properties of petroleum hydrocarbons, such as:

- The formation of observable LNAPL.
- Fire and explosion hazards.

- Effects on buried infrastructure (e.g. penetration of, or damage to, in-ground services).

Application of the MLs requires consideration of site-specific factors such as the depth to building basements and services and depth to groundwater. The ASC NEPM notes that the MLs may have less relevance at operating industrial sites, which have no or limited sensitive receptors in the area of potential impact.

6.1.7 Asbestos

The ASC NEPM provides HSLs for asbestos, which are the same as the investigation criteria in WA DOH 2009. The HSLs relate to the same land use scenarios as the HILs and HSLs noted in **Section 6.1.1**. In summary, the ASC NEPM provides the following information on asbestos:

- Bonded ACM: comprises asbestos containing material that is in a sound condition, although possibly broken or fragmented and where the asbestos is bound in a matrix such as cement or resin. Bonded ACM is restricted to material that cannot pass through a 7 mm x 7 mm sieve. This sieve size equates to the approximate thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and hence potential for fibre release. Bonded ACM is equivalent to 'non-friable' asbestos in Safe Work Australia (2016). Per the ASC NEPM, bonded ACM in sound condition represents a low human health risk.
- Fibrous Asbestos (FA): comprises friable asbestos material and severely weathered asbestos cement sheet, insulation products and woven asbestos material. FA can be broken or crumbled by hand pressure. This material is typically unbonded or was previously bonded and is now significantly degraded. FA is equivalent to friable asbestos in Safe Work Australia (2016).
- Asbestos Fines (AF): includes free fibres, small fibre bundles and small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve. AF is equivalent to friable asbestos in Safe Work Australia (2016).

The ASC NEPM provides the following HSLs for asbestos contamination in soil for a commercial/industrial exposure scenario:

- Bonded ACM: 0.05% w/w.
- Friable ACM (FA and AF): 0.001 % w/w.
- All forms of asbestos: no visible asbestos in surface soils.

In the 2015 assessment, samples for asbestos were analysed by the absence/presence method and as such, results are not comparable to the HSLs. AECOM adopted the HSLs for the samples analysed in the 2020 investigation, which are presented on **Table 5** in **Appendix B**.

6.1.8 Waste Classification

The NSW EPA (2014) *Waste Classification Guidelines – Part 1: Classification of Waste* were utilised for fill or soil materials that may require disposal to landfill. Waste classification criteria are shown on **Tables 4** and **7** in **Appendix B**.

6.1.9 Adopted Soil Assessment Criteria (SAC)

The following have been adopted as the soil assessment criteria.

Table 12 Soil Assessment Criteria

Guideline	Level Adopted	CoPC
ASC NEPM 2013	HIL-D	PAH, Metals, OCP, OPP, PCB, phenols
	Vapour Intrusion: HSL-D, Sand. Depth depends on sample collection depth	TRH, BTEXN
CRC CARE 2011	Direct Contact: HSL-D Direct Contact: Intrusive Maintenance Worker	

Guideline	Level Adopted	CoPC
ASC NEPM 2013	No visible asbestos in surface soils Bonded ACM Friable ACM	Asbestos

The following rationale was applied in the selection of these SAC:

- Commercial/industrial standards (HIL-D and HSL-D for industrial land use) were adopted as they are most applicable criteria for the proposed land use.
- For HSLs, sand was selected as the soil type, based on a conservative measure (i.e. significant volumes of highly variable fill material). Depth was based on sample collection depth.

The selected SAC are provided with the soil analysis results on **Tables 4** to **6** (**Appendix B**).

Table 4 includes the NSW EPA (2014) Waste Classification Criteria for General Solid Waste (GSW) and Restricted Solid Waste (RSW). The Waste Classification criteria, including Toxicity Characteristic Leachate Procedure (TCLP) tests, are presented on **Table 7**.

6.2 Groundwater

The sample analysis data has been compared to the following groundwater investigation levels (GILs) provided in the ASC NEPM:

- HSL D for vapour intrusion, sand aquifer, groundwater 2 to <4 m depth.
- Marine waters.

The following rationale was applied in the selection of the GILs:

- HSL-D was adopted for human health as they are most applicable to the Site.
- Sand was selected as the soil type and depth to groundwater as 2 m to <4 m based on the presence of fill material and measurements.
- Marine water GILs were selected since groundwater may discharge to Alexandra Canal.

AECOM has adopted the high reliability default guideline values (DGV) for marine water with a 95% level of species protection for cadmium and nickel provided in the Australian and New Zealand Guidelines for fresh and marine water (2018).

Given that the Site is located in an area where abstraction of groundwater for drinking purposes is banned, assessment of results to the drinking water GILs have not been considered. The Drinking Water Guidelines are included on **Table 8** for reference purposes.

The GILs and the groundwater sample analysis results are provided on **Table 8** (**Appendix B**).

7.0 Results

7.1 Soil

7.1.1 Fill Materials

Fill materials were logged at all boreholes completed. In the boreholes where the fill material was penetrated, it was logged between 1.5 m (BH100) and 5.1 m thick (BH110). Based on the logged conditions, it is inferred that fill material extend to an average of 3.5 m bgs across the Site. Given the Site is approximately 3.45 ha, a preliminary fill volume is in the order of 120 000 m^3.

Fill materials were variable in composition although typically comprised mixtures of sand, silt and clay with inclusions of sandstone, concrete, glass, brick, ash, slag, terracotta, porcelain, ceramics, metal fragments and road-base gravel. Material logged as 'ironstone' gravel (red to orange gravel, approximately 10 to 20 mm diameter) were present and it is considered these may represent foundry/casting sands. Anthropogenic inclusions were logged in all boreholes. Selected photographs showing the mixed fill material retrieved during sampling are shown in **Appendix F**.

Review of the borelogs, for locations that penetrated the fill material, indicated that:

- Ash was logged at 14 locations.
- Slag was logged at all locations except BH01, BH100, BH103 and BH104.
- Ironstone gravel was logged at all locations except BH02, BH05, BH21 and BH104.
- Metal waste was logged at 17 locations.
- Fragments of probable ACM were observed in BH07, BH21 and BH22 and ground surface adjacent to Unit 9.
- Buried concrete (slabs) were encountered at BH01, BH02, BH14, BH15 and BH108.
- Potential indicators of putrescible waste were observed at BH105 (bone fragment) and BH101 (cotton buds).

Based on the logged conditions, **Figure 12** in **Appendix A** provides inferred cross sections of the Site subsurface. Due to the heterogeneity of the fill material, no distinction between 'fill-types' has been undertaken.

A summary of the fill samples analysed and their description is presented on **Table 1** in **Appendix B**.

7.1.2 Natural Soil and Bedrock

Natural soils were logged to comprise sandy clay, clay, silty clay, silty sand and sandy silt. In locations where organic fibres were logged to be present in natural soil, this represents the presence of decomposing vegetation matter (i.e. peat and/or peat-like material).

Bedrock was not encountered in the boreholes completed.

7.1.3 Soil Odours and VOC screening

Hydrogen sulphide (H_2S) odour was noted in natural material in the many of the boreholes, sometimes logged as 'organic odour', suggesting the presence of ASS rather than hazardous ground gas associated with landfill. PID readings in samples with H_2S odours were between 0 and 390 ppm (BH09_4.6 m). Concentrations of TRH, BTEXN, phenols and VHC were below the laboratory limit of reporting (LOR) in this sample, indicating that the H_2S odour and/or high moisture content in the soil sub-samples may have been affecting the PID.

Odours were noted at the following locations during the 2015 investigation:

Table 13 Soil Odour & VOC Measurements

Location	Odour	PID (ppm)
BH04	Mild hydrocarbon (HC) odour in fill at 0.5 m	0.5
BH11	HC in sandy silt	0.5
BH16	Possible HC at base of fill	2.1
BH17	Slight HC in Fill at 2.7 m	15.2
BH21	Chemical odour noted from 1 m (odour type not specified)	0.3

No odour observations of fill materials were completed in 2020 due to personnel protective equipment (respirators equipped with P2 and organic cartridges). The maximum measured concentrations of VOC in the screened soil-subsamples in the 2020 investigation were:

- Fill materials: 3.8 ppm at BH108.
- Natural soil: 3.2 ppm at BH106.

7.2 Landfill Gas

Field measurements are summarised in the following tables. To provide a preliminary screening assessment of the field data, reference was made to the NSW EPA (2019) *Guidelines for the Assessment and Management of Hazardous Ground Gases*. Section 3.6.2 of the NSW EPA (2019) Guidelines refer to the NSW EPA (2016a) *Environmental Guidelines: Solid Waste Landfills*, which provide the following criteria for gas management:

- Surface emission criteria: the threshold level for further investigation and corrective action is 500 ppm v/v methane at any point on the landfill surface for intermediate and finally-capped areas.
- Gas accumulation criteria, enclosed structures: the threshold level for further investigation and corrective action is detection of methane at concentrations above 1 % (v/v).

Measurements taken within the units on 21 February 2020 are summarised below:

Table 14 Ground Gas Measurements in Ambient Air

Unit	Minutes	CH_4 (% v/v)	H_2S (ppmv)	CO_2 (% v/v)	O_2 (% v/v)	CO (ppmv)
2	0	0	0	0.1	21	0
	4	0	0	0.1	21	0
3	0	0	0	0.1	21	0
	4	0	0	0.1	21.1	0
7	0	0	0	0.1	20.8	0
	4	0	0	0.1	20.8	0
9	0	0	0	0.1	21	0
	5	0	0	0.1	21	0

Methane (CH_4) was not detected by the landfill gas meter in the units measured. The field data for 21 February 2020 indicates that the ground gases investigated are unlikely to pose a constraint to Site redevelopment.

Measurements taken at the groundwater monitoring wells on 21 February 2020 are summarised below:

Table 15 Ground Gas measurements, monitoring wells

Location	Minutes	CH_4 (% v/v)	H_2S (ppmv)	CO_2 (% v/v)	O_2 (% v/v)	CO (ppmv)
MW01	Ambient, ground level (cap on)	0.1	0	0.1	21	1
	0 (cap removed)	0.6	0	0.9	19.8	0
	6	0.2	0	0.2	20.5	0
MW16	Ambient, ground level (cap on)	0	0	0.1	20.7	0
	0 (cap removed)	0	0	1.2	19.4	0
	3	0	0	0.1	20.6	0
MW17	Ambient, ground level (cap on)	0	0	0.1	20.7	0
	0 (cap removed)	0	0	4.2	15.4	0
	4	0	0	0.1	20.6	0
MW19	Ambient, ground level (cap on)	0	0	0.1	20.6	0
	0 (cap removed)	0	0	1.8	19.7	0
	6	0	0	0.1	20.5	0
MW21	Ambient, ground level (cap on)	0.1	0	0.1	20.7	0
	0 (cap removed)	0	0	0.1	20.5	0
	6	0	0	0.1	20.6	0
MW102	Ambient, ground level (cap on)	0	1	0.1	20.8	0
	0 (cap removed)	0	0	0.1	20.6	0
	4	0	0	0.1	20.7	0
MW105	Ambient, ground level (cap on)	0	0	0.1	21.1	0
	0 (cap removed)	0	0	0.4	20.3	0
	6	0	0	0.1	20.8	0
MW115	Ambient, ground level (cap on)	0	0	0.1	20.9	0
	0 (cap removed)	0.1	0	0.1	20.9	0
	6	0.1	0	0.1	20.8	0

The measurement data for 21 February 2020 indicate:

- Methane readings at the ground level, taken immediately above the monitoring wells prior to opening the caps, were 0 to 0.1 % v/v.
- The highest methane measurement for the air space within the monitoring well casings, 0.6 % v/v, was recorded at monitoring well MW01 upon opening the cap and reduced to 0.2 % v/v.

The monitoring well measurement data indicates that the ground gases investigated are unlikely to pose a constraint to Site redevelopment.

7.3 Groundwater

7.3.1 Groundwater Elevation

Groundwater gauging data are presented on **Table 2** and summarised below:

- The measured SWL in the groundwater monitoring wells in August 2015 was between 1.096 (MW01) and 3.16 metres below top of casing (m btoc) (MW16). This represented an average SWL of 2.35 m btoc, equating to 0.99 m AHD.

- The measured SWL in the groundwater monitoring wells in February 2020 was between 0.67 (MW01) and 2.749 m btoc (MW16). This represented an average SWL of 1.74 m btoc, equating to 1.39 m AHD.
- The August 2015 SWL and survey data were inconclusive with respect to identifying the groundwater flow direction. Groundwater was inferred to flow to the south or south east, towards Alexandra Canal.
- The February 2020 SWL and survey data generally indicated a south easterly to southerly flow direction. Data indicated the presence of mounding at MW115 and a low point at MW105, indicating a possible localised reversal of the gradient in the central portion of the Site. Additional monitoring data may be required to confirm the groundwater flow direction.

Groundwater elevation data for February 2020 is presented on **Figure 13** in **Appendix A**.

7.3.2 Geochemical Parameters

The stabilised groundwater geochemical parameters collected during the final purge volume are presented on **Table 3** in **Appendix B** and for February 2020 are summarised below:

- Dissolved oxygen: measurements were between 0 and 2.35 mg/L, indicating low oxygenated conditions.
- Electrical conductivity: measurements were between 485 and 3050 µS/cm, indicating fresh to brackish conditions.
- pH: measurements were between 6.54 and 7.51, indicating near-neutral conditions.
- Redox potential: measurements were between 32.4 and 316.4 mV, indicating a low redox potential.

7.3.3 Groundwater Observations

No LNAPL, unusual odours or colour were noted in the monitoring wells sampled (**Table 3, Appendix B**). A H_2S odour was noted at MW102 during purging and sampling.

7.4 Analysis Results

The soil sample analysis results are presented on **Tables 4** to **7** and the groundwater sample analysis results are presented on **Table 8** (**Appendix B**). For ease of reporting, the tables of results include CoPC for which there are current NSW EPA endorsed assessment criteria. The laboratory analysis reports are presented in **Appendix G** and contain all analysis results.

7.4.1 Soil

TRH, BTEXN

Seventy four samples were laboratory analysed. Concentrations of BTEXN and TRH were below the adopted HSL D for vapour intrusion in the samples analysed.

The concentration of TRH >C16-C34 (F3) exceeded the CRC Care HSL D for Direct Contact in BH21_0.7-0.8. The concentration of F3 in this sample was below the CRC Care criteria for direct contact by an intrusive maintenance worker (IMW).

Concentrations of TRH >C10-C16 (F2) and/or F3 and/or TRH >C34-C40 (F4) exceeded the ASC NEPM management limits (MLs) in three primary samples, including BH17_2.0-2.1, BH20_2.0-2.1 and BH21_0.7-0.8 (**Table 6**).

Concentrations of TRH F2 and/or F3 and/or F4 exceeded the ASC NEPM ecological screening levels in BH17_2.0-2.1, BH20_2.0-2.1 and BH21_0.7-0.8 (**Table 6**).

PAH

Eighty four samples were laboratory analysed and the results indicated:

- Concentrations of total PAH were variable and below the HSL D in the samples analysed.
- Concentrations of naphthalene were below the CRC Care direct contact criteria.

- Concentrations of benzo(a)pyrene toxicity equivalent quotient (B(a)P TEQ) were variable and four results were above the ASC NEPM HIL D. The detected concentration of B(a)P at borehole BH21_07-0.8 exceeded the ASC NEPM HIL D by more than 250%.

Six soil samples were re-analysed by the Toxicity Characteristic Leachate Procedure (TCLP) test method. The B(a)P did not appear to be leaching under acidic conditions (**Table 7**).

Metals

One hundred samples were laboratory analysed to evaluate concentrations of the suite of eight metals. Concentrations of metals in the soil samples analysed were variable and below the adopted SAC with the exception of lead.

Concentrations of lead exceeded the ASC NEPM HIL D (1500 mg/kg) in 46 samples. Of these 46 samples, 20 exceeded the ASC NEPM HIL D by more than 250% (i.e. exceeded 3750 mg/kg). All samples with lead concentrations above the HIL D were fill material.

Results of TCLP tests for metals (**Table 7**) indicated that fill materials spanned the waste categories provided in the NSW EPA (2014) Waste Classification Guidelines, including:

- General Solid Waste (GSW).
- Restricted Solid Waste (RSW).
- Hazardous Waste (HW).

The presence of asbestos would result in a dual classification. The chemical classification and special (asbestos) waste.

OCP, OPP, PCB

Nineteen samples were laboratory analysed. Concentrations of OCP, OPP and PCB were below the ASC NEPM HIL D in the samples analysed.

Phenols

Four soil samples were laboratory analysed. Concentrations of phenol compounds were below the ASC NEPM HIL D in the samples analysed.

VHC

Four soil samples were laboratory analysed. Concentrations of VHC were below the laboratory LOR in the samples analysed.

Asbestos

Forty four fill and two fragment samples were laboratory analysed for asbestos (**Table 5**, **Appendix B**). Asbestos was identified in nine samples from the 2015 investigation, as summarised below:

Table 16 Asbestos results

Sample	Laboratory Comment/Result
BH01_0.3-0.4	one loose bundle of friable asbestos fibres approximately 3 x 1 x 0.5 mm
BH03_1.0-1.2	several friable asbestos fibre bundles approximately 5 x 2 x 2 mm
BH07A_0.5-0.6	one loose bundle of friable asbestos fibres approximately 4 x 1 x 0.5 mm
BH21_0.7-0.8	Several pieces of heavily degraded and friable asbestos fibre board approximately 60 x 30 x 3 mm with soil debris containing several loose bundles of friable asbestos fibres approximately 2 x 1 x 0.5 mm
BH22_0.3-0.4	Two pieces of bonded asbestos cement sheeting approximately 45 x 35 x 5 mm, several pieces of friable asbestos cement sheeting approximately 4 x 4 x 1 mm
BH22_0.45	One piece of bonded asbestos cement sheeting approximately 90 x 60 x 5 mm
SS01	Two pieces of friable asbestos fibre board approximately 4 x 3 x 2 mm, several loose bundles of friable asbestos fibres approximately 2 x 1 x 0.5 mm

Sample	Laboratory Comment/Result
SS02	Four pieces of bonded asbestos cement sheeting approximately 40 x 40 x 5 mm, several pieces of friable asbestos cement sheeting approximately 7 x 6 x 4 mm, several loose bundles of friable asbestos fibres approximately 2 x 1 x 0.5 mm
SS04	Five pieces of bonded asbestos cement sheeting approximately 50 x 30 x 5 mm

Whilst quantification analyses were not undertaken in 2015, the presence of loose bundles of friable asbestos fibres suggests that concentrations of asbestos in soil (w/w%) may exceed the ASC NEPM HSL D.

Twenty eight samples of fill were analysed by the quantification method in the 2020 investigation. Two sample results exceeded the ASC MEPM HSL D for bonded ACM and eight samples exceeded the ASC NEPM HSL D for friable asbestos.

Asbestos was identified by laboratory analysis of samples from boreholes (and surface samples) located across the Site.

7.4.2 Groundwater

The following summary of results primarily relates to the February 2020 data, the most recent GME.

TRH, BTEXN

Eight groundwater samples were laboratory analysed. Concentrations of TRH and BTEXN were below the ASC NEPM HSL D, sand aquifer, 2-<4 m depth and below the ASC NEPM marine GIL. Data indicates a no apparent risk of vapour intrusion from groundwater.

PAH

Concentrations of PAH were below the laboratory limit of reporting (LOR) in the August 2015 GME. No PAH analyses were undertaken in February 2020 based on the 2015 results.

VHC

Eight groundwater samples were laboratory analysed. Concentrations of VHC were below the laboratory LOR. Data indicates no apparent risk of vapour intrusion from groundwater.

Metals

Eight groundwater samples were laboratory analysed. Concentrations of metals were below the ASC NEPM marine GIL or ANZG DGV, with the exception of:

- Copper: concentrations at MW16 (231 µg/L), MW17 (32 µg/L) and MW19 (247 µg/L) exceeded the ASC NEPM marine GIL of 1.3 µg/L. It is noted that these concentrations above the ASC NEPM marine GIL were (typically) an order of magnitude higher in the 2020 GME, which maybe related to the disturbance of the subsurface associated with the motorway works.
- Lead: the concentration at MW16 (8 µg/L) and MW19 (5 µg/L) exceeded the ASC NEPM marine GIL of 4.4 µg/L. The location of MW19 suggests an off-Site source.
- Nickel: the concentration at MW19 (294 µg/L) exceeded the ANZG DGV of 70 µg/L. The location of MW19 suggests an off-Site source.
- Zinc: concentrations at all wells except MW102 (59 to 3360 µg/L) exceeded the ASC NEPM marine GIL of 15 µg/L. Data indicate an off-Site source or regional, diffuse contamination source issue.

It is noted there is no ASC NEPM GIL or ANZG marine DGV for arsenic. The highest dissolved arsenic concentration was reported at monitoring well MW19, indicating an off-Site source.

8.0 Discussion

8.1 Proposed Redevelopment

Information supplied by GPSA (to date) indicates that the proposed redevelopment will comprise free standing warehouses, internal roadways and car-parks and associated landscaped areas. GPSA has advised that:

- The warehouse buildings would comprise ‘slab-on-ground’ construction. The concrete slabs would be supported by piers installed into geotechnically appropriate material at depth.
- No basements or sunken-loading docks are contemplated however, a partial undercroft may be incorporated into the buildings.
- Installation of sub-surface utilities (e.g. hydrant ring-mains, sewer, electricity etc) will be required.

8.2 Soil Impact

The data obtained from this investigation identified lead, B(a)P TRH and asbestos impacts in fill materials. The contaminants are non-volatile and are unlikely to present a vapour inhalation risk and once the Site is redeveloped, the floor slabs and hardstand roadways should provide an effective barrier to the impacted materials. Controls will be required to manage potential exposure to asbestos, lead and B(a)P impacts during redevelopment and subsequent operational phase.

Given the volume of fill material inferred to be present and the variability in contaminant concentrations, it is considered that excavation(s) into fill materials to remove contaminant concentrations exceeding commercial/industrial land use criteria are unlikely to be ‘validated’.

With respect to the proposed redevelopment and based on the available data, AECOM considers that the Site can be made suitable for commercial/industrial land use however, implementation of control/management mechanisms will be required. These are envisaged to include but not necessarily be limited to:

- Demolition and removal of existing buildings and pavements under a Construction Phase Site Management Plan (CSMP) for contamination. The CSMP would also need to address contamination-related risks associated with earthworks to prepare the Site surface for redevelopment and include contingency for the management of expected (e.g. asbestos) and unexpected finds (e.g. USTs encountered, unusual conditions, buried drums and other wastes etc). The CSMP would include information that is typically presented in a Remedial Action Plan (RAP).
- All excavation works undertaken within or on fill material must be supervised by Class A licensed asbestos contractors, including appropriate air monitoring for airborne asbestos fibres.
- Given the variability in composition and contaminants concentrations in the fill materials, they should be retained on Site wherever possible. Surplus fill materials should be appropriately disposed off-site in accordance with NSW EPA (2014) Waste Guidelines. Fill materials may require stabilisation prior to being acceptable for landfill disposal.
- Survey of Site surface after earthworks to record the level (m AHD) of residual fill materials and the visual marker layer.
- Placement of non-contaminated materials such as Virgin Excavated Natural Material (VENM) or concrete hardstand (and pavement sub-grade) above the visible marker layer and residual fill material. The ‘barrier’ may need to be in the order of 0.3 to 0.5 m thick. Surveying should be completed to confirm the depth of cover.
- Excavations for the installation of services should be lined with geofabric and backfilled with VENM, to minimise potential exposure to construction workers and future maintenance workers. All service trenches should be surveyed, to allow appropriate long term management.
- Landscape areas should have a minimum cover of 0.5 m of VENM. A visible marker layer should separate the residual fill materials and the VENM.

- A 'validation' report prepared by an appropriate consultant, verifying that the CSMP was adhered to and including all relevant sample analysis data, air monitoring records, waste disposal documentation (as applicable), survey data and photographic evidence.
- Preparation and adherence to an Operational-phase or Long Term Site Environmental Management Plan (LTSEMP).

8.3 Groundwater Impact

The current data have identified high concentrations of zinc, nickel and copper in groundwater and to a lesser extent, lead and arsenic. Given the high concentrations of lead in fill, it does not appear to be significantly leaching into groundwater. Concentrations of dissolved metals are inferred to be related to an off-Site source or regional, diffuse contamination source issue.

B(a)P has not been detected in groundwater at concentrations above the laboratory LOR, indicating a low leaching potential. AECOM notes that PAH compounds typically have low solubility.

Volatile compounds such as BTEXN, short chain-length TRH and VHC have not been identified in groundwater to date, indicating a low risk of vapour intrusion.

Based on the current data and given consideration of the ban on domestic use of groundwater, the presence of metals impacts is not considered to affect Site suitability for continued commercial/industrial land use. Management of potential exposure to groundwater should be documented in the CSMP and LTSMP.

8.4 Conceptual Site Model

The purpose of a Conceptual Site Model (CSM) is to assess the risks potentially present at the Site by identifying and describing contaminant sources, transport mechanisms, exposure pathways and sensitive receptors associated with the Site. The CSM is based on review of background data and the results of this investigation and is summarised below:

Table 17 CSM

Consideration	Details
Site Setting	• The Site is located in a commercial/industrial area • Current and proposed use is commercial/industrial
Site History	• Detailed history of Site operations and processes not known. USTs known to have been present • Site extensively filled • Former landfill facility and smelter adjacent to Site
CoPC	• CoPC are presented in **Section 4.1** • Based on sample analysis data, principal contaminants of concern are lead, B(a)P, asbestos and long chain-length TRH in soil. • Based on sample analysis data, principal contaminants of concern are zinc, copper, nickel and lead in groundwater.
Sources of Contamination	The following activities are known or suspected to have occurred: • Presence of fill materials. • Demolition of buildings. • Fuel storage, below ground. AECOM notes that the specific locations of former features and nature of activities undertaken is not known. This ESA targeted known former contaminant sources and included grid-based sampling.

Consideration	Details
Groundwater	Site groundwater conditions are summarised below: • Groundwater was present at approximately 0.6 to 2.75 m bgs, an average of approximately 1.7 m bgs (or 1.39 m AHD). • Future redevelopment activities may intersect groundwater, hence, short term exposure (incidental ingestion by intrusive maintenance workers) is possible. • Elevation data generally indicates that groundwater flows towards Alexandra Canal. • Groundwater may be tidal and change flow direction depending on the tide. • The Site is located in an area where extraction of groundwater for domestic purposes is banned. • The former landfill adjacent to the Site may affect the groundwater gradient.
Extent of Soil Impacts	• Given the widespread occurrence of fill materials and variable composition, AECOM considers that the extent of impacts in fill materials are unlikely to be 'delineated'. • Natural soils have not been identified to be contaminated.
Extent of Groundwater Impacts	• No sheen, hydrocarbon odours or LNAPL were identified in the monitoring wells gauged and sampled. • Concentrations of some dissolved metals (mostly copper, nickel and zinc) exceeded the ASC NEPM GILs for the protection of marine water aquatic ecosystems.
Landfill Ground Gases	• Screening for hazardous ground gases in monitoring wells and within buildings did not identify concentrations of CH_4 or H2S considered to pose an unacceptable risk.
Potential transport mechanisms and exposure pathways	• Asbestos in Soil: A complete pathway would exist where soil disturbance/excavation is undertaken without implementation of appropriate control measures, including personnel protective equipment (PPE). A complete pathway would exist where there is exposed fill material at the surface and when personnel utilise these areas. This should be documented and managed according to a management plan. • Lead in Soil: there is a potential for direct dermal contact and/or ingestion of lead in soil however, this is considered to be low for the current and proposed Site use. Adoption of management measures would be required during Site redevelopment plus implementation and adherence to a LTSMP after Site redevelopment. • Hydrocarbons and PAH in soil: as per lead and metals in soil. Volatile hydrocarbons (i.e. BTEXN and TRH C6-C10) have not been identified to date. Based on the available soil and groundwater analysis data, the vapour Inhalation risk is currently considered to be low. • Metals in Groundwater: potential direct dermal contact and incidental ingestion by future construction workers and/or subsurface maintenance workers. Risk considered to be low and could be managed by adoption of appropriate control mechanisms and/or PPE.
Potential Receptors of Contamination	Potential human receptors: • Current Site workers, contractors and visitors. The current risk is considered to be low given that the Site is mostly paved. • Construction and maintenance workers during redevelopment. • Future Site workers, contractors and visitors. • Occupants of nearby commercial/industrial premises during Site redevelopment. Potential environmental receptors: • Fauna in groundwater beneath the Site. • Groundwater migrating to the Alexandra Canal.

9.0 Conclusions

Based on the available data, the following conclusions are made:

- With respect to the proposed redevelopment, AECOM considers that the Site can be made suitable for commercial/industrial land use however, implementation of control/management mechanisms will be required.
- The control mechanisms would include the preparation and adherence to a Remedial Action Plan (RAP), Construction-phase Site Management Plan (CSMP) and after redevelopment, a Long Term Site Environmental Management Plan (LTSEMP).

10.0 References

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Appendix C

Data Validation

1.0 Introduction

This appendix describes the data quality objectives (DQOs) and data quality indicators (DQIs) developed for the Phase I and II ESA (ESA).

2.0 Data Quality Objectives

The seven-step DQO approach, endorsed in the NSW EPA (2017) *Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd Edition)* were adopted. The DQOs have set quality assurance and quality control parameters for the field and laboratory programs to ensure data of appropriate reliability were used to assess the environmental condition of the Site, as summarised in the following sections.

Step 1: State the problem (project objective)

The ESA was undertaken to assess Site suitability for commercial/industrial land use.

Step 2: Identification of the goals (decisions)

Project decisions include:

- Does the fill or natural soil contain concentrations of the contaminants of potential concern (CoPC) above NSW EPA endorsed assessment criteria for commercial/industrial land use.
- Does the groundwater contain concentrations of the CoPC above NSW EPA endorsed assessment criteria for commercial/industrial land use.
- Is there sufficient information on the distribution and characteristics of soil, fill and groundwater to properly characterise contamination at the Site.
- Are the data reliable.

Step 3: Identify inputs to the Decision

The primary inputs required to make the above decisions listed in Step 2 are as follows:

- Defining sample locations at the Site through survey data, maps and plans. Survey data is presented in this Appendix.
- Reviewing Site history and condition data (i.e. geology, hydrogeology, soil, previous reports etc).
- Using appropriate sampling techniques, to obtain samples representative of Site conditions.
- Using appropriate analytical techniques (i.e. NATA certified) with limits of reporting (LOR) below the adopted assessment criteria.
- Appropriate NSW guideline documents.
- Concentrations of CoPC in different fill/soil types and groundwater.
- Quality Assurance and Quality Control (QA/QC) data.

Step 4: Define the study boundaries

The study boundaries included:

- The Site boundary as presented on Figure 2.
- Subsurface boundaries included assessment to at least 0.5 m into natural soils (wherever possible) and shallow groundwater.
- Constraints related to the presence of subsurface utilities and Site operational requirements.

Step 5: Develop a decision rule

The following decision rules were applied:

- If it is determined that the data generated through this investigation is reliable and suitably characterises soil and groundwater contamination, it will be compared against the adopted assessment criteria.
- If comparison of the data generated through this investigation meets the adopted assessment criteria, then Site will be considered to be generally suitable for commercial/industrial land use.
- If it is determined that the data generated through this investigation is not reliable and/or does not suitably characterise soil and groundwater contamination as required, then further investigations may be recommended prior to comparison against the site assessment criteria and/or the development of a management and treatment options.

Step 6: Specify Limits of Decision Error

The acceptable limits on decision errors is described by the DQIs adopted for both the fieldwork and laboratory analysis. A description of the DQIs and assessment of attainment of the DQIs is presented in this Appendix. The DQIs include Precision (P), Accuracy (A), Representativeness (R), Comparability (C) and Completeness (C), collectively known as PARCC parameters.

Step 7: Develop the Plan for Obtaining the Data

The collection of data was optimised by the development of an appropriate sampling and analytical strategy. Attainment of the DQOs has been assessed by reference to the DQIs, presented below.

3.0 DQIs

The DQIs (PARCC parameters) have been established to set acceptance limits on field and laboratory data. The DQIs are presented in Table 1.

Table 1 Data Quality Indicators

DQI	Field	Laboratory	Acceptable Limits
P	SOPs[1] appropriate and complied to. Collection of Intra- and Inter-laboratory duplicate samples	Analysis of: Intra-laboratory duplicate samples (1 in 20 samples) Inter-laboratory duplicate samples[4] (1 in 20 samples) Laboratory duplicate samples	 RPD of < 30% RPD of < 30% Result < 10xLOR: no limit Result 10-20xLOR: 0-50% Result >20xLOR: 0-20%
A	SOPs appropriate and complied with Collection of rinsate blanks	Analysis of: Field/trip blanks (1/day) Method blanks Matrix spikes Surrogate spikes Laboratory control spikes Laboratory prepared spikes	 Non-detect for CoPC Non-detect for CoPC Laboratory specific limits[3] Laboratory specific limits [3] Laboratory specific limits [3] Laboratory specific limits [3]
R	Appropriate media sampled	All critical samples analysed per the sampling and analytical strategy	Appropriate samples analysed
C	Sample SOPs used on each occasion Experienced sampler Same types of samples collected	Same analytical methods used Sample LOR[2] Same laboratories (NATA accredited) Consistent reported units of measurement	As per ASC NEPM (2013) < nominated criteria
C	All critical locations sampled All samples collected SOPs appropriate and complied with Experienced sampler Documentation correct	All critical samples analysed and for the CoPC Appropriate methods implemented Appropriate LORs Sample documentation complete Sample holding times complied	As per ASC NEPM (2013) < nominated criteria As per ASC NEPM (2013)

Notes: 1 = (AECOM) Standard Operating Procedures.
2 = laboratory limit of reporting (LOR).
3 = Reference will be made to the laboratory Analyte Specific Acceptance Criteria (ASAC), calculated on the basis of historical database (i.e. statistically derived limits. These are updated regularly and each laboratory report may have slightly different limits. The limits will be assessed on a batch by batch basis).
4 = referred to as Splits in this Appendix.

The following sections assess the achievement of the DQOs in consideration of the DQIs.

4.0 Data Evaluation

4.1 Field

Field Staff

All samples were collected by suitably qualified and experienced AECOM Environmental Scientists. Sampling was undertaken with reference to Standard Operating Procedures for each task and field briefs prepared by the project manager.

Soil Sampling

The adopted sampling methodologies are presented in the Report text.

Samples were collected by gloved hand, with a new pair of disposable gloves worn for each sample collection event. The samples were placed directly into laboratory prepared jars/containers with Teflon-lined lids, which were filled to minimise the headspace within the jars. Samples for asbestos analyses were placed into snap-lock plastic bags.

Soil sub-samples were collected and placed into snaplock plastic bags and the vapour headspace in the bag samples was measured in the field for volatile organic compounds (VOC) using a calibrated photoionisation detector (PID). The PID calibration record is included in this **Appendix** and the readings are presented in **Appendix F**.

Groundwater Sampling

Eight Class 18 (50 mm diameter) uPVC groundwater monitoring wells were installed. Preparation of the wells for sampling (i.e. development and purging) is discussed in the report. Groundwater geochemical parameters were measured by a calibrated water quality meter (WQM) during development and purging.

Sampling was completed by low flow methodology once geochemical parameters stabilised. Samples were collected by gloved hand, with a new pair of disposable gloves worn for each sample collection event.

Calibration records for the WQM and the field worksheets are provided in this **Appendix**.

Sample Handling & Preservation

The soil samples were placed immediately into laboratory prepared and supplied, acid washed and solvent jars with screw top Teflon-lined lids. Sample jars were filled so that no headspace remained. The groundwater samples were decanted immediately into laboratory prepared and supplied bottles. All samples were placed in a chilled, insulated cooler (*i.e.* esky) with crushed ice between sampling and analysis.

Samples were preserved for the various contaminants of concern in accordance with the requirements of the ASC NEPM as detailed in Table 2:

Table 2: Sample Containment and Preservation

Matrix	Analyte	Container
Soil	All CoPC	250 mL glass jar, Teflon-lined plastic lids.
	Asbestos	Plastic snap-lock bags
Water	TRH C6-C10, BTEXN, VOC	4 x 40 mL glass vials with sulfuric acid preservative.
	TRH C_{10}-C_{40}, PAH	100 ml glass amber bottle, unpreserved
	Dissolved metals	60 ml plastic with nitric acid preservative and field filtered (0.45µm Inline™ filter)

Sample numbers, depths, preservation and analytical requirements were recorded on the chain of custody (CoC) documentation, which accompanied the samples to the laboratory. Signed copies of the COCs are provided with the laboratory reports in **Appendix G**.

Calibration

The field equipment (monitors, meters etc) was calibrated by the supplier(s) prior to use by AECOM. All calibration results were satisfactory. Calibration records are included in this **Appendix**.

Field Duplicates

The purpose of field duplicate samples is to estimate the variability of a given characteristic or contaminant associated with a population (*i.e.* measure the precision of the sampling, sample preparation and sample analysis process). Inter-laboratory duplicates (Split duplicates) are utilised to assess the accuracy of the primary laboratory data.

The field duplicated soil samples were obtained from similar soils of an identical depth and immediately adjacent to the primary sample by placing approximately equal portions of the primary sample into two sample jars. Duplicated groundwater samples were collected by filling replicated sample jars from the low flow pump outlet tubing.

Duplicate samples were labelled to conceal their relationship to the primary sample from the laboratory and the key to the duplicate samples was recorded in the field note book.

It is common that significant variation in duplicate results is often observed (particularly for solid matrix samples) due to sample heterogeneity and/or low reported concentrations near the laboratory limit of reporting (LOR). The overall precision of field duplicates (including Splits and laboratory duplicates) is assessed by their Relative Percent Difference (RPD), given by:

$$RPD = \frac{|C1-C2|}{(C1+C2)/2} \times 100$$

(where C1 = primary sample result
C2 = duplicate sample result)

The RPD between the primary and duplicated sample results have been compared to the acceptance criteria of < 30%. A summary of the primary and field duplicated sample results are presented on **Tables 4** and **6** (**Appendix B**). The rate of duplicate and split sample analyses is summarised on Table 3:

Table 3 Field Duplicate Summary

CoPC	Primary samples	Duplicate samples	Split duplicate samples
Soils		**(rate %)**	**(rate %)**
TRH, BTEXN	63	6 (9.5)	5 (8)
PAH	72	7 (9.7)	5 (7)
Metals	88	7 (8)	5 (5.6)
OCP, OPP	17	1 (5.8)	1 (5.8)
PCB	17	1 (5.8)	1 (5.8)
Asbestos	46	0	0
Phenols	3	0	1 (33)
VHC	3	0	1 (33)
Groundwater		**(rate %)**	**(rate %)**
TRH, BTEXN	13	0	2 (15)
PAH	13	0	2 (15)
Metals	13	0	2 (15)
VHC	13	0	2 (15)

The rate of duplicate and split sample analyses generally met the DQI of 1 in 20 primary samples (i.e. 5%). Where a small number of primary samples were analysed for a particular CoPC, Split duplicate samples were analysed in preference to duplicates to evaluate laboratory comparability. AECOM

considers that the rate of duplicate and split sample analyses is satisfactory for the purpose of this assessment.

The RPD of field duplicate and split samples met the DQI, with the following exceptions:

- BH03_1.0-1.2/QC111: elevated RPDs for PAH and metals are attributed to sample heterogeneity (fill material). The data are considered to be acceptably accurate.
- BH05_1.0-1.1/QC200: elevated RPDs for PAH and metals are attributed to sample heterogeneity (fill material). Elevated RPDs for PAH are also attributed to low detected concentrations. The data are considered to be acceptably accurate.
- BH07B_1.2-1.3/QC201: elevated RPDs for PAH and metals are attributed to sample heterogeneity (fill material). Elevated RPDs for PAH are also attributed to low detected concentrations. The data are considered to be acceptably accurate.
- BH09_4.0-4.2/QC101: elevated RPDs for metals are attributed to sample heterogeneity (fill material). The data are considered to be acceptably accurate.
- BH21_0.7-0.8/QC202: elevated RPDs for TRH are attributed to sample heterogeneity (fill material). It is noted the results were the same order of magnitude and confirmed the presence of impacts. The data are considered to be acceptably accurate.
- BH22_4.5-4.7/QC100: elevated RPDs for metals are attributed to low concentrations. The data are considered to be acceptably accurate.
- BH104_1.6-1.7/QC111: elevated RPD for TRH F3 is attributed to low concentrations. The data are considered to be acceptably accurate.
- BH106_0.2-0.3/QC100: elevated RPDs for PAH and metals are attributed to sample heterogeneity (fill material). The data are considered to be acceptably accurate.
- BH107_0.5-0.6/QC105: elevated RPDs for metals are attributed to sample heterogeneity (fill material) and/or low concentrations. The data are considered to be acceptably accurate.
- BH109_0.9-1.0/QC102: elevated RPDs for metals are attributed to sample heterogeneity (fill material). The data are considered to be acceptably accurate.
- BH113_0.2-0.3/QC106: elevated RPDs for metals are attributed to sample heterogeneity (fill material) and/or low concentrations. The data are considered to be acceptably accurate.
- BH114_0.45-0.55/QC114: elevated RPDs for PAH and metals are attributed to sample heterogeneity (fill material) and/or low concentrations. The data are considered to be acceptably accurate.
- MW01/QC200: elevated RPD for nickel is attributed to low detected concentrations. The data are considered to be acceptably accurate.
- MW102/QC306: elevated RPD for arsenic and nickel are attributed to low detected concentrations. The data are considered to be acceptably accurate.

AECOM concludes that the precision of the data is sufficient for the purposes of the project.

Decontamination and Rinsate Blanks

Soil samples were collected directly from the hand auger cutting head, push tube core or where unavoidable, lead auger (the tools). The tools were decontaminated prior to use and after each sampling location by brushing off adhered soil and then washing in potable water.

An oil water interface (IF) probe was used to obtain measurements of standing water levels and total well depths in the monitoring wells. The IF probe was decontaminated prior to use and between monitoring well locations by washing the IF probe head and tape in a phosphate free detergent solution, rinsing in potable water and drying with clean paper towel.

Low-flow sampling equipment (peristaltic pump) was used for groundwater sampling. New sample and pump tubing were used at each monitoring well location. The tubing was the only pump component to be in contact with groundwater and therefore decontamination was not required.

Rinsate samples were collected by pouring laboratory prepared deionised water over the decontaminated tools and IF probe head and collecting the 'rinse' into sample containers.

Analysis results for the soil rinsate samples are presented on **Table 9** in **Appendix B**. CoPC concentrations were below the laboratory LOR. AECOM considers that appropriate decontamination procedures were adopted.

Trip Blanks

A trip blank assesses the potential for cross contamination during transit from the Site to the laboratory. Samples are typically analysed for the same contaminants targeted as part of the assessment.

The results for the groundwater and soil trip blank samples (refer Table **8** and **9**, respectively) were less than the laboratory LOR and indicated that cross contamination was unlikely to have occurred during sample storage and transit.

4.2 Laboratory QA/QC

Laboratories

Samples were submitted to the following laboratories:

- ALS (primary laboratory, soil and groundwater samples): NATA accreditation number is 825 and its analytical procedures are based on established internationally-recognised procedures.
- Envirolab (secondary laboratory, groundwater samples): NATA accreditation numbers are 13535 and 1261 and its analytical procedures are based on established internationally-recognised procedures.

Analytical Methods

The laboratory analytical methods for the primary laboratories are summarised in Table 4.

Table 4: Analytical Methods

CoPC	Matrix	Method	LOR	Criteria
Metals	Soil	USEPA 6010 ICP/AES	0.1-5	>5
TRH (C6-C10)		USEPA 5030/8260 P&T/HS/GC/MS	10	n/a
TRH (>C10-C40)		USEPA 3510/8015 GC/FID	50-100	>100
PAH		USEPA 3510/8270	0.5	>0.5
BTEXN plus F1, F2		USEPA 5030/8260 GC/MS	0.2-1	>1
OCP, OPP		USEPA 8270B	0.05–0.2	>0.2
Asbestos		AS 4964 – 2004	0.01 w/w 0.001 w/w	0.05 w/w 0.001 w/w
PCB		USEPA 3510/8270	0.1	>0.1
TRH (C6-C10) BTEXN	Water	USEPA 5030/8260 P&T/HS/GC/MS	10 1-2	n/a 3
TRH (>C10-C40)		USEPA 3510/8015 GC/FID	50-100	n/a
VHC		USEPA 5030/8260	1-5	n/a

The laboratory LORs were below the adopted assessment criteria.

Laboratory (Method) Blanks

Laboratory or control blanks consist of reagents specific to each individual analytical method and are prepared and analysed by laboratories in the same manner as regular samples. The preparation and analysis of laboratory blanks enables the measurement of contamination within the laboratory.

Laboratory blanks are typically analysed at a frequency of 1 in 20, with a minimum of one analysed per batch. A review of the laboratory reports indicated the rate of analysis and results met the DQI.

Laboratory Duplicates

Laboratory duplicate samples are prepared in the laboratory by splitting a field sample and analysing it as two independent samples. The analysis of laboratory duplicate samples provides an indication of analytical precision and may be influenced by sample heterogeneity. The laboratory duplicate RPDs are used to assess laboratory precision.

Laboratory duplicates are analysed at a frequency of 1 in 20, with a minimum of one analysed per batch, when the batch size exceeds five samples. A review of the laboratory reports indicated that the frequency of duplicate analyses and the RPDs met the DQI, with the exception of:

- ES1529109: BH22_0.8-0.9, lead RPD of 21 %. This is attributed to sample matrix (fill).
- ES1529109: BH04_0.5-0.6, lead RPD of 72 % and nickel RPD of 36.4%. This is attributed to sample matrix (fill).
- ES1529109: TRH >C10-C16 RPD of 32 %. This is attributed to sample matrix (fill).

The data is considered acceptably precise.

Laboratory Control Spikes

Laboratory control spikes (LCS) are prepared within the laboratory by spiking an aliquot of an appropriate clean matrix reagent with known concentrations of specific analytes. The LCS is then analysed and the results are used to assess the laboratory performance on sample preparation and analysis procedure. Accuracy is assessed by calculation of percent recovery (PR).

LCS are typically analysed at a frequency of 1 in 20, with a minimum of one analysed per analytical batch. Review of the laboratory reports indicated that the frequency of LCS and the PRs met the DQI.

Matrix Spikes

Matrix spikes are samples prepared within the laboratory by adding a known concentration (i.e. a spike) of a contaminant into the sample. The sample is then analysed and the amount of spike recovered is measured to assess the effects of the sample matrix on the accuracy and precision of the analytes. Essentially, spikes are used to confirm that the laboratory method is recovering the analyte that is being tested. Accuracy is assessed by the calculation of the PR.

Matrix spike PR results met the DQI with the exception of:

- ES1529109: Matrix spike recoveries for metals, TRH and/or PAH in nine samples were not calculated due to background concentrations.
- ES1529109: Matrix spike recovery for TRH >C10-C16 was 158 % compared to the DQI of 73-137% in sample QC202. Given that the primary and duplicate results were the same order of magnitude and confirmed the presence of impacts, the data are considered to be acceptable.
- ES1529728: matrix spike recovery for zinc in sample MW19 was not calculated due to background concentrations.

The data is considered to be acceptably accurate.

Surrogates

Surrogates are compounds which are similar to the organic analytes of interest in chemical composition, extraction and chromatographic behaviour but which are not normally found in field samples. Surrogates are generally spiked into all sample aliquots prior to preparation and analysis by chromatographic methods. Essentially, surrogates are used to test the laboratory method.

PRs are calculated for each surrogate, providing an indication of analytical accuracy. US EPA methodology (SW846) requires that surrogate testing be performed whenever analysing by Gas Chromatography or HPLC (i.e. for organics).

Review of the laboratory reports indicated that the PRs for surrogates met the DQI.

The data is considered to be acceptably accurate.

Holding Times

The ASC NEPM, APHA 20th Edition and AS2031.1-1986 provide recommended technical holding times (THT) for various analyses in samples which must be met in order to consider the results valid, as presented on Table 5. The holding times may vary slightly depending on the document referenced.

Table 5 Holding Times

CoPC	Matrix	THT
TRH C6-C10, BTEXN	Soil / Water	14 days / 7 days
TRH > C10-C40	Soil / Water	14 days / 7 days
PAH	Soil / Water	14 days / 7 days
OCP, OPP, PCB	Soil / Water	14 days / 7 days
Metals	Soil / Water	6 months
Mercury	Soil / Water	28 days
Asbestos	Soil	Indefinite
VHC	Soil / Water	14 days / 7 days

Review of the laboratory documentation indicated that the THT have been met for all analyses, with the exception of:

- ES2004680: TCLP analysis for B(a)P on sample QC100 was one day overdue.
- ES2004682: TCLP analysis for B(a)P on samples BH102_0.5-0.6 and BH105_0.85-0.95 were one day overdue.

The THT exceedances on the TCLP samples are not considered to compromise data integrity.

Sample Receipt Temperatures

Guidance documents recommend that soil and water samples analysed for VOC and semi volatile organic compounds are cooled to <6^{0}C. The laboratory issued sample receipt forms indicated that the following batches recorded elevated temperatures:

- ES1529729 (18.2^{0}C): samples received with ice.
- 235771 (17^{0}C): samples received with ice.
- 236880 (18^{0}C): samples received with ice.
- ES2002766 (6.8^{0}C): samples received with ice.
- ES2003147 (13.1^{0}C): samples received with ice.

Given that the primary and duplicated soil and groundwater sample analysis data indicated acceptable comparability, the elevated sample receipt temperatures are not considered to compromise data integrity.

5.0 Data Validation

The overall assessment of the quality of the data with respect to the DQIs is summarised in Table 6:

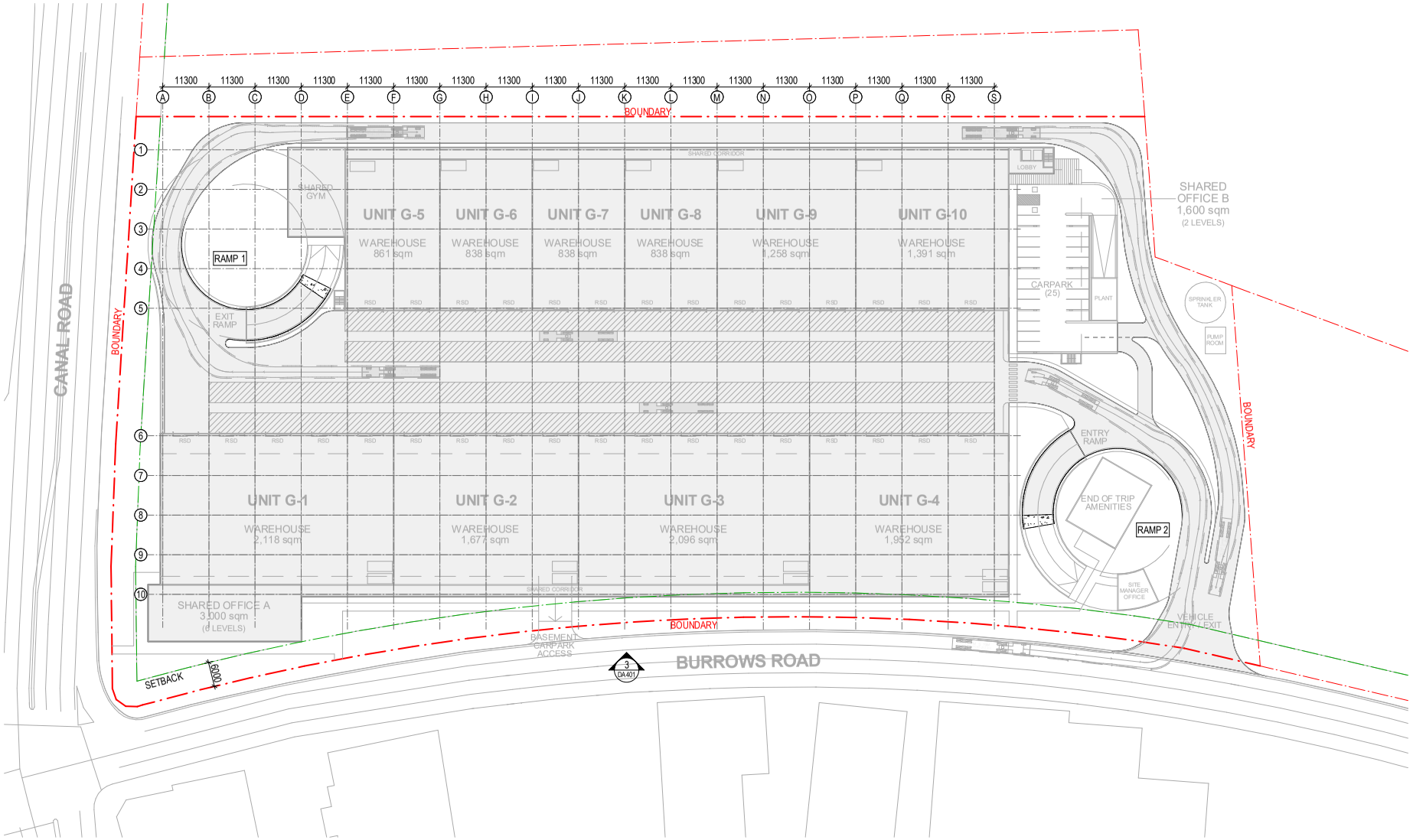
Table 6 Data Validation

DQI	Description	Compliance
P	**Precision** is a quantitative measure of the variability (or reproducibility) of data.	All work was conducted in accordance with AECOM SOPs. Precision or variability of the data was assessed by determining RPDs between the original and duplicate samples analysed. Based on the results discussed, AECOM considers that the data is acceptably precise.
A	**Accuracy** is a quantitative measure of the closeness of reported data to the true value.	All work was conducted in accordance with AECOM SOPs. Accuracy of the data was mainly assessed through review of the laboratory QA/QC results. Based on the results discussed, AECOM considers the data is acceptably accurate.
R	**Representativeness** is the confidence (expressed qualitatively) that data are representative of each media present on the site.	Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of parameter variations at sampling points or environmental conditions. Based on the sampling and analytical regime undertaken, the results obtained are considered to be representative of the soil and groundwater conditions at the locations tested.
C	**Comparability** is the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.	Comparability expresses the confidence with which one data set can be compared with another. In order to assess comparability, field sampling procedures, laboratory sample preparation procedures, analytical procedures, and reporting units must be known and similar to established protocols, as was the case during this project. Qualitatively, data subjected to strict QA/QC procedures will be deemed more reliable and therefore more comparable, than other data. The sampling was conducted by AECOM environmental scientists in accordance with documented SOPs and field briefs prepared by the project manager. Each analyte was analysed by the same analytical laboratory using identical methods and laboratory LORs were consistent over each laboratory batch. Additionally, check laboratories were used to assess variability. Based on the above, the data obtained for the project are considered to be suitably comparable.
C	**Completeness** is a measure of the amount of usable data (expressed as %) from a data collection activity.	The completeness of data is defined as the percentage of analytical results that are considered valid. Valid chemical data are values that have been identified as acceptable or acceptable as qualified during the data validation process. The completeness is a comparison of the total number of samples accepted against the total number of samples, calculated as a percentage. The project goal for completeness is 95%. Completeness also includes checking that all entries in the data tables are correct, properly entered, and that any typographical errors are corrected and the data are re-entered properly, as required. All samples collected and analysed complied with the DQOs and DQIs except where discussed and considered to be reliable, as such the data obtained is considered to be sufficiently quantitative and complete for the purposes of this project (i.e. >95%).

Based on an assessment of field and laboratory QA/QC data, the reported analytical results are considered, by achievement of the DQIs, to be reliable and representative of concentrations of the chemical contaminants of concern analysed at the locations sampled.

Indicative development plan

Goodman



1 GROUND 1 : 500

575

PRELIMINARY

SBA ARCHITECTS

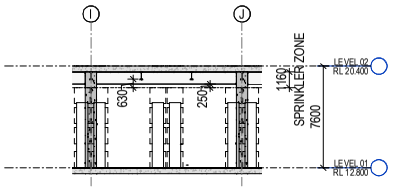
Burrows Industrial Estate — Multilevel Industrial Facility — **GROUND FLOOR**

1 - 3 Burrows Road, Alexandria

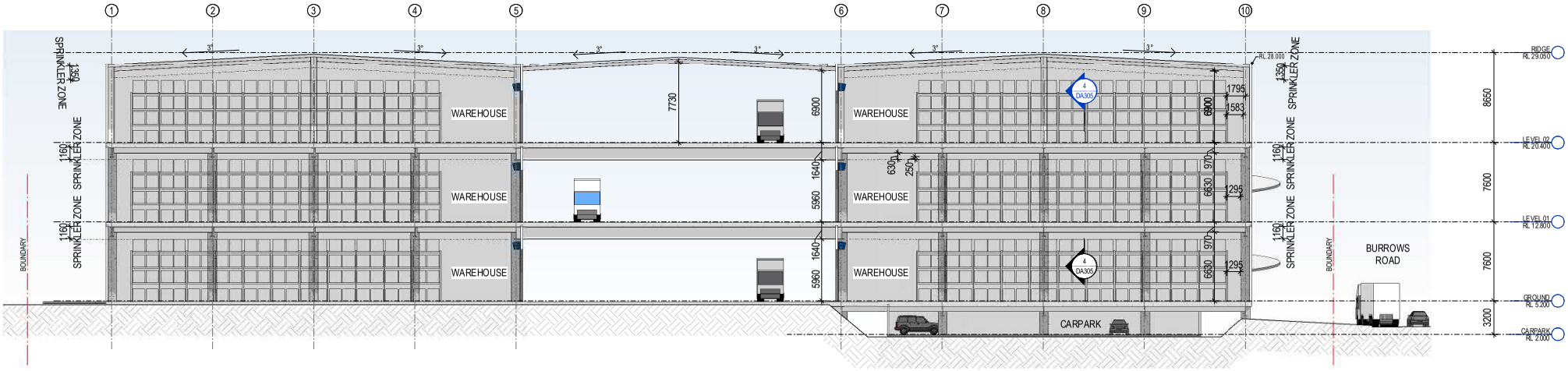
1:500 @ A1
1:1000 @ A3
Date 1

DA201 (1)
Job No 19211

Goodman



4 RACKING SECTION 1 : 200



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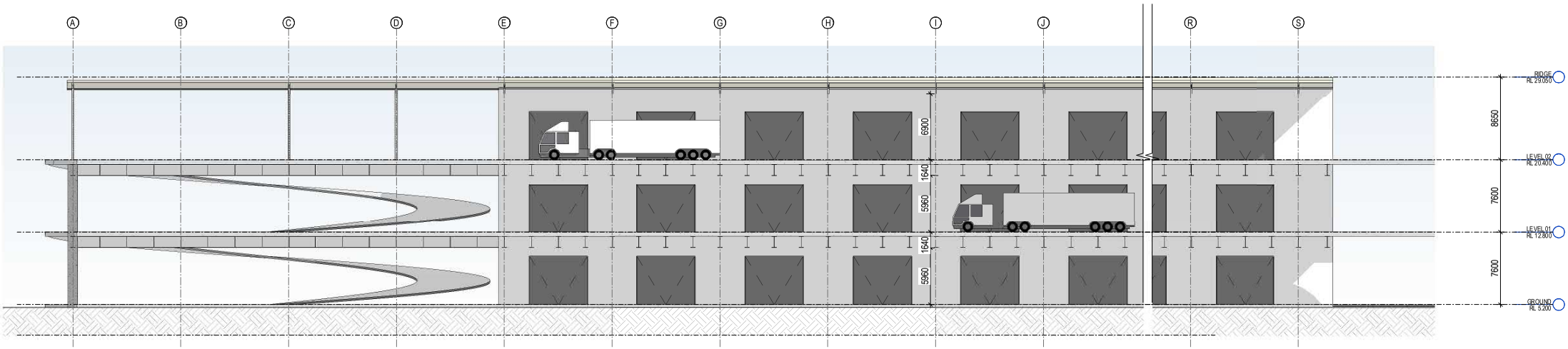
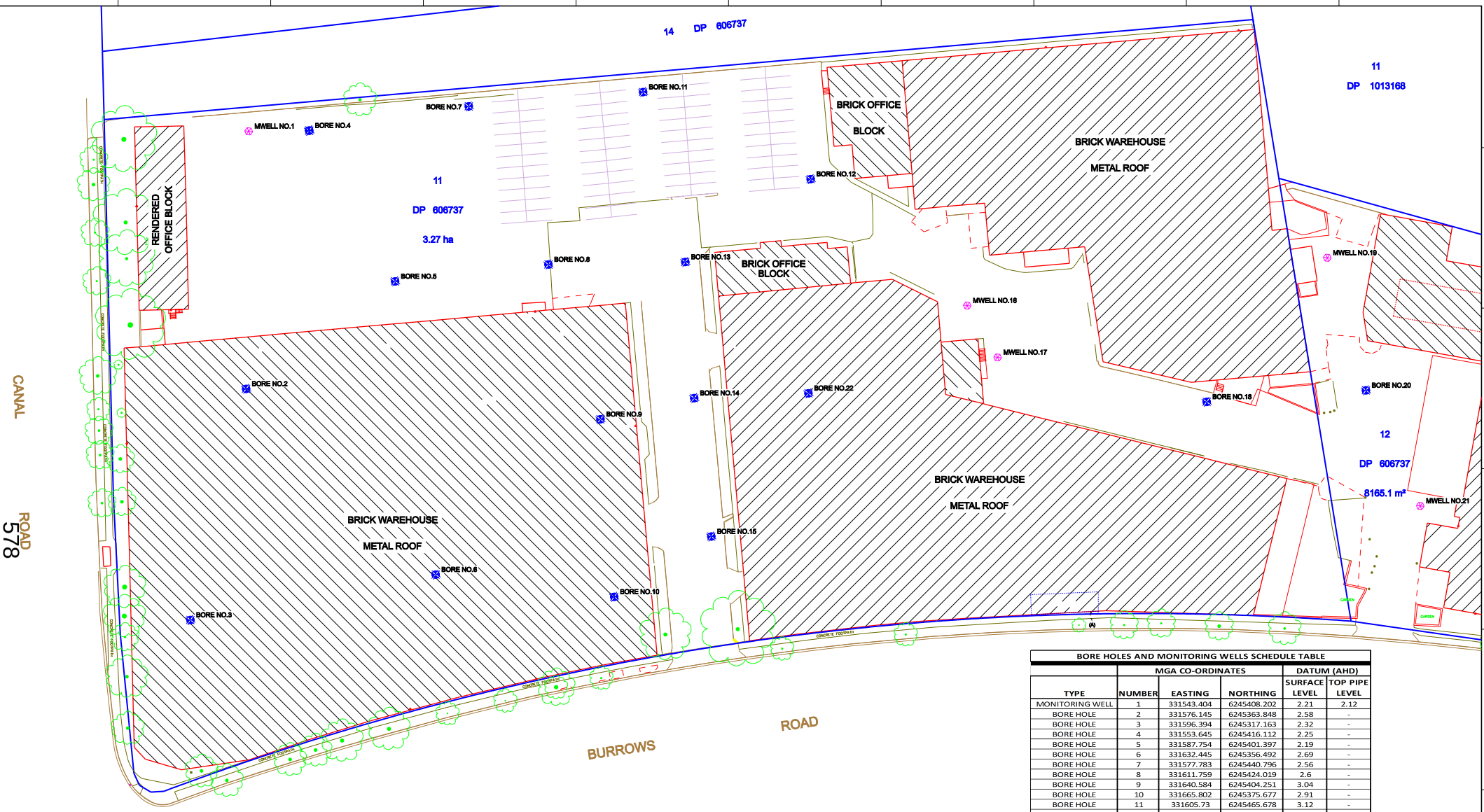


2 SECTION 2 1 : 200

576

SBA ARCHITECTS	Burrows Industrial Estate — Multilevel Industrial Facility	SECTIONS	DA305 (3)
	1 - 3 Burrows Road, Alexandria	02/08/19	Job No 19211

Survey Data



NOTE:
TOPOGRAPHICAL SURVEY INFORMATION DERIVED FROM CARDNO DRAWING 117708001-00

DIAL BEFORE YOU DIG www.1100.com.au

BORE HOLES AND MONITORING WELLS SCHEDULE TABLE

TYPE	NUMBER	MGA CO-ORDINATES EASTING	MGA CO-ORDINATES NORTHING	DATUM (AHD) SURFACE LEVEL	DATUM (AHD) TOP PIPE LEVEL
MONITORING WELL	1	331543.404	6245408.202	2.21	2.12
BORE HOLE	2	331576.145	6245363.848	2.58	-
BORE HOLE	3	331596.394	6245317.163	2.32	-
BORE HOLE	4	331553.645	6245416.112	2.25	-
BORE HOLE	5	331587.754	6245401.397	2.19	-
BORE HOLE	6	331632.445	6245356.492	2.69	-
BORE HOLE	7	331577.783	6245440.796	2.56	-
BORE HOLE	8	331611.759	6245424.019	2.6	-
BORE HOLE	9	331640.584	6245404.251	3.04	-
BORE HOLE	10	331665.802	6245375.677	2.91	-
BORE HOLE	11	331605.73	6245465.678	3.12	-
BORE HOLE	12	331645.559	6245472.364	3.62	-
BORE HOLE	13	331634.823	6245442.06	2.96	-
BORE HOLE	14	331653.883	6245419.946	2.93	-
BORE HOLE	15	331674.617	6245398.482	2.7	-
MONITORING WELL	16	331688.598	6245470.9	4.23	4.15
MONITORING WELL	17	331700.452	6245465.954	4.13	4.04
BORE HOLE	18	331741.891	6245485.266	3.42	-
MONITORING WELL	19	331743.935	6245525.412	3.51	3.44
BORE HOLE	20	331767.618	6245507.731	3.24	-
MONITORING WELL	21	331791.781	6245494.973	3.12	3.04
BORE HOLE	22	331672.77	6245435.465	3.37	-

IMPORTANT NOTE:
This plan is prepared for AECOM from a combination of field survey and existing records for the purpose of designing new constructions on the land and should not be used for any other purpose.
The title boundaries shown hereon were not marked by the author at the time of survey and have been determined by plan dimensions only and not by field measurement.

A services search of the area surveyed above has not been undertaken. Visible services shown hereon have been located where possible by field survey. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.
This note is an integral part of this plan.

REVISION	DATE	DESCRIPTION	CCAD REF	APPROVED
00	04-09-2015	ORIGINAL ISSUE	117740AA	MC

SCALE: HORZ. NOT TO SCALE VERT.
A1
CONTOUR INTERVAL: MAJOR 0.2 MINOR 0.1
HORIZONTAL ORIGIN
COORD. SYSTEM: MGA
MARK ADOPTED: SSM 59266
COORDINATES: E 331 908.285 N 6 246 274.426
VERTICAL DATUM
DATUM: AHD
BM ADOPTED: PM 14328 RL: 2.818

Cardno Hard&Forester
Shaping the Future
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Rockdale NSW 2216
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f: (02) 9599 2148
e: survey@hardforester.com.au w: www.hardforester.com.au

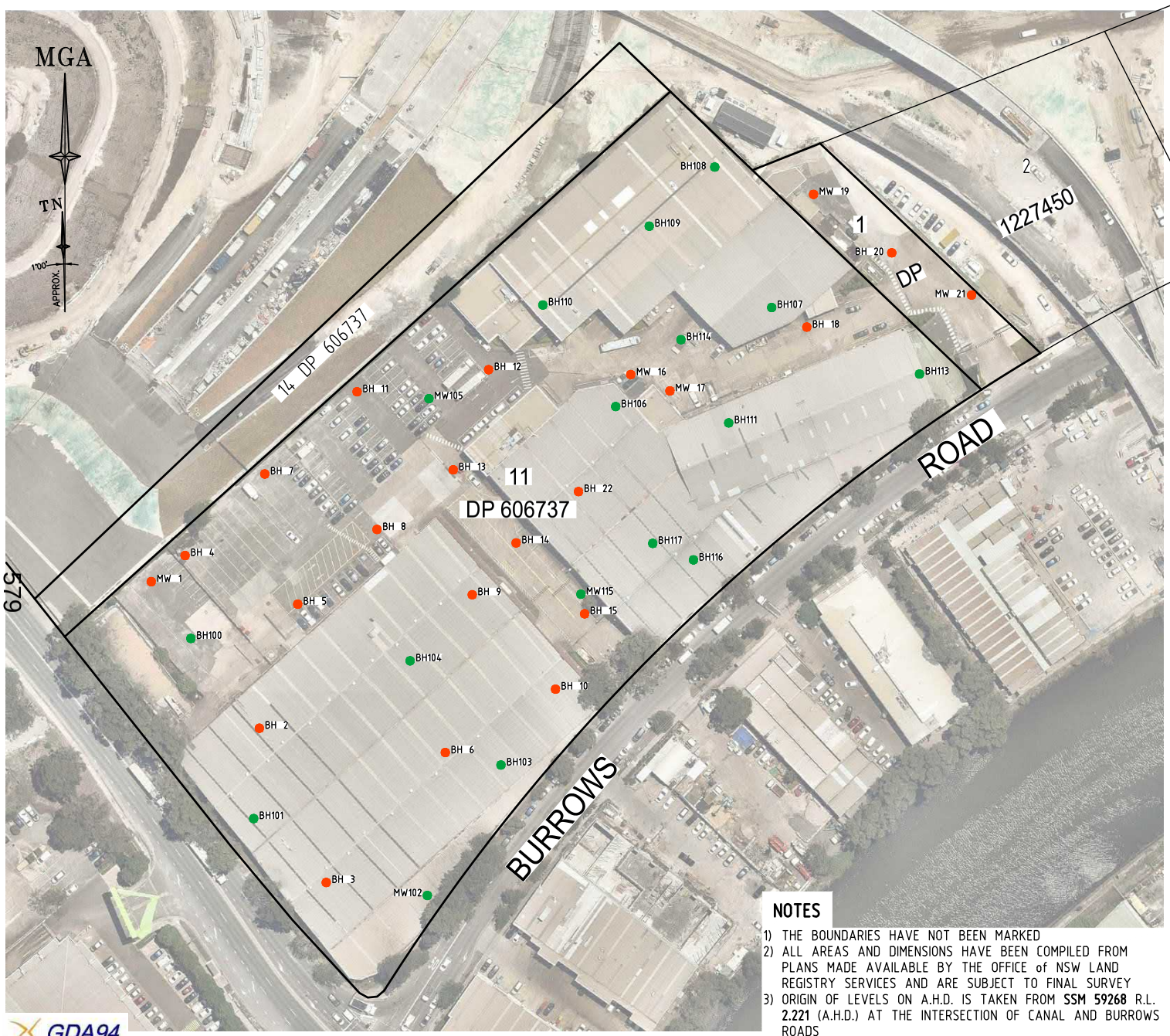
SURVEYED	DRAWN	CHECKED	PASSED
JJ	JC	JJ	MC

PROJECT:
1-3 BURROWS ROAD ALEXANDRIA

PLAN SHOWING BORE HOLE AND MONITORING WELLS LOT 11 & 12 DP 606737

AECOM

SHEET 1 OF 1
DRAWING NUMBER 117740001
REV 00



LEGEND

BORE HOLE 2015	BH
MONITORING WELL 2015	MW
BORE HOLE 2020	BH
MONITORING WELL 2020	MW

2015 Bore Hole & Monitoring Wells

Code	Easting	Northing	RL (AHD)
MW 1	331543.404	6245408.202	2.21
MW 19	331743.935	6245525.412	3.51
MW 21	331791.781	6245494.973	3.12
BH 18	331741.891	6245485.266	3.42
BH 20	331767.618	6245507.731	3.24
BH 22	331672.77	6245435.465	3.37
BH2	331576.145	6245363.848	2.58
BH 3	331596.394	6245317.163	2.32
BH4	331553.645	6245416.112	2.25
BH5	331587.754	6245401.397	2.19
BH6	331632.445	6245356.492	2.69
BH7	331577.783	6245440.796	2.56
BH8	331611.759	6245424.019	2.6
BH9	331640.584	6245404.251	3.04
BH10	331665.802	6245375.677	2.91
BH11	331605.73	6245465.678	3.12
BH12	331645.559	6245472.364	3.62
BH13	331634.823	6245442.06	2.96
BH14	331653.883	6245419.946	2.93
BH15	331674.617	6245398.482	2.7

2020 Bore Holes & Monitoring Wells

Code	Easting	Northing	RL(AHD)	Description
BH100	331555.408	6245391.019	2.035	
BH101	331574.416	6245336.499	2.422	
MW102	331627.004	6245313.221	2.385	Road Cover
			2.3	PVC Casing
BH103	331649.295	6245352.702	2.786	
BH104	331621.782	6245384.239	2.852	
MW105	331627.489	6245463.586	3.287	Road Cover
			3.202	PVC Casing
BH106	331684.03	6245461.203	3.467	
BH107	331731.264	6245491.173	4.32	
BH108	331714.016	6245533.699	4.935	
BH109	331694.186	6245515.801	4.924	
BH110	331661.963	6245491.955	4.888	
BH111	331718.244	6245456.264	3.455	
BH113	331776.03	6245471.041	3.473	
BH114	331703.793	6245481.454	4.335	
MW115	331673.5	6245404.4	2.883	Road Cover
			2.843	PVC Casing
BH116	331707.577	6245414.797	3.382	
BH117	331695.246	6245419.79	3.367	

NOTES

1) THE BOUNDARIES HAVE NOT BEEN MARKED
2) ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY THE OFFICE of NSW LAND REGISTRY SERVICES AND ARE SUBJECT TO FINAL SURVEY
3) ORIGIN OF LEVELS ON A.H.D. IS TAKEN FROM **SSM 59268** R.L. **2.221** (A.H.D.) AT THE INTERSECTION OF CANAL AND BURROWS ROADS

GDA94

Revision	Date	Description	Reference
D	00/00/00	-	00
C	00/00/00	-	00
B	00/00/00	-	00
A	00/00/00	-	00

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THIS IS THE PLAN REFERRED TO IN MY LETTER DATED:

Registered Surveyor NSW

Client AECOM AUSTRALIA PTY LTD

Drawing title

PLAN OF BORE HOLE & MONITORING WELL LOCATIONS OVER LOT 11 DP 606737 AND LOT 1 DP 1227450 AT No.1-3 BURROWS ROAD, ALEXANDRIA

datum AHD
site Area N/A
LGA SYDNEY

reference number 50937 001MON
scale 1:1250 @A3
date of survey 07/02/20

SHEET 1 OF 1

Calibration Records, 2015 Investigation

Gas Calibration Certificate

Instrument MX6
Serial No. 14042SE-015
Sensors CO, O2, H2S, CH4, PID

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation		
	Filter		
	Flow		
	Valves, Diaphragm		
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	CO	✓	
	O2	✓	
	H2S	✓	
	CH4		
	PID		
Alarms	Beeper	✓	
	Settings	✓	
Software	Version		
Datalogger	Operation		
Download	Operation		
Other tests:			

Low	High	TWA	STEL
90ppm	400ppm	30ppm	60ppm
20%	24%	N/A	N/A
30ppm	50ppm	10ppm	15ppm
N/A	N/A	N/A	N/A
50ppm	100ppm	10ppm	25ppm

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No	Instrument Reading
CO		100ppm CO	NIST	SY74	100ppm
O2		20.9% Fresh Air		Fresh Air	20.9%
H2S		25ppm H2S	NIST	SY74	25ppm
CH4		60% Methane	NIST	SY23	60% CH4
PID		100ppm Isobutylene	NIST	SY64	100ppm

Calibrated by: Anne Rutlidge

Calibration date: 28/08/2015

Next calibration due: 24/02/2016

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 4441

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Sophie Boler**

Calibration date: **24/08/2015**

Next calibration due: **23/10/2015**

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-105435

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Low	High	TWA	STEL
50ppm	100ppm	N/A	N/A

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		100ppm Isobutylene	NIST	SY64		101.3ppm

Calibrated by: Joanna Wong

Calibration date: 19/08/2015

Next calibration due: 18/09/2015

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3983

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
Connectors	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: **Sophie Boler**

Calibration date: **27/08/2015**

Next calibration due: **26/10/2015**

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-105892

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	**Low** 50ppm / **High** 100ppm / **TWA** / **STEL**
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		100ppm Isobutylene	NIST	SY64		99.7ppm

Calibrated by: **Joanna Wong**

Calibration date: **19/08/2015**

Next calibration due: **18/09/2015**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 10E101052

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3.Specific conductance	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		LE1408	pH 7.00
2. pH 10.00		pH 10.00		MH1685	pH 10.04
3. pH 4.00		pH 4.00		MG1348	pH 3.88
4. mV		231.9mV		ML1823/ML1824	231.7mV
5. EC		2.76mS		LK2419	2.76mS
6. D.O		0.00ppm		2810	0.00ppm
7. Temp		21.0°C		MultiTherm	20.9°C

Calibrated by: SB **Sophie Boler**

Calibration date: **24/08/2015**

Next calibration due: **23/09/2015**

Multi Parameter Water Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument YSI Quatro Pro Plus
Serial No. 13C100783

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		LE1048	pH 7.02
2. pH 10.00		pH 10.00		MH1685	pH 9.96
3. pH 4.00		pH 4.00		MG1348	pH 3.95
4. mV		230.7mV		ML1823/ML1824	230.3mV
5. EC		2.76mS		LH1691	2.76mS
6. D.O		0 ppm		2810	0.00ppm
7. Temp		21.5°C		MultiTherm	21.5°C

Calibrated by: SB **Sophie Boler**

Calibration date: **27/08/2015**

Next calibration due: **23/02/2016**

AECOM

16;#Australia New Zealand|a541b326-6e42-45fc-a7d5-d797f3cb72ce

PID Calibration Form

Q4AN(EV)-336-FM12

Project Name	BURRONS INDUSTRIAL
Project Number	60438840
Frequency	☑ Daily on User ☐ Twice Daily

PID Serial No.	Date/Time	Hired Equipment Y/N (if yes, attach calibration sheet)	Fresh Air Cal. OK Y/N	Gas	Calibrate OK Y/N	Filter Change Required Y/N	Pump Clean Required Y/N	Charging Required Y/N	Comments	Name (print)	Signature
T-105892	12/8/15	Y	Y	Isobutylene	Y	N	N	N		K. PIGRAM	K Pigram

588

Calibration Records, Drilling

Calibration & Service Report
PID

Company:	Active Environmental Solutions Hire	**Manufacturer:**	RAE Systems	**Serial #:**	592-905200
Contact:	William Pak/Milenko Sisic	**Instrument:**	MiniRAE 3000	**Hire #:**	986
Address:	Unit 16, 191 Parramatta Road	**Model:**	PGM 7320	**Client:**	Kurtis Wathen
	AUBURN NSW 2144	**Configuration:**	PID (10.6eV)	**Company:**	AECOM Australia
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Wireless:**	-	**Project #:**	60623599 Task 1.1
Email:	hire@aesolutions.com.au	**Network ID:**	-	**Notes:**	

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
	Cradle	✓	
Pump	Flow	✓	>500 mL/min
Filter	Filter, fitting, etc	✓	
Alarms	Audible, visual, vibration	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	2.16
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
PID	Lamp	✓	
PID	Sensor	✓	
THP	Sensor	✓	

Engineer's Report

Setup, service and calibration for hire

Calibration Certificate

Sensor	Type	Serial No:	Span Gas	Concentration	Traceability Lot #	CF	Reading	
							Zero	Span
Oxygen								
LEL								
PID	10.6eV	-	Isobutylene	100ppm	A0442963	1.00	0	100ppm
Toxic 1								
Toxic 2								
Toxic 3								
Toxic 4								
Toxic 5								

Calibrated/Repaired by: William Pak

Date: 22.01.2020

Next due: 22.07.2020

Calibration Records, MW Development

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	Heron	**Serial #:**	01- 7622
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	H.OIL Interface Probe 30 m	**Tape Length:**	30m
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Equipment Check

30 m Heron Interface Probe

Customer:		**Manufacturer:**	Heron	
Contact:		**Instrument:**	H.OIL Interface Probe	
Order:		**Serial #:**	01-7622	
		Cable length:	30 m	
Item	**Test**	**Pass**	**Comments**	
Battery	Voltage (9v battery)	✓	Voltage above 7.9v	
	Fuses, circuit board	✓		
Probe	Decontaminated	✓		
	Condition	✓	Good, clean	
	Operation	✓	Responding	
Connectors	Condition	✓		
Tape Check	Decontaminated	✓		
	Checked for cuts	✓	Good condition	
Speaker	Operation	✓		
Light	Operation	✓		
Instrument Test	Water	✓	Surface level using tap water	
	Oil	✓	Surface level using Petrol and tap water	
This is to certify that the above instrument has been checked and is in good working order.				

Checked By: Milenko Sisic

Check Date: 05/02/2020 **Due for Check:** 05/08/2020

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	YSI	**Serial #:**	18C104584
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	WQM Professional Plus w/ Quatro Cable	**Cable Length:**	1m
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Item	Test	Pass	Comments
Battery	2 x Alkaline C-cells	✓	Voltage reading above 2.9V
	Battery Saver	✓	Automatically turns off after 60 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	4.0.0
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	Good, clean
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	
pH slope		✓	55 to 60 mV/pH; ideal 59mV
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	Good, clean
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	Variance range ± 20mV
Conductivity			
Condition		✓	Good, clean
Temperature		✓	°C
Conductivity cell constant 5.0 ± 1.0 in GLP file		✓	
Clean sensor reads less than 3 uS/cm in dry air		✓	
Calibrated and conforms to manufacturer's specifications		✓	µs/cm
Dissolved Oxygen			
Condition		✓	Good, clean
DO sensor in use		✓	Galvanic
1.25 mil PE membrane (yellow membrane):		✓	
DO Sensor Value		✓	(min 4.31 uA - max 8.00 uA) Avg 6.15 uA
Calibrated and conforms to manufacturer's specifications		✓	ppm

Instrument Readings

Parameter	Standards	Reference	Calibration Point	Before	After	Units
Temperature	Center 370 Thermometer	Room Temp.	23.9	N/A	24.0	°C
pH	pH 4.00	336722	4.01	4.24	4.01	pH
pH	pH 7.00	329744	7.00	7.21	7.00	pH
Conductivity	2760 µs/cm at 25°C	332208	2760	2761	2760	µs/cm
ORP (Ref. check only)	Zobell A & B	340526 & 340529	233.3	251.8	233.3	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	5928	0.0	1.9	0.0	%
100% Dissolved Oxygen	100% Air Saturation	Fresh Air	100.0	87.8	100.0	%

Calibrated By: Milenko Sisic

Calibration Date: 05/02/2020 **Calibration Due:** 05/08/2020

Calibration Records, Gas Monitor

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 11-Mar-2019

Certificate Number: G505789_1/22717

Issued by: QED Environmental Systems Ltd.

Customer: **Thermo Fisher Scientific Australia Pty L**
5 Caribbean Drive PO Box 9092 Scoresby
VIC 3179 AUSTRALIA

Description: Gas Analyser

Model: GA5000

Serial Number: G505789

UKAS Accredited results:

Results after adjustment :

Methane (CH_4)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	4.9	0.41
15.0	14.9	0.64
49.9	49.5	0.94

Carbon Dioxide (CO_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	5.0	0.43
15.0	14.9	0.70
50.1	50.2	1.1

Oxygen (O_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
21.3	21.3	0.31

The inwards assessment was carried out 11-Dec-2018.
The maximum adjustment is larger than the inwards assessment uncertainty.
Inwards assessment data is available if requested.

All concentrations are molar.

CH_4, CO_2 readings recorded at : 32.6 °C ± 2.5 °C

O2 readings recorded at : 22.4 °C ± 2.5 °C

Barometric Pressure : 1013 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Calibration Instance:101 IGC Instance:101

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 11-Mar-2019

Certificate Number: G505789_1/22717

Issued by: QED Environmental Systems Ltd.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	**Instrument Reading**
1013	1014

Additional Gas Cells		
Gas	**Certified Gas (ppm)**	**Instrument Reading (ppm)**
CO	507	515
H_2S	251	251

Internal Flow	
Applied (l/hr)	**Instrument Reading (l/hr)**
5	5.2
10	10.1

Date of Issue : 12-Mar-2019 **Approved by Signatory**

Dawn Hemings

Laboratory Inspection

Calibration Instance: 101 IGC Instance: 101

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

Calibration & Service Report
Gas Monitor

Company: Active Environmental Solutions Hire

Contact: Aleks Todorovic
Address: 2 Merchant Avenue
Thomastown Vic 3074
Phone: 03 9464 2300 | **Fax**: 03 9464 3421
Email: Hire@aesolutions.com.au

Manufacturer:	Geotechnical Instruments Ltd	**Serial #:**	G505789
Instrument:	Portable Gas Analyser	**Asset #:**	-
Model:	GA5000	**Part #:**	-
Configuration:	CH4; CO2: O2; H2S; CO	**Sold:**	-
Wireless:	-	**Last Cal:**	-
Network ID:	-	**Job #:**	-
Unit ID:	-	**Cal Spec:**	Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
Internal Flow Pod	Zeroed	✓	
Pump	Flow	✓	>600 mL/min
Filter	Filter, fitting, etc	✓	
Tubing	Set of 3 tubes	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	1.14.12
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen		✓	
CH4		✓	
CO2		✓	
H2S		✓	
CO		✓	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report- Calibration Certificate

Setup, service and calibration for hire

Sensor	Span Gas	Concentration	Traceability Lot #	CF	Reading
					Span
Oxygen	Nitrogen	99.99% N2 (0 % O2)	WO213376-2	1	0.0%
	Fresh air	20.9	Fresh Air	1	20.9%
CH4	Nitrogen	99.99% N2 (0% CH4)	WO213376-2	1	0.0%
	Methane	60%	2174-1-2	1	60.0%
CO2	Nitrogen	99.99% N2 (0% CO2)	WO213376-2	1	0.0%
	Carbon Dioxide	40%	2174-1-2	1	40.0%
CO	Nitrogen	99.99% N2 (0 PPM CO)	WO213376-2	1	0 PPM
	Carbon Monoxide	100 PPM	WO183929-19	1	100 PPM
H2S	Nitrogen	99.99% N2 (0 PPM H2S)	WO213376-2	1	0 PPM
	Hydrogen Sulfide	25 PPM	WO183929-19	1	25 PPM

Calibrated/Repaired by: Milenko Sisic

Date: 18/02/2020 Next due: 18/08/2020

Calibration Records, GME

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	Geotech	**Serial #:**	5008
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	51350021	**Cable Length:**	4.5m
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Equipment Check

Geopump Peristaltic Pump

Customer:		**Manufacturer:**	Geotech
Contact:	Milenko	**Instrument:**	Peristaltic Pump
Order:		**Serial #:**	5008
		Head Serial #:	D18003992
		Cable length:	4.5m

Item	Test	Pass	Comments
Battery	12 Voltage	✓	Voltage above 13 V
	Fuses	✓	
	Capacity	✓	
Pump	Decontaminated	✓	
	Condition	✓	
	Operation	✓	
	0.5 m Silicon Tubing	✓	New Tubing
Charger	Condition	✓	
Hard Case	Condition	✓	
Instrument Test	Operation checked	✓	
Instruction manual	Included	✓	

Comments

New Unit.

This is to certify that the above instrument has been checked and is in good working order.

Checked By: Milenko Sisic

Check Date: 11/02/2020 **Due for Check:** 11/08/2020

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	Solinst	**Serial #:**	312417
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	122 Interface Probe 30m	**Tape Length:**	30m
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Equipment Check

Oil/Water Interface Meter - Solinst 122 Interface Meter

Customer:		**Manufacturer:**	Solinst Interface Meter
Contact:	Milenko	**Instrument:**	Model 122
Order:		**Serial #:**	312417
		Tape length:	30m

Item	Test	Pass	Comments
Battery	Voltage (2 x 9v battery)	✓	Voltage above 7.9v
	Fuses	✓	
	Capacity	✓	
Probe	Decontaminated	✓	
	Condition	✓	
	Operation	✓	
Connectors	Condition	✓	
Tape Check	Condition	✓	Good, no tears
	Decontaminated	✓	
Instrument Test	At surface level	✓	Tap water and Citronella oil
Speaker	Operation	✓	

Comments

Spare batteries included.

This is to certify that the above instrument has been checked and is in good working order.

Checked By: Milenko Sisic

Check Date: 11/02/2020 **Due for Check:** 11/08/2020

Calibration & Service Report
Water Quality Meter

Company:	Active Environmental Solutions Hire	**Manufacturer:**	YSI	**Serial #:**	15H103057
Address:	Unit 16, 191 Parramatta Road AUBURN NSW 2144	**Instrument/Model:**	WQM Professional Plus w/ Quatro Cable	**Cable Length:**	1m
Phone:	02 9716 5966 | **Fax**: 02 9716 5988	**Client Company:**		**Client Email:**	
Email:	hire@aesoultions.com.au	**Client Name:**		**Client Phone:**	

Item	Test	Pass	Comments
Battery	2 x Alkaline C-cells	✓	Voltage reading above 2.9V
	Battery Saver	✓	Automatically turns off after 60 minutes if not used
Connections	Condition	✓	Good, clean
Cable	Condition	✓	Clean, no tears
Display	Operation	✓	
Firmware	Version	✓	4.0.0
Keypad	Operational	✓	
Display	Screen	✓	
Unit	Condition, seals and O-rings	✓	
Monitor housing	Condition	✓	
pH			
Condition		✓	New probe fitted
pH millivolts for pH7 calibration range 0 mV ± 50 mV		✓	
pH 4 mV range + 165 to + 180 from 7 buffer mV value		✓	
pH slope		✓	55 to 60 mV/pH; ideal 59mV
Response time < 90 seconds		✓	
Calibrated and conforms to manufacturer's specifications		✓	
ORP			
Condition		✓	New probe fitted
Response time < 90 seconds		✓	
within ± 80mv of reference Zobell Reading		✓	
Calibrated and conforms to manufacturer's specifications		✓	Variance range ± 20mV
Conductivity			
Condition		✓	Good, Clean.
Temperature		✓	°C
Conductivity cell constant 5.0 ± 1.0 in GLP file		✓	
Clean sensor reads less than 3 uS/cm in dry air		✓	
Calibrated and conforms to manufacturer's specifications		✓	µs/cm
Dissolved Oxygen			
Condition		✓	New probe fitted
DO sensor in use		✓	Polarographic
1.25 mil PE membrane (yellow membrane):		✓	
DO Sensor Value		✓	(min 4.31 uA - max 8.00 uA) Avg 6.15 uA
Calibrated and conforms to manufacturer's specifications		✓	ppm

				Instrument Readings		
Parameter	**Standards**	**Reference**	**Calibration Point**	**Before**	**After**	**Units**
Temperature	Center 370 Thermometer	Room Temp.	21.7	N/A	21.8	°C
pH	pH 4.00	336722	4.01	3.98	4.01	pH
pH	pH 7.00	329744	7.00	6.95	7.00	pH
Conductivity	2760 µs/cm at 25°C	332208	2760	2759	2760	µs/cm
ORP (Ref. check only)	Zobell A & B	340526 & 340529	235.3	233.4	235.3	mV
Zero Dissolved Oxygen	NaSO3 in distilled water	5928	0.0	-0.1	0.0	%
100% Dissolved Oxygen	100% Air Saturation	Fresh Air	100.0	114.2	100.0	%

Calibrated By: Milenko Sisic

Calibration Date: 11/02/2020 **Calibration Due:** 11/08/2020

MW Development & GME Field Sheets

AECOM

Site Contamination Analysis – Water Quality Sampling Form

WELL DEVELOPMENT

Project Name:	BULLOCKS INDUSTRIAL	Project Number: 60438840	Well No: MW21
Recorded By:	KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date:	25.08.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC): 3.895	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 2.024	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC): 3.600
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☒ Other PARAMETER STABILISATION	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ TD - ____ WL) x (____ D /2)^2 x 0.00314] + [0.2 x (0.00314 x ____ borehole radius^2 x ____ TD-WL) – 0.2 x (0.00314 x ____ well radius^2 x ____ TD-WL)] = ____ 1 BV (L)

Start Time	Stop Time	Elapsed Time	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)
0838	0905			

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
0841		1.0	0.10	2444	7.03	-82.5	18.3	2.025	
0844		2.0	0.19	1879	7.01	-60.1	18.1	2.026	
0847		3.0	0.31	1308	7.10	-63.4	17.8	2.026	→ Becoming slightly turbid
0850		4.0	0.34	1190	7.12	-61.6	17.9	2.025	
0853		5.0	0.80	1040	7.11	-45.7	17.8	2.025	
0856		6.0	0.64	995	7.08	-51.1	17.8	2.026	→ Becoming clear slight brown tinge v. slight turbidity
0859		7.0	0.86	969	7.04	-48.2	17.7	2.025	
0902		8.0	0.96	957	7.04	-44.9	17.7	2.026	
		↓ clear @ 8L							

Groundwater equilibrium reached at	± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)

Observations in first 1L purged (turbidity, colour, odour, sheen): 1. grey/brown, moderate-highly turbid

Observations during sampling (turbidity, colour, odour, sheen): As above moderately turbid >1L

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☐ Same as purge method ☐ Other: very soft hose

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

WELL DEVELOPMENT

Project Name:	BURROWS INDUSTRIAL	Project Number: 60438840	Well No: MW19
Recorded By:	KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date:	25-8-15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC): 3.920	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 2.464	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC): 3.700
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☒ Other PARAMETER STABILISATION	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ - ____) x (____/2)^2 x 0.00314] + [0.2 x (0.00314 x ____^{2} x ____) – 0.2 x (0.00314 x ____^{2} x ____)] = ____

TD WL D borehole radius TD-WL well radius TD-WL 1 BV (L)

Start Time: 0920	Stop Time: 0950	Elapsed Time:	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
0923		1.0	0.28	1145	6.77	29.9	19.4	2.465	
0926		2.0	0.42	1154	6.75	29.2	19.3	2.465	
0929		3.0	0.25	1072	6.73	77.5	19.0	2.465	⇒ Becoming clear, V. slight turbidity
0932		4.0	0.23	1078	6.72	79.4	19.1	2.465	
0935		5.0	0.49	1063	6.73	60.7	19.2	2.464	
0938		6.0	0.28	1086	6.71	71.6	19.0	2.466	
0941		7.0	0.40	1076	6.71	74.8	19.0	2.465	
0944		8.0	0.29	1067	6.71	78.3	19.0	2.466	
0947		9.0	0.28	1067	6.71	78.7	19.0	2.466	
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): Brown, slight-moderate turbidity, no odour, no sheen

Observations during sampling (turbidity, colour, odour, sheen): becoming clearer, slight turbidity

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☐ Same as purge method ☐ Other: soft hose

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

WELL DEVELOPMENT

Project Name:	BURROWS INDUSTRIAL	Project Number: 60438840	Well No: MW17
Recorded By:	AAEP	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date:	25.8.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☐50 ☐100 ☐Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC): 4.091	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 3.061	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC): 3.900
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☒ Other PARAMETER	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ - ____) x (____/2)^2 x 0.00314] + [0.2 x (0.00314 x ____^{2} x ____) – 0.2 x (0.00314 x ____^{2} x ____)] = ____

TD WL D borehole radius TD-WL well radius TD-WL 1 BV (L)

Start Time: 1026 Stop Time: 1055 Elapsed Time: Initial depth to water: (with pump in well) Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
1029		1.0	0.01	1560	6.97	-132.8	21.4	3.174	
1032		2.0	0.08	1761	6.88	-115.3	22.4	3.177	
1035		3.0	0.06	1653	6.87	-110.4	22.0	3.168	→ clear v
1038		4.0	0.08	1509	6.85	-105.2	21.6	3.174	slightly
1041		5.0	0.09	1423	6.83	-102.3	21.9	3.168	turbid
1044		6.0	0.10	1385	6.83	-103.8	22.0	3.172	
1047		7.0	0.13	1367	6.83	-102.7	21.8	3.174	
1050		8.0	0.15	1363	6.82	-99.0	21.6	3.174	
1053		9.0	0.18	1357	6.82	-97.0	21.8	3.176	
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): D. grey/brown, highly turbid, no odour, no

Observations during sampling (turbidity, colour, odour, sheen): As above, becoming moderate – sheen & highly turbid

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☐ Same as purge method ☐ Other: slightly soft base

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

Project Name: BURRONS INDUSTRIAL	Project Number: 60438840	Well No: MW16
Recorded By: KATE P	Well Type: ☑ Monitor ☐ Extractor ☐ Other	
Date: 25.08.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC): 4.491	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 3.171	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC): 4.200
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☒ Other PARAMETER STABILISATION	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(_____ - _____) x (_____/2)^2 x 0.00314] + [0.2 x (0.00314 x _____^{2} x _____) – 0.2 x (0.00314 x _____^{2} x _____)] = _____

TD WL D borehole radius TD-WL well radius TD-WL 1 BV (L)

Start Time: 1103 Stop Time: 1150 Elapsed Time: Initial depth to water: (with pump in well) Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
1106		1-0	0.26	1830	7.09	-10.1	22.3	3.470	
1109		2.0	0.27	2013	6.91	-31.5	22.4	3.704	
1112		3.0	1.20	2379	6.84	-46.8	22.5	3.913	
1115		4.0	0.05	2538	6.90	-48.0	22.5	4.173 → DRY	
~~1118~~ 1125		5.0	1.03	2982	6.96	-39.7	22.6	3.726	WAIT FOR RECHARGE
~~1121~~ 1128		6.0	1.34	2720	6.91	-48.8	22.6	3.924	
~~1124~~ 1134		7.0	1.36	2708	6.91	-46.7	22.6	3.665	
~~1127~~ 1137		8.0	1.08	2686	6.91	-48.4	22.7	3.695 → DRY	
~~1130~~ 1140		9.0	0.09	2190	6.90	-57.9	22.8	3.710	WAIT FOR RECHARGE
1143		10.0	1.35	2440	6.94	-54.1	22.1	3.921	
1146		11.0	1.36	2415	6.94	-52.1	22.0	4.103	PULL UP TUBING = BLOCKED OFF
		↳ WELL DRY @ 11.5L							
Groundwater equilibrium reached at		± 10%	± 3%		± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): - grey/brown highly turbid, no odour, no sheen

Observations during sampling (turbidity, colour, odour, sheen): decreasing turbidity ↓ clear @ 9L

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

PVC CUTTINGS

Well Sampling

Sampling Method ☐ Same as purge method ☐ Other:.....

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

WELL DEVELOPMENT

Project Name: BURROWS INDUSTRIAL	Project Number: 60438840	Well No: MW1
Recorded By: KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date: 25.8.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC): 3.454	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 1.030	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC): 3.200
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☒ Other READINGS	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

SIMULTANEOUS

[(_____ - _____) x (_____/2)^2 x 0.00314] + [0.2 x (0.00314 x _____^{2} x _____) – 0.2 x (0.00314 x _____^{2} x _____)] = _____

TD WL D borehole radius TD-WL well radius TD-WL 1 BV (L)

Start Time: 1155 Stop Time: 1227 Elapsed Time: Initial depth to water: (with pump in well) Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
1158		1.0	0.22	1204	7.13	-105.5	19.9	1.045	
1201		2.0	0.23	1177	7.02	-111.4	19.8	1.040	
1204		3.0	0.30	1159	7.03	-112.4	19.7	1.042	⇒ clear, no turbidity
1207		4.0	0.41	1106	7.07	-116.5	19.6	1.043	
1210		5.0	0.56	1021	7.12	-116.5	19.7	1.039	
1213		6.0	0.58	989	7.12	-113.8	19.7	1.037	
1216		7.0	0.57	990	7.12	-111.9	19.7	1.037	
1219		8.0	0.53	1006	7.08	-106.8	19.6	1.037	
1222		9.0	0.50	1015	7.06	-104.3	19.5	1.038	
1225		10.0	0.48	1019	7.05	-102.8	19.5	1.037	
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): Grey/brown, slightly turbid, no odour, no

Observations during sampling (turbidity, colour, odour, sheen): Becoming clear to slight grey/brown tinge

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☐ Same as purge method ☐ Other: Water in roadbox, very soft base

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

Project Name: BILLDINGS INDUSTRIAL	Project Number: 60738840	Well No: MW21
Recorded By: KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date: 31.8.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC):	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 2.026	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC):
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ (TD) - ____ (WL)) x (____ (D)/2)² x 0.00314] + [0.2 x (0.00314 x ____ (borehole radius)² x ____ (TD-WL)) – 0.2 x (0.00314 x ____ (well radius)² x ____ (TD-WL))] = ____ 1 BV (L)

Start Time:	Stop Time:	Elapsed Time:	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)
0815	0840			

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
0818		0.5	0.17	1293	6.83	17.0	17.2	2.034	
0821		1.0	0.10	1263	6.72	5.3	17.3	2.035	
0824		1.5	0.04	1216	6.70	7.1	17.1	2.034	
0827		2.0	0.02	1198	6.71	2.8	17.2	2.034	
0830		2.5	0.09	1125	6.74	3.5	17.1	2.034	
0833		3.0	0.06	932	6.75	9.4	16.8	2.035	
0836		3.5	0.06	841	6.74	10.6	16.9	2.035	
0839		4.0	0.07	806	6.73	11.2	16.9	2.035	
Groundwater equilibrium reached at		± 10%		± 3% (EC)	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): Brown, slightly turbid, no odour, no sheen

Observations during sampling (turbidity, colour, odour, sheen): becoming clear, no turbidity, no odour, no sheen

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☒ Same as purge method ☐ Other:.....

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments
MW21	2xv; 1x1	TRH, BTEXN, PAH	H2SO4; Nil	ALS	
MW21	1bp	metals	HNO3	ALS	Field filtered

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

SAMPLE BOTTLE TIME = 0900

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

Project Name: BURDONS INDUSTRIAL	Project Number: 60438840	Well No: MW19
Recorded By: KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date: 31.8.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC):	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 2.449	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC):
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ (TD) - ____ (WL)) x (____ (D) /2)^2 x 0.00314] + [0.2 x (0.00314 x ____ (borehole radius)^2 x ____ (TD-WL)) – 0.2 x (0.00314 x ____ (well radius)^2 x ____ (TD-WL))] = ____ 1 BV (L)

Start Time: 0856	Stop Time:	Elapsed Time:	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
0859		0.5	0.34	812	6.50	72.7	17.7	2.450	
0902		1.0	0.17	828	6.55	67.4	18.3	2.452	
0905		1.5	0.07	827	6.59	65.5	18.3	2.454	
0908		2.0	0.07	815	6.58	64.6	18.0	2.454	
0911		2.5	0.04	816	6.51	66.4	18.0	2.455	
0914		3.0	0.03	820	6.52	66.8	18.3	2.456	
0917		3.5	0.03	822	6.58	63.9	18.5	2.456	
0920		4.0	0.02	820	6.58	63.4	18.4	2.456	
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): clear, no turbidity, no odour, no sheen

Observations during sampling (turbidity, colour, odour, sheen): As above

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☒ Same as purge method ☐ Other:.....

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments
MW19	3x 1x2	TPH, BTEXN, PAHs	H_2SO_4; Nil	AIS	
MW19	1x500	Metals	HNO_3	AIS	field filtered

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

SAMPLE BOTTLE TIME = 0945

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

Project Name: BULLENS INDUSTRIAL	Project Number: 60438840	Well No: MW16
Recorded By: KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date: 31.8.15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC):	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 3.160	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC):
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ (TD) - ____ (WL)) x (____ (D)/2)^2 x 0.00314] + [0.2 x (0.00314 x ____ (borehole radius)^2 x ____ (TD-WL)) – 0.2 x (0.00314 x ____ (well radius)^2 x ____ (TD-WL))] = ____ 1 BV (L)

Start Time: 1037	Stop Time:	Elapsed Time:	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
1040		0.5	0.29	2224	6.88	72.1	21.5	3.420	
1043		1.0	0.09	2189	6.89	63.5	21.4	3.540	
1046		1.5	0.07	2062	6.88	41.1	21.5	3.730	
1049		2.0	0.18	2100	6.88	30.7	21.5	3.820	
1052		2.5	0.27	2110	6.87	22.3	21.6	3.913	
1055		3.0	0.63	2135	6.87	20.2	21.7	4.006	
1058		3.5	0.86	2139	6.88	18.1	21.7	4.113	
1101		4.0	0.92	2206	6.88	17.6	21.7		
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): clear, no turbidity, no odour, no sheen

Observations during sampling (turbidity, colour, odour, sheen): As above

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☒ Same as purge method ☐ Other:.....

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments
MW16	2xV; 1xA	TRH, BTEXN, PAHs	H_2SO_4; Nil	AIS	
MW16	1xP	Metals	HNO_3	AIS	Field filtered

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

SAMPLE BOTTLE TIME = 1115

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

AECOM

Site Contamination Analysis – Water Quality Sampling Form

Project Name: BULLENS INDUSTRIAL	Project Number: 60438840	Well No: MW17
Recorded By: KATE P	Well Type: ☒ Monitor ☐ Extractor ☐ Other	
Date: 31-8-15	Well Material: ☒ PVC ☐ SS ☐ Other	

Well Purging

Well Details	Purge Method
Well Diameter (D in mm): ☒ 50 ☐ 100 ☐ Other:	☐ Bailer – Type: ☐ PVC ☐ SS ☐ Teflon ☐ Other:
Total Depth of Well (TD in m BTOC):	☒ Pump – Type: ☐ Submersible ☐ Bladder ☒ Other: PERISTALTIC
Water Level Depth (WL in m BTOC): 3.065	**Pump Intake Setting**
Number of bore volumes (BV) to be purged (# VOLS)	Depth pump set (m BTOC):
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other	Screen Interval (m BTOC) Top : Bottom:

Purge Volume Calculation: (accounting for porosity of packing material surrounding well in bore hole)

[(____ (TD) - ____ (WL)) x (____ (D)/2)^2 x 0.00314] + [0.2 x (0.00314 x ____ (borehole radius)^2 x ____ (TD-WL)) – 0.2 x (0.00314 x ____ (well radius)^2 x ____ (TD-WL))] = ____ 1 BV (L)

Start Time:	Stop Time:	Elapsed Time:	Initial depth to water: (with pump in well)	Final depth to water: (after sampling, with pump in well)
1108				

Field Parameter Measurements

Actual Time	Elapsed minutes	Purge Vol (L)	DO (mg/L)	EC. (µS/cm)	pH	Redox (mV)	Temp (°C)	SWL (m BTOC)	Pump setting (rate)
1111		0.5	0.18	1600	6.86	-56.6	21.7	3.076	
1114		1.0	0.06	1522	6.81	-57.9	21.5	3.084	
1117		1.5	0.02	1349	6.72	-52.6	21.3	3.089	
1120		2.0	0.00	1279	6.72	-51.3	21.3	3.089	-0.17.00
1123		2.5	—	1201	6.69	-48.4	21.1	3.089	-0.27.00
1126		3.0	—	1259	6.68	-46.6	21.0	3.089	
Groundwater equilibrium reached at			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	(3 consecutive measurements)	

Observations in first 1L purged (turbidity, colour, odour, sheen): clear slight grey/brown tinge, no odour, no

Observations during sampling (turbidity, colour, odour, sheen): becoming clear, no turbidity, no sheen

Discharge water disposal: ☒ Drums ☐ Sanitary sewer ☐ Storm sewer ☐ Surface ☐ Other

Well Sampling

Sampling Method ☒ Same as purge method ☐ Other:.....

Sample Distribution Sample Series:

Sample No.	Vol/Cont.	Analysis	Preservatives	Lab	Comments
MW17	2x V; 1x d	TPH, BTEX, PAHs,	H_2SO_4; Nil	AIS	
MW17	1x P	Metals	HNO_3	AIS	field filtered

Quality Control Samples

QA/QC Sample ID	Sample Type (duplicate, etc)	Parent Sample ID

Sampling notes: well condition, weather, change in pump depth, equipment difficulties

SAMPLE BOTTLE TIME = 1145

Do ECs need review? ☐ Yes ☐ No Are salinity corrections warranted?: ☐ Yes ☐ No

Note: m BTOC = m below top of casing

Soil Bore Log

AECOM

FIELD LOG OF BORING NO. SB - _____ / MONITOR WELL NO. MW - _____

Project Number: _____ Project Name: _____ Logged By: _____

Date Completed: ____/____/____ Drill Rig Type: _____ Drilling Contractor: _____

Depth (metres)	Groundwater Encountered	PID (ppm)	SPT COUNTS (150 mm, 150 mm, 150 mm)	Sample Type (see below)	SOIL TYPE: C = clay, M = silt, S = sand, G = gravel; eg. silty sand = MS	USCS Group Symbol	CONSISTENCY: CLAY (v.soft, soft, medium stiff, stiff, v.stiff, hard) / SAND (v.loose, loose, m.dense, dense, v.dense)	MOISTURE: S = saturated, V = very moist, M = moist, sl = slightly moist, X = dry	PLASTICITY: VH = v.high, H = high, M = medium, L = low	COLOUR eg. black, grey, red, orange, yellow - dark, pale, mottled	MINOR COMPONENTS & COMMENTS eg. odours, PSH, ash, slag, gravel	Sampling Interval

SURFACE COVER: [ ] CONCRETE____(mm) [ ] BITUMEN____(mm) [ ] GRAVEL [ ] GRASS [ ] OTHER: _____

Start		1146					SW	1.096					
		MW01											
Time		(L)	DO		EC		pH	Redox		Temp	SW		
1149		0.5	0.07		1039		6.90	-78.0		20.0	1.096		
1152		1.0	0.01		1032		6.82	-73.9		20.0	1.096		
1155		1.5	—		1013		6.77	-68.4		19.7	1.096	-0.2%	DO
1158		2.0	—		1009		6.77	-69.8		19.7	1.096	-0.2%	DO
1201		2.5	—		1004		6.78	-65.4		19.6	1.096	-0.2%	DO
1204		3.0	—		1000		6.79	-65.0		19.6	1.096	-0.3%	DO
grey/brown, slightly turbid, no odour, no sheen													
		clear from 1.5L											

DRILLING METHOD: [ ] Solid Flight Augers: ____(mm) dia. [ ] Hollow Flight Augers: ____(mm) dia. Hand Auger____(mm) dia. [ ] Push Tube [ ] Test Pit

BOREHOLE ABANDONMENT: [ ] Backfill & Compact [ ] Resurface (Concrete/ColdMix) [ ] Monitor Well [ ] Other: _____

WELL CONSTRUCTION DETAILS:	Well diameter: [ ] 50mm [ ] 100mm [ ] other: ____ Well Depth: _____(m) Screen from: _____(m) up to _____ (m) Riser from: _____(m) up to _____ (m) Well Cover: [ ] Flush mounted [ ] Stickup [ ] Padlocked	Gravel Pack from: _____ (m) up to _____ (m) Type: _____ Bentonite Seal from: _____ (m) up to _____ (m) Pellet Size: _____(mm) Backfill from: _____ (m) up to _____ (m) Type: _____ Grout from: _____ (m) up to _____ (m) Type: _____
WELL DEVELOPMENT DETAILS:	Development Method: _____ Developed By: _____ Date: ___/___/___	
ADDITIONAL COMMENTS:	BOTTLE TIME = 1230 QC200 dup MW01 QC201 Lysate	

Sample Type Symbols: X = Auger I = SPT/Push Tube G = grab sample

TB Trip Blank

FIELDWORK QUALITY MANUAL

MW02

FQM-5.05-F1 – GROUNDWATER SAMPLING AND PURGING RECORD

Bore ID:

Project Name:	Goodman Finucky	Project Number:	G06235ag	PM Name:	A.L.	Sample Date:	7/2
Client:	Goodman	Project Location:	1-3 Byrnes Rd	Fieldwork Staff:	R Panozzo	Well Development or Well Sampling Event? (circle)	

GENERAL BORE INFORMATION

Date of GW Level:	7.2.20	Bore Radius (mm):	50
Depth to GW (m-pvc):	1.145	Screen Interval (m):	
Bore Depth (m-pvc):	4.28	Casing Radius (mm):	
Depth to Product (m-pvc):		Cover Type (gatic/stickup):	
Product Thickness (m):		Bore Locked (YES/NO):	
		Key Type (if applicable):	9/16
Calculated bore volume (L):		Includes/ excludes bore annulus (circle)	

PARAMETER INFO.

Chem Kit Serial No.:	17C1046984
Chem Kit Model:	YSI pro
Corrected Redox:	Y / (N)
(The correction to apply is probe dependent)	
Parameter method:	☐ Downhole ☑ Retrieved

DECONTAMINATION

- ☑ Decontaminated
- ☐ Dedicated
- ☐ Disposable
- ☐ Other (specify)

SAMPLING METHOD:

Low Flow: Pump rate:

Intake depth:

- ☐ Bailer ☐ Hydrasleeve
- ☐ Peristaltic Pump ☐ Waterra
- ☐ Other (specify)

HYDRASLEEVE INFO.

Hydrasleeve Size:	Monitoring sequence followed (number in order):
Hydrasleeve Type:	Gauging
Sampling Depth (m-pvc):	Hydrasleeve in
Hydrasleeve Install time:	Hydrasleeve out
Sampling Start Time:	Parameters

# of purge volumes removed:

Total purged volume (L):

WATER QUALITY PARAMETERS

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1133	0.5	1.14		0	1147	7.41	-99.3	23.4	Black / dark grey NOIS H-turbidity
1135		1.145		0.12	1325	7.25	-85.3	23.3	"
1137		1.145		0	1202	7.34	-127.4	23.1	"
1140	20	1.145		0	1401	7.30	-125.4	23.3	Grey NOIS, m-H turbidity
1142	25	1.149		0	1416	7.26	-126.4	23.4	clearing, NOIS L-m turbidity
1143	30	1.145		0	~~1500~~ 1500	7.34	-132.4	23.1	Grey, NOIS m-H turbidity
1145	35	1.145		0	2160	7.24	-130.4	23.2	
1152	40	1.145		0.29	2066	7.20	-131.7	23.1	
1156	45	1.142		0	1414	7.24	-121.5	23.2	Clear, NOIS, M turbidity, grey
1159	55	1.141		0	1446	7.24	-130.0	23.3	"
	60	1.141		0.01	1447	7.24	-131.1	23	"
1213	65	1.141		0.01	1430	7.30	-131.2	23.2	"
			Acceptable Parameter Range:	± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

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ANALYTES SAMPLED FOR:

Field Filtered:	Unfiltered:

BOTTLES COLLECTED

	x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)
	x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic

QA/QC INFORMATION

FIELD COMMENTS

Bore volume calculation, bore condition, fate of tubing, redox correction etc..

Approval and Distribution

Fieldwork Staff Signature	Date 7/2	Checker Name and Signature	Date
Project Manager Signature	Date	Distribution: Project Central File	

FIELDWORK QUALITY MANUAL

MW102

FQM-5.05-F1 – GROUNDWATER SAMPLING AND PURGING RECORD

Bore ID:

Project Name:		Project Number:	60623509	PM Name:	AL	Sample Date:	7/12
Client:	Goodman	Project Location:	1-3 Burrows Rd	Fieldwork Staff:	R. Panozzo	Well Development or Well Sampling Event? (circle)	

GENERAL BORE INFORMATION

Date of GW Level:	7/12	Bore Radius (mm):	
Depth to GW (m-pvc):	1.141	Screen Interval (m):	
Bore Depth (m-pvc):	4.28	Casing Radius (mm):	
Depth to Product (m-pvc):		Cover Type (gatic/stick up):	
Product Thickness (m):		Bore Locked (YES/NO):	
		Key Type (if applicable):	
Calculated bore volume (L):		Includes/ excludes bore annulus (circle)	

PARAMETER INFO.

Chem Kit Serial No.: 18C1095609

Chem Kit Model: YSI pro

Corrected Redox: Y / (N)

(The correction to apply is probe dependent)

Parameter method: ☐ Downhole (☑) Retrieved

DECONTAMINATION

- ☐ Decontaminated
- ☑ Dedicated
- ☐ Disposable
- ☐ Other (specify)

SAMPLING METHOD:

Low Flow: Pump rate:

Intake depth:

- ☐ Bailer ☐ Hydrasleeve
- ☐ Peristaltic Pump ☐ Waterra
- ☐ Other (specify)

HYDRASLEEVE INFO.

Hydrasleeve Size:	Monitoring sequence followed (number in order):
Hydrasleeve Type:	Gauging
Sampling Depth (m-pvc):	Hydrasleeve in
Hydrasleeve Install time:	Hydrasleeve out
Sampling Start Time:	Parameters

# of purge volumes removed:

Total purged volume (L):

WATER QUALITY PARAMETERS

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
1215	70	1.138		0.01	1399	7.24	-110.9	23	Grey NOIS, m turbidity
1217	75	1.138		0.01	1426	7.29	-123.1	23.3	dark grey, NOIS m-turbidity - clearing
1220	80	1.138		0.2	1440	7.29	-125.1	23.3	light grey, NOIS m turbidity
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

ANALYTES SAMPLED FOR:

Field Filtered:	Unfiltered:

BOTTLES COLLECTED

	x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)
	x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic

QA/QC INFORMATION

FIELD COMMENTS

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

80L purged.

DW 1.14m

TD 4.4m

Approval and Distribution

R. Panozzo — Fieldwork Staff Signature — 7/12. — Date

Checker Name and Signature — Date

Project Manager Signature — Date

Distribution: Project Central File

FIELDWORK QUALITY MANUAL

BH1MW103

FQM-5.05-F1 – GROUNDWATER SAMPLING AND PURGING RECORD

Bore ID:

Project Name:		Project Number:	60623599	PM Name:	AC	Sample Date:	
Client:	Goodman	Project Location:	1-3 Burrows Rd	Fieldwork Staff:	R.Pantazi	Well Development or Well Sampling Event? (circle)	

GENERAL BORE INFORMATION		PARAMETER INFO.	DECONTAMINATION	SAMPLING METHOD:	HYDRASLEEVE INFO.	
Date of GW Level:	Bore Radius (mm):	Chem Kit Serial No.:	☐ Decontaminated	Low Flow: Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc):	Screen Interval (m):	Chem Kit Model:	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc):	Casing Radius (mm):	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/NO):	Parameter method: ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable):	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

WATER QUALITY PARAMETERS

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
									Dark grey becomes grey, NOIS. H-M turbidity
									May require further purging.
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

ANALYTES SAMPLED FOR:		BOTTLES COLLECTED						QA/QC INFORMATION
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic	

FIELD COMMENTS

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

45 L removed.
unable to take parameters dere to high rainfall and aw well flooding

~~Purged till dry to not bail~~

Approval and Distribution

R. Pantazi — Fieldwork Staff Signature	9/12 — Date	Checker Name and Signature	Date
Project Manager Signature	Date	Distribution: Project Central File	

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FIELDWORK QUALITY MANUAL

FQM-5.05-F1 – GROUNDWATER SAMPLING AND PURGING RECORD

Bore ID: BH/MW115

Project Name:	Goodman; Burrows Rd	Project Number:	60623509	PM Name:	AL	Sample Date:	
Client:	Goodman	Project Location:	1-3 Burrows Rd	Fieldwork Staff:	N. Panozzo	Well Development or Well Sampling Event? (circle)	

GENERAL BORE INFORMATION		PARAMETER INFO.	DECONTAMINATION	SAMPLING METHOD:	HYDRASLEEVE INFO.	
Date of GW Level: 7/2/20	Bore Radius (mm): 50	Chem Kit Serial No.: 18C1004684	☐ Decontaminated	Low Flow: Pump rate:	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 1.68	Screen Interval (m):	Chem Kit Model: YSI pro	☐ Dedicated	Intake depth:	Hydrasleeve Type:	
Bore Depth (m-pvc): 4.348	Casing Radius (mm):	Corrected Redox: Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc):	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☐ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m):	Bore Locked (YES/NO):	Parameter method: ☐ Downhole ☑ Retrieved		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): Allen					Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

WATER QUALITY PARAMETERS

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
8 50	5	1.685		0.07	1100	6.35	31	23	Dark brown/grey, NOS, H-turbidity
8 52	10	1.68		0.01	1015	6.46	26.6	23.6	clearing, L. grey
q01	15	1.68		0.77	1025	6.60	-8.0	23.1	"
q03	20	1.68		0.70	1018	6.63	-22	23.5	"
q05	25	1.683		0.69	1062	6.66	-29.5	23.5	"
q08	30	1.685		0.65	1027	6.62	-32.5	23.5	Dark grey
q08	35	1.68		0.49	1028	6.73	-45.6	23.4	Dark grey
q10	40	1.68		0.42	998	6.72	-44.5	23.3	clearing, Light Grey, NOS, H-T
q11	45	1.68		0.41	999	6.72	-44.5	23.5	clear-ing grey, NOS
q23	50	1.68		0.74	925	6.72	-53.2	23.5	light grey
q20	55	1.68		0.54	915	6.72	-57.2	23.6	light grey
q28	60	1.69		0.54	904	6.74	-58.4	23.6	light grey
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

ANALYTES SAMPLED FOR:		BOTTLES COLLECTED						QA/QC INFORMATION
Field Filtered:	Unfiltered:	x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)		
		x 40 mL Vial (H_2SO_4)		x 100 mL Amber		x 250 mL Plastic		

FIELD COMMENTS

Bore volume calculation, bore condition, fate of tubing, redox correction etc.

Developed;
Parameters stable.
GOL removed

Approval and Distribution

Fieldwork Staff Signature	Date 7/12/20	Checker Name and Signature	Date
Project Manager Signature	Date	Distribution: Project Central File	

Well ID	Date	Time	Pump Speed	Vol (L)	SWL	DO (PPM or mg/L)	EC (µS/cm)	pH	Eh/Redox (mV)	Temp (°C)	Turbidity	Water Colour	Odour	water Sampling.Daer Samplin		Groundwater Sampling.Pump Category	Pump Type	Time	Depth to Water	Well Depth
MW105	12/02/2020	07:16:32	Slow	0.5	1.813	0.07	1398	6.39	16.8	24	Turbid	Grey / Brown	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW105	12/02/2020	07:23:04	Slow	1	1.813	0.12	1400	6.46	5.9	24	Clearing	Light Grey	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW105	12/02/2020	07:26:19	Slow	1.5	1.813	0.65	1400	6.51	10.6	24.2	Low	Clear	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW105	12/02/2020	07:30:05	Slow	2	1.813	0.35	1405	6.55	6.7	24.4	Low	Clear	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW105	12/02/2020	07:32:37	Slow	2.5	1.813	0.32	1404	6.57	2.7	24.5	Low	Clear	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW105	12/02/2020	07:35:22	Slow	3	1.813	0.34	1403	6.59	-0.9	24.6	Low	Clear	No odour	12/02/2020	07:15:42	Low Flow	Peristaltic	07:12:47	1.811	4.39
MW16	12/02/2020	08:06:36	Slow	0.5	2.75	0.24	1526	6.63	31.4	23.8	Clearing	Light Grey	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW16	12/02/2020	08:09:07	Slow	1	2.75	0.21	1482	6.54	49.9	23.8	Low	Clear	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW16	12/02/2020	08:12:04	Slow	1.5	2.75	0.37	1429	6.49	86.6	23.8	Low	Clear	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW16	12/02/2020	08:15:53	Slow	2	2.75	0.62	1401	6.5	103.1	24	Low	Clear	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW16	12/02/2020	08:18:06	Slow	2.5	2.75	1.1	1396	6.52	107.9	24.1	Low	Clear	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW16	12/02/2020	08:21:04	Slow	3	2.75	1.7	1385	6.54	111.4	24.1	Low	Clear	No odour	12/02/2020	07:59:44	Low Flow	Peristaltic	07:57:30	2.749	4.22
MW17	12/02/2020	09:06:48	Slow	0.5	2.647	2.3	1307	6.72	101.6	23.7	Low	Clear	No odour	12/02/2020	09:01:31	Low Flow	Peristaltic	08:55:33	2.647	3.99
MW17	12/02/2020	09:09:14	Slow	1	2.647	0.13	1304	6.72	100.2	23.8	Low	Clear	No odour	12/02/2020	09:01:31	Low Flow	Peristaltic	08:55:33	2.647	3.99
MW17	12/02/2020	09:12:06	Slow	1.5	2.647	0.13	1304	6.72	97.6	23.8	Low	Clear	No odour	12/02/2020	09:01:31	Low Flow	Peristaltic	08:55:33	2.647	3.99
MW17	12/02/2020	09:15:05	Slow	2	2.647	0.21	1334	6.72	95.4	24	Low	Clear	No odour	12/02/2020	09:01:31	Low Flow	Peristaltic	08:55:33	2.647	3.99
MW115	12/02/2020	09:42:59	Slow	0.5	1.439	0.49	1124	6.87	-17.2	23	Medium	Light Grey	No odour	12/02/2020	09:35:27	Low Flow	Peristaltic	09:31:59	1.438	4.42
MW115	12/02/2020	09:45:41	Slow	1	1.439	0.07	1110	6.86	-59.4	23	Low	Clear	No odour	12/02/2020	09:35:27	Low Flow	Peristaltic	09:31:59	1.438	4.42
MW115	12/02/2020	09:48:13	Slow	1.5	1.439	0.04	1109	6.86	-70.6	23.1	Low	Clear	No odour	12/02/2020	09:35:27	Low Flow	Peristaltic	09:31:59	1.438	4.42
MW115	12/02/2020	09:51:03			1.439	0.06	1102	6.85	-74.8	23.3	Low	Clear	No odour	12/02/2020	09:35:27	Low Flow	Peristaltic	09:31:59	1.438	4.42
MW115	12/02/2020	09:54:39	Slow	2.5	1.439	0.14	1079	6.84	-70.1	23.3	Low	Clear	No odour	12/02/2020	09:35:27	Low Flow	Peristaltic	09:31:59	1.438	4.42
MW21	12/02/2020	10:25:08	Slow	0.5	1.64	0.02	749	7.14	-57	23.6	Turbid	Grey / Brown	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:28:27	Slow	1	1.642	0.02	737	7.14	-79.6	23.6	Clearing	Light Grey	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:31:27	Slow	1.5	1.642	0.34	661	7.06	-68.4	24.6	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:34:15	Slow	2	1.642	0.94	596	6.9	-34	24.7	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:37:09	Slow	2.5	1.642	1.14	567	6.87	-15.4	24.7	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:40:09	Slow	3	1.642	1.2	558	6.87	-3.3	24.7	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:43:05	Slow	3.5	1.642	1.29	555	6.87	3.1	24.7	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW21	12/02/2020	10:46:07	Slow	4	1.642	1.3	549	6.87	8.7	24.8	Low	Clear	No odour	12/02/2020	10:20:11	Low Flow	Peristaltic	10:17:23	1.643	3.415
MW19	12/02/2020	11:13:48	Slow	0.5	2.125	2.57	1656	6.71	84.1	24.6	Low	Clear	No odour					11:07:31	2.034	3.425
MW19	12/02/2020	11:16:19	Slow	1	2.116	2.34	1654	6.71	87.8	24.7	Low	Clear	No odour					11:07:31	2.034	3.425
MW19	12/02/2020	11:19:11	Slow	1.5	2.112	2.35	1655	6.73	92.9	24.8	Low	Clear	No odour					11:07:31	2.034	3.425
MW01	12/02/2020	12:00:58	Slow	0.5	0.677	0.15	492	7.03	-14.8	24.1	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW01	12/02/2020	12:03:19	Slow	1	0.677	0.09	488.1	6.99	23.6	24.4	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW01	12/02/2020	12:06:06	Slow	1.5	0.677	0.06	477.2	6.96	-23.6	25.1	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW01	12/02/2020	12:09:07	Slow	2	0.677	0.06	472.8	6.96	-25.9	25.6	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW01	12/02/2020	12:12:05	Slow	2.5	0.677	0.05	479.1	6.96	-35.9	25.7	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW01	12/02/2020	12:14:12	Slow	3	0.677	0.05	485.7	6.95	-40.1	25.7	Low	Clear	No odour	12/02/2020	11:54:44	Low Flow	Peristaltic	11:53:08	0.677	3.275
MW102	12/02/2020	12:46:23	Slow	0.5	0.841	0.5	8739	6.96	-43.3	23.1	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	12:49:22	Slow	1	0.942	0.02	7229	7.13	-104.4	22.8	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	12:52:05	Slow	1.5	0.942	0	5545	7.27	-126.4	22.8	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	12:55:26	Slow	2	0.942	0	4453	7.39	-143.7	22.9	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	12:59:39	Slow	2.5	0.947	0.02	4179	7.43	-143.7	22.9	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	13:05:05	Slow	3	0.947	0.08	5133	7.35	-130.7	22.9	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	13:08:17	Slow	4	0.947	0	3188	7.53	-169.9	22.8	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	13:11:10	Slow	4.5	0.947	0	3066	7.52	-170.6	23	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	13:13:53	Slow	5	0.947	0	3064	7.51	-171.7	23	Low	Light Grey	No odour	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42
MW102	12/02/2020	13:15:05	Slow	5.5	0.947	0	3053	7.51	-172.6	23	Low	Light Grey	Hydrogen Sulph	12/02/2020	12:42:51	Low Flow	Peristaltic	12:41:15	0.941	4.42

Ground Gas Monitoring Field Sheets

FQM - Landfill Gas - Sub Services and Structures Survey Data Sheet

Project Name:	Burrows Industrial Estate	Project Number:	60623599	PM Name:	AL	Date:	21/12/20
Client:	Goodman	Project Location:	1-3 Burrows Road, St Peters	Fieldwork Staff:	KW	Monitoring Instrument and Serial Number:	GA5000

Location ID	Type	GPS		Stabilised Reading										
(Building, Service or Structure)		Easting	Northing	Time	CH_4 % v/v	CH_4 Peak % v/v	CO_2 % v/v	CO_2 Peak % v/v	O_2 % v/v	O_2 Minimum %	Balance % v/v	H_2S ppmv	CO ppmv	Pressure Barometric (mb)
Unit 7	Building			8:00	0.0		0.1		20.8		79.1	0	0	1015
Unit 7	" "			8:02	0.0		0.1		20.8		79.1	0	0	1015
Unit 7	" "			8:04	0.0		0.1		20.8		79.1	0	0	1015
Unit 9	Building			8:06	0.0		0.1		21.0		78.9	0	0	1016
Unit 9	" "			8:08	0.0		0.1		21.0		78.9	0	0	1016
Unit 9	" "			8:10	0.0		0.1		21.0		78.9	0	0	1016
Unit 3	Building			9:00	0.0		0.1		21.0		78.9	0	0	1016
Unit 3	" "			9:02	0.0		0.1		21.1		78.9	0	0	1016
Unit 3	" "			9:04	0.0		0.1		21.1		78.9	0	0	1016
Unit 2	Building			8:45	0.0		0.1		21.0		78.9	0	0	1016
Unit 2	" "			8:47	0.0		0.1		21.0		79.0	0	0	1016
Unit 2	" "			8:49	0.0		0.1		21.0		79.0	0	0	1016

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Fieldwork Staff Signature	Date	Project Manager Signature	Date
[signature]	21/12/20		

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

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Project Name:	Burrows Industrial Estate	Project Number:	60623599	PM Name:	AL	Date:	21/2/20
Client:	Goodman	Project Location:	1-3 Burrows Road, St Peters	Fieldwork Staff:	KW	Monitoring Instrument and Serial Number:	GA5000

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW21	7:16	Ambient	0.1		0.1		20.7		79.2	0	0	-	1015	-0.34	
	7:18	~~Pre-purge~~	0.0		0.1		20.5		79.3	0	0	-	1015	-0.36	well opened
	7:20	~~1 min~~	0.0		0.1		20.6		79.3	0	0	-	1015	-0.36	
	7:22	~~2 min~~	0.0		0.1		20.6		79.3	0	0	-	1015	-0.36	
	7:24	~~3 min~~	0.0		0.1		20.6		79.3	0	0	-	1015	-0.36	stabilised
		Unstable- (Fluctuation or direction & rate of change in 10 secs)										-			

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW19	7:26	Ambient	0.0		0.1		20.6		79.3	0	0		1015	-0.24	
	7:27	~~Pre-purge~~	0.0		1.8		19.7		79.6	0	0		1015	-0.24	well opened
	7:29	~~1 min~~	0.0		0.1		20.4		79.4	0	0		1015	-0.24	
	7:31	~~2 min~~	0.0		0.1		20.5		79.4	0	0		1015	-0.24	
	7:33	~~3 min~~	0.0		0.1		20.5		79.4	0	0		1015	-0.24	stabilised
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW17	7:40	Ambient	0.0		0.1		20.7		79.2	0	0		1015	-0.24	
	7:41	Pre-purge	0.0		4.2		15.4		78.4	0	0		1015	-0.24	well opened
	7:43	1 min	0.0		0.1		20.6		79.3	0	0		1015		
	7:45	2 min	0.0		0.1		20.6		79.3	0	0		1015		stabilised
	~~7:47~~	3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW16	7:49	Ambient	0.0		0.1		20.7		79.2	0	0	-	1015	-0.24	
	7:50	Pre-purge	0.0		1.2		19.4		79.7	0	0	-	1015		
	7:51	1 min	0.0		0.1		20.6		79.3	0	0	-	1015		
	7:53	2 min	0.0		0.1		20.6		79.3	0	0	-	1015		stabilised
		3 min													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

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Fieldwork Staff Signature _____ Date _____ Project Manager Signature _____ Date _____

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FQM - Landfill Gas - Soil and Gas Bores Survey Sheet

Project Name:	Burrows Industrial Estate	Project Number:	60623599	PM Name:	AL	Date:	21/2/20
Client:	Goodman	Project Location:	1-3 Burrows Road, St Peters	Fieldwork Staff:	KW	Monitoring Instrument and Serial Number:	GA5000

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW105	8:14	Ambient	0.0		0.1		21.1		78.8	0	0	–	1015	-0.26	
	8:15	~~Pre-purge~~	0.0		0.4		20.3		78.4	0	0	–	1015	-0.26	well opened
	8:17	~~1 min~~	0.0		0.5		19.4		79.1	0	0	–	1015	-0.26	
	8:19	~~2 min~~	0.0		0.1		20.8		79.1	0	0	–	1015	-0.26	
	8:21	~~3 min~~	0.0		0.1		20.8		79.1	0	0	–	1015	-0.26	stabilised
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW115	8:23	Ambient	0.0		0.1		20.9		79.0	0	0	–	1016	-0.22	
	8:24	~~Pre-purge~~	0.1		0.1		20.9		79.0	0	0	–	1016	-0.22	well opened
	8:26	~~1 min~~	0.4		0.2		20.6		78.9	0	0	–	1016	-0.22	
	8:28	~~2 min~~	0.1		0.1		20.8		79.0	0	0	–	1016	-0.22	
	8:30	~~3 min~~	0.1		0.1		20.8		79.0	0	0	–	1016	-0.22	stabilised
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW01	8:35	Ambient	0.1		0.1		21.0		78.9	0	1	–	1016	-0.24	
	8:37	~~Pre-purge~~	0.6		0.9		19.8		78.4	0	0	–	1016	-0.24	well opened
	8:39	~~1 min~~	0.2		0.3		20.3		79.2	0	0	–	1016	-0.24	
	8:41	~~2 min~~	0.2		0.2		20.5		79.2	0	0	–	1016	-0.24	
	8:43	~~3 min~~	0.2		0.2		20.5		79.2	0	0	–	1016	-0.24	stabilised
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

Purging Details			CH_4		CO_2		O_2		Balance	H_2S	CO	Flow	Pressure		Comments
ID	Time	Time	% v/v	Peak % v/v	% v/v	Peak % v/v	% v/v	Minimum %	% v/v	ppmv	ppmv	L/hour	Barometric (mb)	Relative (mb)	
MW102	8:50	Ambient	0.0		0.1		20.8		79.1	1	0	–	1016	-0.24	
	8:51	~~Pre-purge~~	0.0		0.1		20.6		79.2	0	0	–	1016	-0.24	well opened
	8:53	~~1 min~~	0.0		0.1		20.7		79.3	0	0	–	1016	-0.24	
	8:55	~~2 min~~	0.0		0.1		20.7		79.3	0	0	–	1016	-0.24	stabilised
		~~3 min~~													
		Unstable- (Fluctuation or direction & rate of change in 10 secs)													

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Fieldwork Staff Signature — 21/2/20 Date — Project Manager Signature — Date

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