2023–2024 Groundwater and Surface Water Monitoring Report

Camden Gas Project

Prepared for AGL Upstream Investments Pty Ltd

October 2024

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Executive Summary

AGL Upstream Investments Pty Ltd (AGL) owns and operated the Camden Gas Project (CGP) located in the Macarthur Region, 65 kilometres (km) southwest of Sydney, NSW. The CGP produced natural gas from coal seams for the Sydney region from 2001 until 2023 and consisted of 144 gas wells. The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550–700 metres below ground level (mbgl). Following final production at the Rosalind Park Gas Plant on 28 August 2023, the remaining gas wells are no longer producing and are being progressively plugged and abandoned.

Over the monitoring year (1 July 2023–30 June 2024), the CGP groundwater monitoring network comprised seven monitoring bores at two nested monitoring sites. A combination of shallow and deep monitoring bores target the alluvium near the Nepean River and the Hawkesbury Sandstone overlying the target coal seams. Groundwater levels have been recorded at six hourly intervals and water quality data has been collected on a six-monthly basis during the monitoring year. The Menangle Park and Glenlee sites have been monitored since June 2013 and February 2014 respectively.

Four monitoring bores at Denham Court were monitored from 2011 to 2016, before being decommissioned at the landowners' request. Final water quality monitoring was undertaken in April 2016 and groundwater level data was available until October 2016. Denham Court was located 12 km north from the CGP and acted as a control and background monitoring location (Inset 1, Figure 1.1).

Surface water quality and level is monitored at one location along the Nepean River, near the Menangle Park site. Groundwater and surface water quality data was collected twice during the monitoring year in October 2023 and April 2024. This report presents an assessment of water level and water quality data from the groundwater monitoring network and from the Nepean River for the period up to 30 June 2024, with an emphasis on data obtained during the current monitoring year.

Groundwater level in the Nepean River alluvium is shallow (less than 10 mbgl) and shows a direct response to rainfall and flood events. Groundwater levels in each of the Hawkesbury Sandstone aquifers are shallow (approximately 8 mbgl to 15 mbgl) and follow similar trends. There is no apparent response to individual rainfall events at the Glenlee site, while a clear response to rainfall events can be observed at the Menangle Park site. Recorded groundwater levels during the 2023–2024 monitoring year were comparable to groundwater levels recorded during previous monitoring years and consistent with the climatic variations at the Menangle Park site. A stable groundwater trend can be observed at the deep Glenlee monitoring bore.

Groundwater sampled from the alluvium at the Menangle Park site is fresh to marginal, and generally has low dissolved metal concentrations. Groundwater sampled from the Hawkesbury Sandstone is fresh to marginal at the Menangle Park site. Historically groundwater at the Glenlee site has been slightly saline however, more recently slightly lower salinity levels have been observed and through the monitoring year remained brackish (instead of slightly saline). Dissolved metal concentrations in the Hawkesbury Sandstone are generally low. Dissolved methane was detected at all monitoring bores and toluene was observed at the Glenlee site and Menangle Park monitoring bore MPMB04. Overall, groundwater quality during the 2023–2024 monitoring year was generally comparable to historic observations.

Based on available data, there are no observable impacts to groundwater levels or quality that are attributable to the CGP operations. There is no evidence of connectivity between the shallower monitored zones and the coal seams (except for the potential natural migration of gases through the Narrabeen Group strata). This corroborates the conceptual model (Parsons Brinckerhoff 2011) indicating the presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and coal seams which restricts depressurisation and impedes the vertical flow of groundwater.

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1 Introduction

1.1 Background

AGL Upstream Investments Pty Ltd (AGL) owns and operated the Camden Gas Project (CGP) located in the Macarthur region, 65 kilometres (km) southwest of Sydney, NSW. The CGP produced natural gas from coal seams for the Sydney region from 2001 until 28 August 2023 and consisted of 144 gas wells. The maximum number of operational gas wells over the monitoring year was 26 within the Stage 1 and Stage 2 areas (Figure 1.1). The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550–700 metres below ground level (mbgl). Following final production at the Rosalind Park Gas Plant in August 2023, the remaining gas wells are no longer producing and are being progressively plugged and abandoned.

EMM Consulting Pty Limited (EMM) was engaged by AGL to compile groundwater and surface water monitoring results, collected between 1 July 2023 and 30 June 2024 (the monitoring year) and to analyse the data and trends with reference to the CGP activities.

A dedicated water monitoring network, consisting of 11 monitoring bores was installed between October 2011 and February 2014 targeting the alluvium, the Ashfield Shale, and the Hawkesbury Sandstone. The current groundwater monitoring network comprises seven dedicated monitoring bores across two sites. The collection of groundwater level and groundwater quality data commenced in October 2011 and groundwater levels have been recorded at six-hourly intervals. Following one initial sample in November 2011, water quality data was collected on a quarterly basis between May 2013 and April 2015 and on a six-monthly basis from April 2015 onwards. In addition, one surface water monitoring location has been sampled for water quality on two occasions during the 2023–2024 monitoring year.

This report contains an evaluation of the data obtained during the 2023–2024 monitoring year, with comparison to the data obtained during the previous monitoring years (EMM 2023, 2022, 2021, 2020, 2019, 2018, 2017, and 2016; Parsons Brinckerhoff 2012, 2013a, 2014a, 2014b and 2015e).

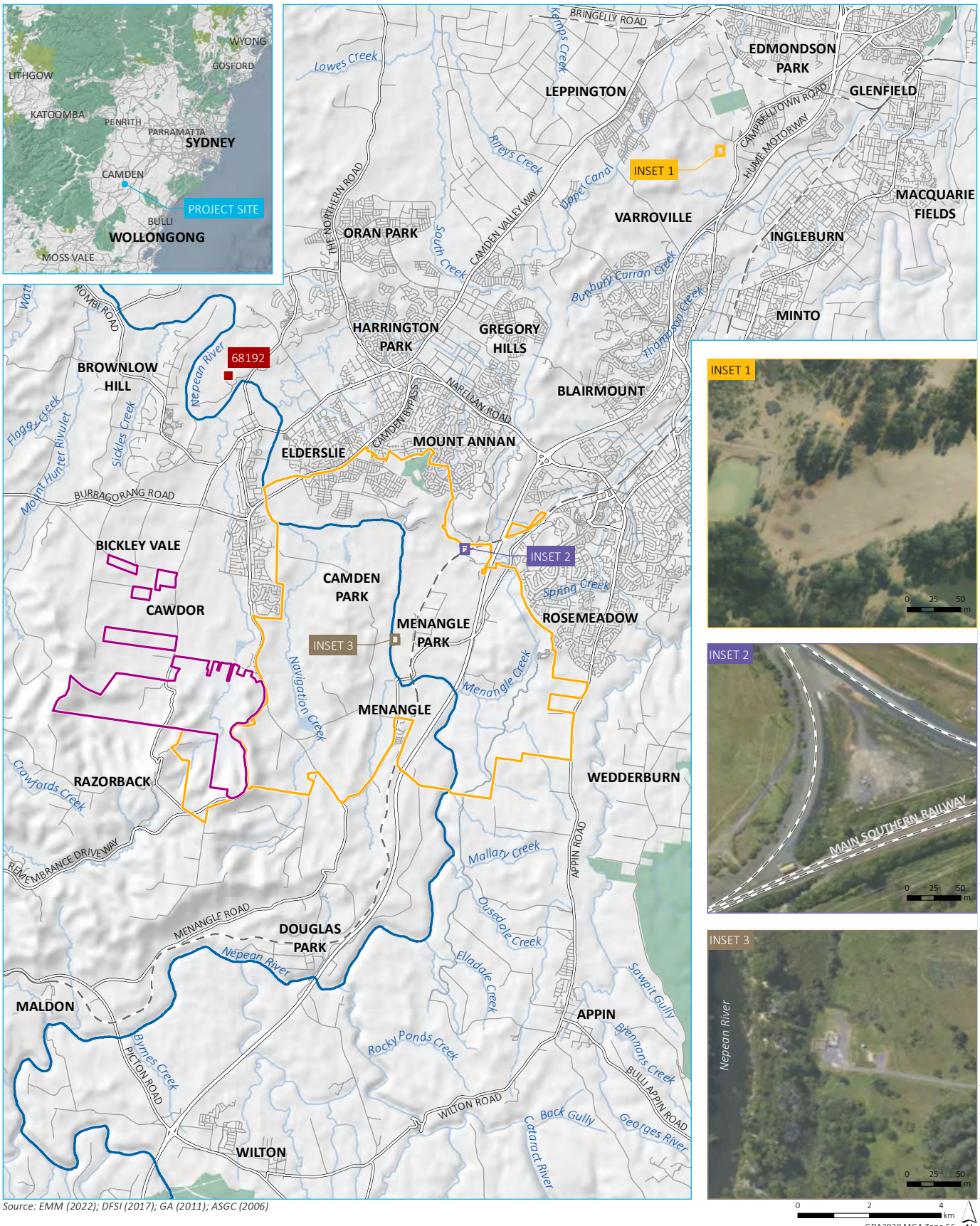
Groundwater and surface water quality data was collected twice during the monitoring year in October 2023 and April 2024. Four monitoring bores at Denham Court (RMB01, RMB02, RMB03, RMB04) were monitored from 2011 to 2016 before being decommissioned at the landowners' request. Final water quality monitoring was undertaken in April 2016 and groundwater level data was available until October 2016. Denham Court was located 12 km from the CGP and acted as a control and background monitoring location (Inset 1, Figure 1.1).

The objective of the groundwater monitoring program is to determine whether the CGP activities (primarily the local depressurisation of the deep coal seam water bearing zones) are impacting the shallow beneficial aquifers in the Hawkesbury Sandstone and alluvium of the Nepean River. The groundwater monitoring program provides water level and water quality data as well as trends for each of the shallow groundwater systems of the region, in areas within (and previously in areas also distant from) the CGP.

1.2 Scope of work over the 2023–2024 monitoring year

This report presents and interprets groundwater level and groundwater quality data, collected since monitoring began at each of the established sites. Emphasis is placed on the data obtained during the monitoring year. The scope of works comprised:

- Conduct groundwater monitoring, including six hourly groundwater level measurements and two groundwater quality sampling events (October 2023 and April 2024), testing for water quality field parameters, major cations and anions, dissolved metals, nutrients, dissolved methane, and other hydrocarbons.
- Conduct surface water quality sampling events (October 2023 and April 2024) at one location (the Nepean River, near the Menangle Park site).
- Analyse and interpret water level and water quality results with reference to the conceptual model, where relevant.
- Establish whether there are any observable impacts from coal seam gas (CSG) activities within the shallow aquifers.



Source: EMM (2022); DFSI (2017); GA (2011); ASGC (2006)

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KEY

- Camden Gas Project Stage 1
- Camden Gas Project Stage 2
- Nepean River
- BOM weather station
- Groundwater monitoring bore
- Decommissioned groundwater monitoring bore
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody
- NPWS reserve

Groundwater monitoring locations

AGL Camden Gas Project
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Figure 1.1

2 Site characterisation

2.1 Rainfall

The nearest Bureau of Meteorology (BoM) weather station with consistent historical climate data, is located at Camden Airport (BoM site number 68192), approximately 2.5 km northwest of the Stage 2 area (Figure 1.1).

In instances where data is unavailable from BoM station 68192, data is patched from other nearby stations (Queensland Government 2023).

Over the period of record (December 1971 to current), temperatures at Camden Airport ranged from a mean monthly low of 3.1°C in July to a mean monthly high of 29.7°C in January. The average annual rainfall is 787.3 millimetres (mm). July receives the least rain, with a mean rainfall of 39.4 mm, while February receives the most rain, with a mean rainfall of 103.2 mm (Bureau of Meteorology, 2024). This is displayed in Figure 2.1.

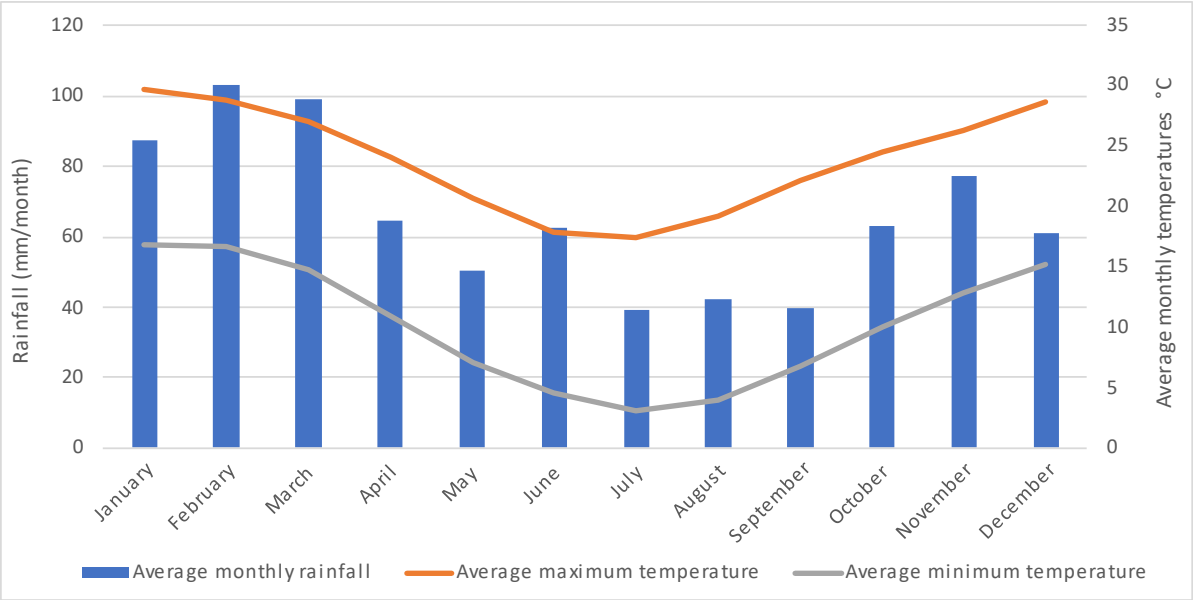


Figure 2.1 Average monthly temperature and rainfall at BoM station 68192 (Camden airport) from January 1971 to July 2024

Cumulative deviation from daily rainfall mean (CDFM) for Camden Airport is plotted in Figure 2.2. Long term CDFM is generated by subtracting daily rainfall from the average daily rainfall for the period of record (1971–2024) and then accumulating the residuals. Periods of below average rainfall are represented as downward trending slopes while periods of above average rainfall are represented as upward trending slopes.

The CDFM plot (Figure 2.2) shows a relatively wet period between 1971 and 1992 with the exception of a few drought years in the early 1980s. Drier conditions prevailed from 1992 with the Millenium Drought extending to 2007. A period of average rainfall followed from 2007 to 2017. Drought conditions prevailed from 2018 to 2020, and above average rainfall was observed from January 2020 to April 2023. A below average rainfall trend was observed from April 2023 to December 2023 with above average rainfall for the remainder of the monitoring year.

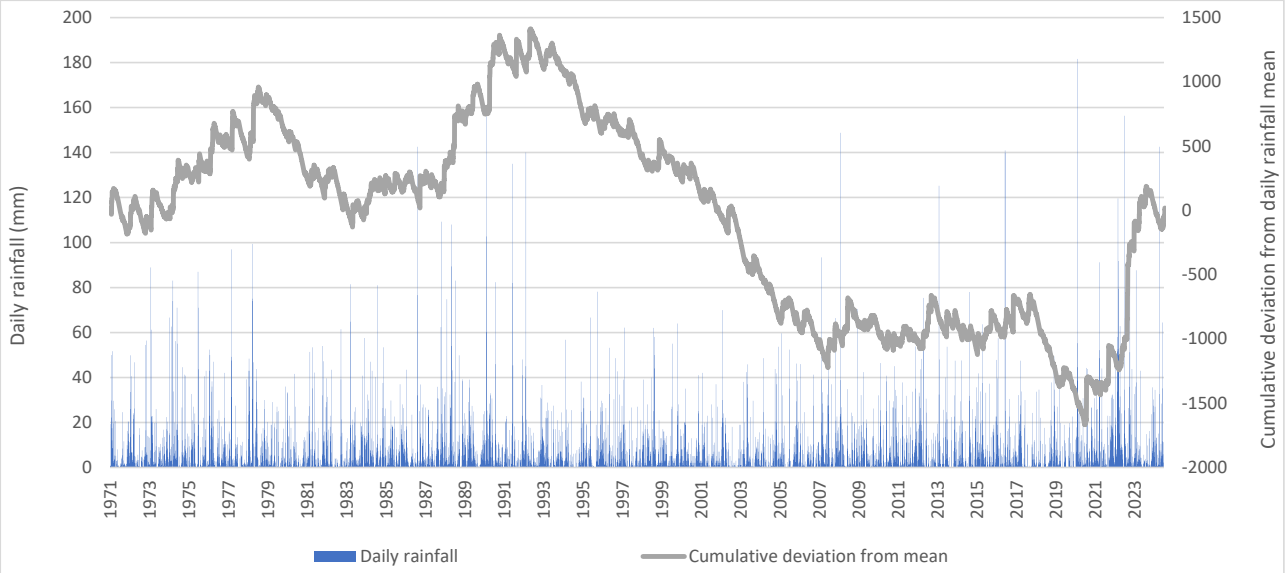


Figure 2.2 Cumulative deviation from daily rainfall mean

2.2 Surface hydrology

The CGP is located within the Hawkesbury Nepean Catchment and the Sydney Metropolitan Catchment. The major surface hydrology features in the CGP area are, the Nepean River and its tributaries, which meander in a south to north direction within the project area, and the Georges River, which flows in a northerly direction in the south-east of the project area.

Small farm dams are common in rural areas and provide water for stock as well as garden and irrigation purposes. Dams are replenished by rainfall and runoff, although some seepage flow through the weathered soil profiles occurs after long wet periods. Dams and seepage flows are not related to the regional groundwater systems around the CGP. There are no known springs in the CGP area.

2.3 Geological setting

The CGP is located within the Southern Coalfield of the Sydney Geological Basin. The Basin is primarily a Permo-Triassic sedimentary rock sequence (Parkin 2002) and is underlain by undifferentiated sediments of Carboniferous and Devonian age. The stratigraphy of the CGP in the Camden-Campbelltown area is summarised in Table 2.1. The geology and structure of the CGP is shown on Figure 2.3.

The Illawarra Coal Measures is the economic sequence of interest for CSG development in the area, and consists of interbedded sandstone, shale and coal seams, with a thickness of approximately 300 m. The upper sections of the Permian Illawarra Coal Measures (Sydney Subgroup) contain the major coal seams consisting of the Bulli Coal Seam, Balgownie Coal Seam, Wongawilli Coal Seam, and Tongarra Coal Seam. The seams targeted for CSG production within the CGP are the Bulli and Balgownie coal seams, both of which are 2 m to 5 m thick within the CGP.

The Illawarra Coal Measures is overlain by Triassic sandstones, siltstones and claystones of the Narrabeen Group and the Hawkesbury Sandstone. Overlying the Hawkesbury Sandstone is the Triassic Wianamatta Group shales which comprise most of the surficial geology (where thin alluvial deposits are not present).

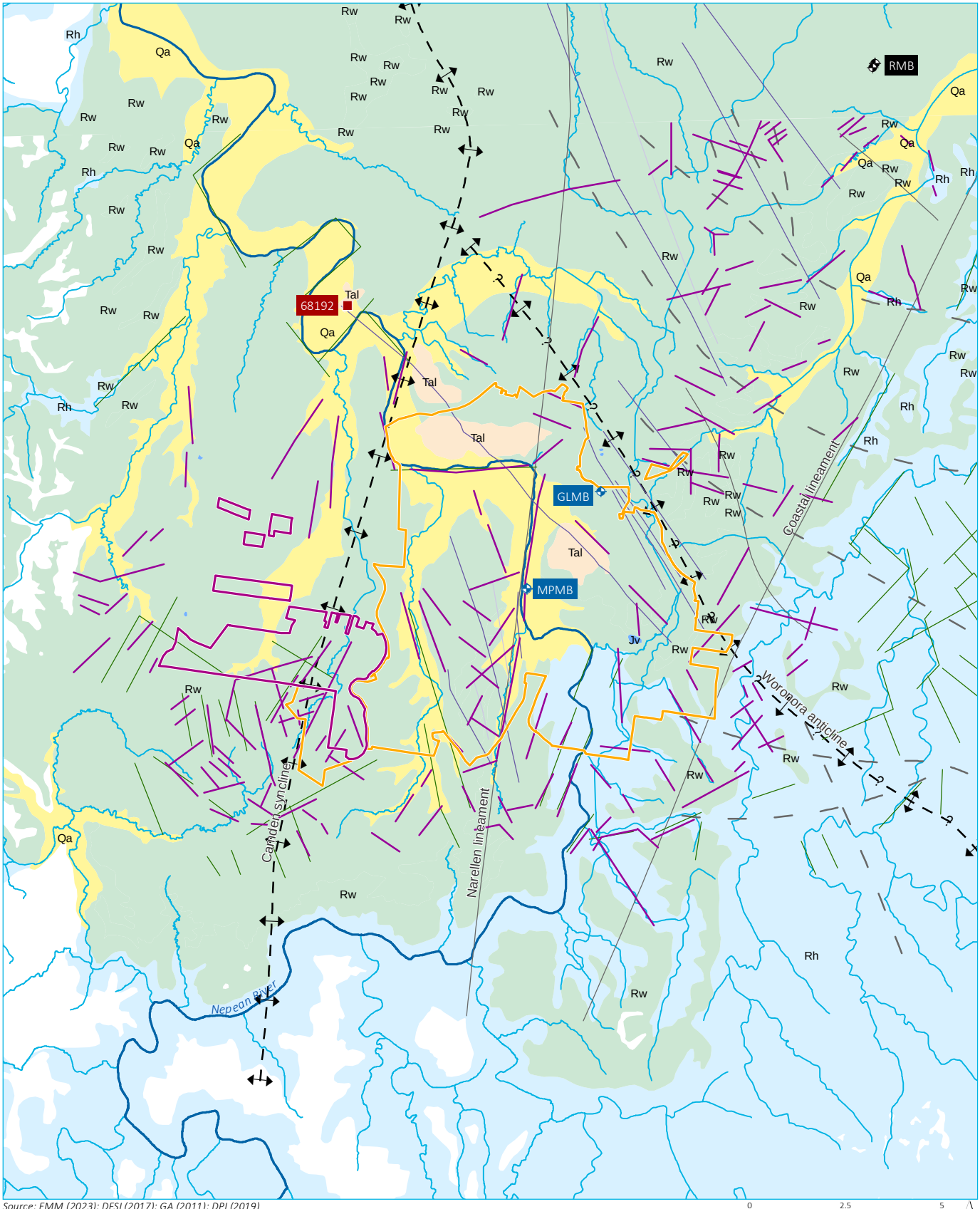
Structurally, the CGP area and surrounds are dominated by the north-northeast plunging Camden Syncline, which is a broad and gentle warp structure (Alder et al. 1991 and Bray et al. 2010). The Camden Syncline is bounded in the west and truncated in the south-west by the north-south trending Nepean Structural Zone, part of the Lapstone Structural Complex.

The CGP is relatively unaffected by major faulting however, a set of NW-NNW trending faults associated with the Lapstone Monocline Structure are present (Alder et al. 1991 and Blevin et al. 2007). These faults have been identified from exploration and 2D seismic studies and they have been identified as high-angle, low to moderate displacement normal faults (Blevin et al. 2007). Many of these features intersect coal seams however very few, if any, affect the entire stratigraphic sequence and display no expression at surface.

Table 2.1 Summary of regional Permo-Triassic geological stratigraphy

Period	Group	Sub-group	Formation	Description	Average thickness (m)[1]
Quaternary			Alluvium	Quartz and lithic 'fluvial' sand, silt and clay.	<20
Tertiary			Alluvium	High level alluvium.	
Triassic	Wianamatta Group		Bringelly Shale	Shale, carbonaceous claystone, laminate, lithic sandstone, rare coal.	80 (top eroded)
			Minchinbury Shale	Fine to medium-grained lithic sandstone.	-
			Ashfield Shale[2]	Black to light grey shale and laminate (Bembrick et al. 1987).	-
	Mittagong Formation			Dark grey to grey alternating beds of shale laminate, siltstone and quartzose sandstone (Alder et al. 1991).	11
	Hawkesbury Sandstone			Massive or thickly bedded quartzose sandstone with siltstone, claystone and grey shale lenses up to several metres thick (Bowman 1974; Moffitt 2000).	173
	Narrabeen Group	Gosford Sub-group	Newport Formation	Fine-grained sandstone (less than 3 m thick) interbedded with light to dark grey, fine-grained sandstones, siltstones and minor claystones (Bowman 1974).	35
			Garie Formation	Cream, massive, kaolinite-rich pelletal claystone, which grades upwards to grey, slightly carbonaceous claystone containing plant fossils at the base of the Newport Formation (Moffitt 2000).	8
		Clifton Sub-group	Bald Hill Claystone[2]	Massive chocolate coloured and cream pelletal claystones and mudstones, and occasional fine-grained channel sand units (Moffitt 2000).	34
			Bulgo Sandstone	Thickly bedded sandstone with intercalated siltstone and claystone bands up to 3 m thick (Moffitt 2000).	251
			Stanwell Park Claystone[2]	Red-green-grey shale and quartz sandstone (Moffitt 1999).	36
			Scarborough Sandstone	Quartz-lithic sandstone, pebbly in part (Moffitt 1999).	20
			Wombarra Claystone[2]	Grey shale and minor quartz-lithic sandstone (Moffitt 1999).	32
Permian		Sydney Sub-group	Bulli Coal Seam	Coal interbedded with shale, quartz-lithic sandstone, conglomerate, chert, torbanite seams and occasionally carbonaceous mudstone (Moffitt 2000).	4
			Loddon Sandstone		12
			Balmain Coal Member		24
			Balgownie Coal Seam		2
			(Remaining Sydney Subgroup)		
		Cumberland Sub-group			
	Shoalhaven Group			Sandstone, siltstone, shale, polymictic conglomerate, claystone; rare tuff, carbonate, evaporate.	
Palaeozoic	Lachlan Fold Belt			Intensely folded and faulted slates, phyllites, quartzite sandstones and minor limestones of Ordovician to Silurian age (Moffitt 2000).	

Notes: *1. Average thickness from available well data within CGP (AGL 2013).*
2. Aquitard or aquiclude.



Source: EMM (2023); DFSI (2017); GA (2011); DPI (2019)

0 2.5 5 km

GDA 1994 MGA Zone 56

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Camden Gas Project Stage 1
Camden Gas Project Stage 2
Nepean River

Groundwater monitoring
Decommissioned groundwater monitoring bore
BOM weather station

Certain fault *(AGL Energy)*
Possible fault *(AGL Energy)*
Fault *(Geology 100k DPI / Mauger et al; Southern Coal Fields map)*
Interpreted Fault *(Geology 100k DPI / Mauger et al; Southern Coal Fields map)*
Syncline
Anticline
Lineament *(CSIRO 1:80,000 Landsat interpreted fracture analysis)*
Lineaments (air photo interpreted; CSIRO)

250k
Jv - Basalt, dolerite & volcanic breccia
Qa - Quaternary alluvium
Tal - High level gravels
Rw - Bringelly Shale, Minchinbury Sandstone & Ashfield Shale
Rh - Hawkesbury Sandstone

Surface geology

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Figure2.3

2.4 Hydrogeological setting

The Southern Coalfield is located within the area covered by the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources. The CGP is located across two porous rock water sources – the Sydney Basin Nepean water source to the south, and the Sydney Basin Central water source to the north (NOW 2011). These water sources are separated by the Nepean River, and each includes all the groundwater contained in the Permian and Triassic sedimentary rocks. There is no differentiation between the fresh/marginal quality groundwater contained in the Triassic aquifers and the brackish/saline groundwater contained in the deeper Permian aquifers/water bearing zones.

The recognised hydrogeological units within the CGP are shown in Table 2.2.

Table 2.2 Hydrogeological units within the CGP area

Hydrogeological unit	Aquifer type
Alluvium	Unconfined aquifer
Ashfield Shale (Wianamatta Group)	Aquitard or unconfined/perched
Hawkesbury Sandstone	Unconfined/semi-confined aquifer
Bald Hill Claystone (Narrabeen Group)	Aquitard/aquiclude
Bulgo Sandstone (Narrabeen Group)	Confined aquifer
Stanwell Park Claystone (Narrabeen Group)	Aquitard/aquiclude
Scarborough Sandstone (Narrabeen Group)	Confined aquifer
Wombarra Claystone (Narrabeen Group)	Aquitard/aquiclude
Illawarra Coal Measures	Confined water bearing zones

Alluvium occurs along the floodplain of the Nepean River and its tributaries. Alluvial deposits are generally thin, discontinuous (except along the Nepean River) and relatively permeable. The unconfined groundwater systems within the alluvium are responsive to rainfall and stream flow and form a minor beneficial groundwater system. There are also small terrace areas of tertiary alluvium within the CGP area that contain localised groundwater systems of variable quality (Figure 2.3).

The Ashfield Shale which outcrops across the majority of the CGP is generally of low permeability and yield; however small water bearing zones are sometimes present. Water is typically brackish to saline, especially in low relief areas of Western Sydney (due to the marine depositional environment of the shales) (Old 1942). Average bore yields are 1.3 litres per second (L/s) (AGL 2013).

The Hawkesbury Sandstone and Narrabeen Group form part of an extensive generally semi-confined regional groundwater system within the Sydney Basin sequence. The Hawkesbury Sandstone is more widely exploited for groundwater than the overlying and underlying formations, being of generally higher yield, better water quality and either outcropping or buried to shallow depths over the basin.

Groundwater flow within the Hawkesbury Sandstone and Narrabeen Group groundwater systems at a regional scale has a major horizontal component, due to the alternation of sheet and massive facies, with some vertical leakage. The Hawkesbury Sandstone and Narrabeen Group are characterised by dual porosity. Primary porosity is attributed to connected void space between sand grains, secondary porosity is from rock defects such as joints, fractures, faults and bedding planes. Superior bore yield in the sandstone aquifers of the Hawkesbury Sandstone is often associated with secondary porosity (major fractures or a high fracture zone density). Yields of up to 40 L/s have been recorded in bores intercepting these zones within deformed areas of the Sydney Basin (McLean and Ross 2009).

Typically, within the CGP area, bore yields within the Hawkesbury Sandstone rarely exceed 2 L/s (SCA 2007 and Ross 2014). The Narrabeen Group aquifer is generally not used as a water source as it is considered poorer quality and lower permeability compared to the overlying Hawkesbury Sandstone groundwater systems (Madden 2009).

Yields are highest and salinity is freshest south of the Nepean River due to the proximity to recharge areas. North of the Nepean River, the groundwater within the Hawkesbury Sandstone is brackish/slightly saline. Groundwater is used for irrigation and domestic purposes to the south and immediately to the north of the Nepean River; however, further north of the river, groundwater quality is typically only suitable for stock (AGL 2013).

The coal seams present in the Illawarra Coal Measures contain both regionally and locally minor water bearing zones. Due to the greater depth of burial of the coal measures and fine-grained nature of the sedimentary rocks, the permeability is generally lower than the overlying sandstone aquifers. Recharge to the Permian water bearing zones is likely to occur where formations are outcropping, which occurs at a significant distance to the south of the CGP. Salinity of the water bearing zones is typically brackish to moderately saline.

Within the CGP, there is limited rainfall recharge to the Ashfield Shale with most rainfall generating runoff and overland flow. Some leakage through the Ashfield Shale into the Hawkesbury Sandstone is expected where there is adequate fracture spacing. It is assumed that most recharge to the sandstone aquifers occurs via lateral groundwater through-flow from upgradient areas to the south. There is insufficient data within the CGP to define local flow paths and natural discharge zones. Regionally, groundwater flow is predominantly towards the north or northeast, eventually discharging via the Georges, Parramatta or Hawkesbury River systems. Although groundwater-surface water interactions are not well defined in the area, there may be a small base flow or interflow discharge component to local stream headwaters during wet periods (Parsons Brinckerhoff 2010).

3 Monitoring program

3.1 Monitoring network

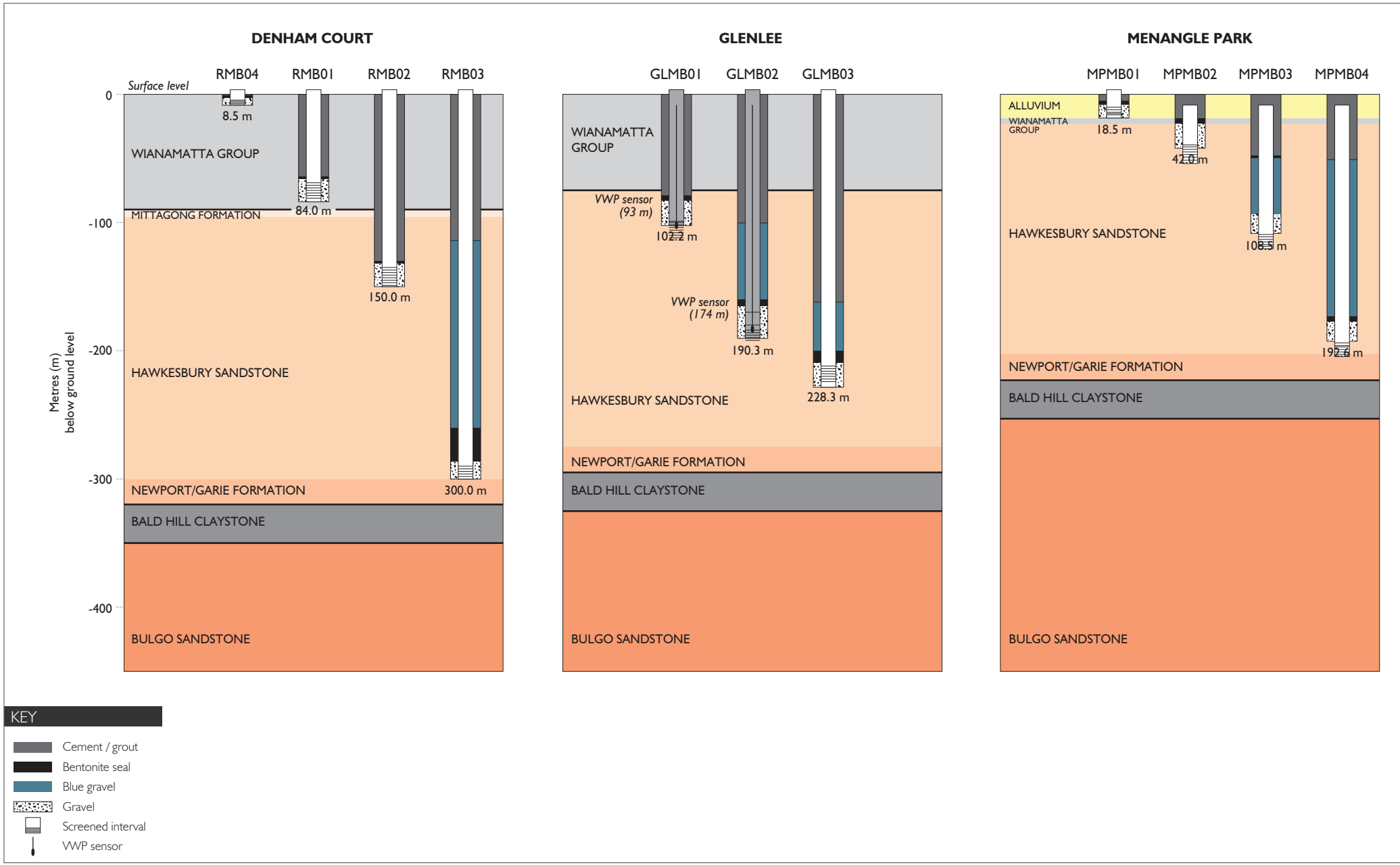
Construction details for the original 11 monitoring bores within the CGP area are presented in Table 3.1 and Figure 3.1. Throughout the 2023-2024 monitoring year, the monitoring network consisted of seven monitoring bores at the Menangle Park and Glenlee locations. The Denham Court monitoring bores (RMB01-04) were decommissioned in October 2016.

Table 3.1 Groundwater monitoring bore details

Monitoring bore	Location	Active in FY24	Total depth [1](mbgl)	Screened depth [1](mbgl)	Lithology	Formation
RMB01[2]	Denham Court	No	84.0	69.0–81.0	Siltstone	Ashfield Shale
RMB02[2]	Denham Court	No	150.0	135.0–147.0	Sandstone	Hawkesbury Sandstone (upper)
RMB03[2]	Denham Court	No	300.0	290.0–299.0	Sandstone	Hawkesbury Sandstone (lower)
RMB04[2]	Denham Court	No	8.5	4.5–7.5	Clay/siltstone	Ashfield Shale (weathered)
MPMB01	Menangle Park	Yes	18.5	10.0–16.0	Clay	Alluvium
MPMB02	Menangle Park	Yes	42.0	27.4–39.4	Sandstone	Hawkesbury Sandstone (upper)
MPMB03	Menangle Park	Yes	108.5	97.0–106.0	Sandstone	Hawkesbury Sandstone (middle)
MPMB04	Menangle Park	Yes	192.6	182.6–191.6	Sandstone	Hawkesbury Sandstone (lower)
GLMB01[3]	Glenlee	Yes	102.2	87.0–99.0[3]	Sandstone	Hawkesbury Sandstone (upper)
GLMB02[3]	Glenlee	Yes	190.3	168.0–180.0[3]	Sandstone	Hawkesbury Sandstone (middle)
GLMB03	Glenlee	Yes	228.3	212.0–224.0	Sandstone	Hawkesbury Sandstone (lower)

Notes:

1. mbgl – metres below ground level.
2. Monitoring bores RMB01-04 were decommissioned early October 2016 and are no longer monitored.
3. Monitoring bores GLMB01 and GLMB02 were converted to vibrating wire piezometers (VWP) on 12 March 2015. The VWP sensors are installed at 93 mbgl and 174 mbgl respectively.



Nested groundwater monitoring bores at the Denham Court, Glenlee, and Menangle Park sites
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Figure 3.1

3.2 Water level monitoring

Pressure transducer data loggers (Solinst M30 level loggers) are suspended from galvanised steel wire in the water column and programmed to record the groundwater level every 6 hours. To verify the level recorded by the dataloggers, manual measurements are recorded periodically using an electronic dip meter. The monitoring collection, period of record for each monitoring location is presented in Table 3.2.

A barometric logger installed above the water table at Menangle Park monitoring bore MPMB01, records changes in atmospheric pressure. Data from this logger is used to correct the effects of a changing barometric pressure on water level loggers in the adjacent monitoring bores.

Table 3.2 Summary of water level monitoring locations and data collection periods

Monitoring locations	Monitoring period of record
Denham Court (RMB01, RMB02, RMB03, RMB04)	November 2011 (June 2013 for RMB04) to October 2016
Menangle Park (MPMB01, MPMB02, MPMB03, MPMB04)	June 2013 to present
Glenlee (GLMB01, GLMB02, GLMB03)	February 2014 to March 2015 at GLMB01 and GLMB02 February 2014 to September 2024 at GLMB03

In March 2015 the GLMB01 and GLMB02 monitoring bores were converted to vibrating wire piezometer (VWP) data loggers. VWP sensors at GLMB01 and GLMB02, are interpreted to have stabilised at lower piezometric pressure head levels when compared to water levels observed in the monitoring bores prior to conversion to VWPs. The data since March 2015 is not considered to be representative of water levels in the shallow sandstone aquifers. It is possible that during the conversion of the monitoring bores to VWPs, the grout did not fully penetrate the gravel pack of the former standpipe monitoring bore, creating an unnatural pressure gradient adjacent to the piezometer and bore wall. The gravel pack has a much higher hydraulic conductivity (K) (both horizontal and vertical K) than the grouted VWP sensor and the surrounding formation. In this case the higher vertical gradient in the gravel pack may be responsible for reducing horizontal pressure on the sensor hence the observed pressure difference.

Water level monitoring paused at GLMB03 between October 2021 and October 2022 due to borehole clogging and the detection of elevated levels of naturally occurring hazardous gases present within the bore. The monitoring bore was reconditioned, and water levels since stabilised.

3.2.1 Surface water levels

Water levels in the Nepean River are monitored by Water NSW (gauging station 212238) using an automatic datalogger, upstream from and close to the Menangle Park site. This water level is included in the Menangle Park hydrograph for comparison (Figure 4.1). River height is derived from automated telemetric real-time data that have been processed to remove erroneous data (WaterNSW 2024).

3.3 Water quality monitoring

Groundwater sampling was undertaken on 11 occasions at Denham Court (November 2011 to October 2016), 26 occasions at Menangle Park (since August 2013) and 23 occasions at Glenlee (since February 2014) with details provided in Table 3.3.

Surface water quality sampling has been undertaken on 16 occasions (since 2013) at the Nepean River near the Menangle Park groundwater monitoring site.

Groundwater and surface water sampling was undertaken twice in the 2023–2024 monitoring year at Menangle Park, Glenlee and the Nepean River on 26 October 2023 and 30 April 2024.

Sampling of groundwater and surface water was undertaken by Parsons Brinckerhoff from October 2011 through to April 2016. Sampling from October 2016 onwards has been undertaken by EMM.

Table 3.3 Groundwater quality program

Sampling event	Denham Court				Menangle Park				Glenlee			Reference report
	RMB01	RMB02	RMB03	RMB04	MPMB01	MPMB02	MPMB03	MPMB04	GLMB01	GLMB02	GLMB03	
November 2011	IW	✓	✓	✓	-	-	-	-	-	-	-	Parsons Brinckerhoff (2012)
May 2013	IW	✓	✓	✓	-	-	-	-	-	-	-	Parsons Brinckerhoff (2013a)
August 2013	IW	IW	✓	✓	✓	✓	✓	Blocked	-	-	-	Parsons Brinckerhoff (2013c)
November 2013	✓	✓	✓	IW	✓	✓	✓	✓	✓	✓	✓	Parsons Brinckerhoff (2014c)
February 2014	IW	IW	✓	✓	✓	✓	✓	✓	✓	✓	✓	Parsons Brinckerhoff (2014d)
May 2014	IW	IW	✓	✓	✓	✓	✓	✓	✓	✓	✓	Parsons Brinckerhoff (2014e)
August 2014	IW	IW	✓	✓	✓	✓	✓	✓	✓	✓	✓	Parsons Brinckerhoff (2014f)
January 2015	IW	IW	✓	✓	✓	✓	✓	✓	✓	✓	✓	Parsons Brinckerhoff (2015a)
April 2015	IW	IW	✓	✓	✓	✓	✓	✓	Converted to vibrating wire piezometer (VWP) therefore no longer sampled.		✓	Parsons Brinckerhoff (2015b)
October 2015	✓	✓	✓	IW	✓	✓	✓	✓			✓	Parsons Brinckerhoff (2015d)
April 2016	✓	✓	✓	IW	✓	✓	✓	✓			✓	Parsons Brinckerhoff (2016a)
October 2016	Denham Court bore sites decommissioned in October 2016 and no longer sampled.				✓	✓	✓	✓			✓	EMM (2017)
April 2017					✓	✓	✓	✓			✓	EMM (2017)
October 2017					✓	✓	✓	✓			✓	EMM (2018)
April 2018					✓	✓	AS	AS			✓	EMM (2018)

Sampling event	Denham Court				Menangle Park				Glenlee			Reference report
	RMB01	RMB02	RMB03	RMB04	MPMB01	MPMB02	MPMB03	MPMB04	GLMB01	GLMB02	GLMB03	
October 2018					✓	✓	✓	✓			✓	EMM (2019)
April 2019					✓	✓	✓	✓			✓	EMM (2019)
October 2019					✓	✓	✓	✓			✓	EMM (2020)
April 2020					✓	✓	✓	✓			✓	EMM (2020)
November 2020					✓	✓	✓	✓			✓	EMM (2021)
April 2021					✓	✓	✓	✓			✓	EMM (2021)
November 2021					✓	✓	✓	✓			✓	EMM (2022)
April 2022					✓	✓	✓	✓			Gas	EMM (2022)
October 2022					✓	✓	✓	✓			✓	EMM (2023a)
April 2023					AS	AS	AS	AS			AS	EMM (2023a)
October 2023					✓	✓	✓	✓			✓	EMM (2023b)
April 2024					✓	✓	✓	✓			✓	EMM (2024)

Notes:

√ = sampling occurred.

- = borehole not installed.

IW = Insufficient water to sample monitoring bore.

Blocked = MPMB04 not sampled due to blockage in monitoring bore (Parsons Brinckerhoff 2013b).

AS = Additional sampling. GLMB03, MPMB03, and MPMB04 were re-sampled on 24 April 2018 to include dissolved methane analysis. GLMB03 and MPMB01-04 were re-sampled on 24 May and 27 June 2023 for TPH, TRH, and BTEX.

Gas = GLMB03 was not sampled due to elevated levels of naturally occurring hazardous gases in this bore.

3.3.1 Sampling techniques

Two methods were used to obtain groundwater quality samples from the monitoring bores based on permeability of the screened formation, which was determined for each bore during past hydraulic conductivity testing. In summary:

- A submersible 12 V pump is used at higher yielding bores MPMB01 and MPMB02.
- A dedicated micro-purge™ low flow sampling pump was used at lower yielding monitoring bores and selected deeper bores: MPMB03, MPMB04 and GLMB03.

Where a submersible pump was used, a minimum of three well volumes was purged from the monitoring bore prior to sampling to allow a representative groundwater sample to be collected. Water quality parameters were measured during and immediately after purging to monitor water quality changes and to indicate representative groundwater, suitable for sampling and analysis.

The micro-purge™ system allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need to purge relatively large volumes of groundwater from these bores. Water quality parameters were monitored during micro-purge™ pumping, to ensure that a representative groundwater sample was collected.

Physicochemical parameters (pH, electrical conductivity (EC), and total dissolved solids (TDS)) were measured during and following purging using a calibrated hand-held water quality meter.

Surface water samples were taken at the Nepean River, riverbank using a telescopic sampling pole. The sample was collected from just below the water surface and approximately 1 m away from the riverbank.

3.3.2 Chemical analysis of water

Groundwater and surface water samples collected in the field are analysed for a broad chemical suite designed specifically to assess the chemical characteristics of the different water bearing zones at the monitoring sites. Table 3.4 details the analytical suite.

Table 3.4 Analytical suite

Category	Parameters
Physicochemical parameters (measured in the field)	Electrical conductivity (EC), pH, total dissolved solids (TDS)
General parameters	EC, pH[1], TDS
Major ions	Cations (calcium, magnesium, sodium, potassium) Anions (chloride, carbonate, bicarbonate, sulphate)
Dissolved metals and minor/trace elements	Aluminium, antimony, arsenic, barium, beryllium, boron, bromide, bromine, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury[2], molybdenum, nickel, selenium, strontium, uranium, vanadium, zinc
Other analytes	Fluoride, cyanide, silica (reactive), total suspended solids (TSS)
Nutrients	Ammonia, nitrate, nitrite, total organic carbon (TOC), phosphorus (total and reactive)
Hydrocarbons	Phenol compounds, polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and xylenes (BTEX)

Category	Parameters
Dissolved gases	Methane

Notes: 1. Generally analysed outside of recommended holding times.
2. Included in all samples after the August 2013 sampling event.

Samples requiring laboratory analysis were analysed by Australian Laboratory Services (ALS) in Smithfield, a NATA accredited laboratory. Water samples for laboratory analysis are collected in sample bottles specified by the laboratory, with appropriate preservation where required. Samples undergoing dissolved metal analysis are filtered through 0.45 µm filters in the field prior to collection.

3.3.3 Quality assurance and quality control (QA/QC)

i Field QA/QC

The following field sampling QA/QC procedures were applied to prevent cross-contamination and preserve sample integrity:

- samples were collected in clearly labelled bottles with appropriate preservation solutions
- samples were delivered to the laboratories within the specified holding times (except for pH)
- unstable parameters were analysed in the field (physicochemical parameters).

ii Laboratory QA/QC

The laboratories conduct their own internal QA/QC program to assess the repeatability of the analytical procedures and instrument accuracy. These programs include analysis of laboratory sample duplicates, spike samples, certified reference standards, surrogate standards/spikes and laboratory blanks. In addition, a duplicate sample is collected in the field to assess sampling and laboratory analysis accuracy.

4 Groundwater levels

Hydrographs showing groundwater levels and rainfall from the beginning of the period of record, until 30 April 2024 (the most recent collection of data during the monitoring period) are presented for Menangle Park in Figure 4.1 and Glenlee in Figure 4.2. The Menangle Park site is located close to the Nepean River and river levels from the Water NSW gauging station 212238 have been included in the hydrograph for comparison (Figure 4.1). Individual hydrographs for each monitoring bore are included in Appendix A.

As discussed in Section 3.2, VWPs were installed at GLMB01 and GLMB02 in March 2015. It is interpreted that VWP pressures stabilised at a lower piezometric pressure head, compared to the pressures observed prior to the conversion to VWPs. This discrepancy is likely due to difficulties in establishing a complete grout seal during the VWP conversion process, resulting in communication between the grouted VWP sensors and the rock formations. The absolute pressure values post-VWP installation are not representative of formation water levels. VWP hydrographs have been included in Appendix A.

The datalogger at MPMB04 malfunctioned from May 2021 to April 2022, likely due to damage caused by floods overtopping the site. The datalogger was replaced in April 2022 however it also malfunctioned from November 2023 and was re-started April 2024, before being replaced in September 2024.

4.1 Temporal trends

4.1.1 Alluvium

The groundwater level in the alluvium (MPMB01) is shallow (less than 10 mbgl) and shows a direct response to rainfall and flood events (Figure 4.1). The groundwater level remained relatively stable throughout the monitoring period with short term spikes due to rainfall, consistent with historical observations.

4.1.2 Ashfield Shale

Monitoring of the Ashfield Shale is no longer completed as the Denham Court bores have been decommissioned. Previous results have shown that groundwater levels in the Ashfield Shale (RMB01) are typically deep (approximately 80 mbgl) and showed no apparent response to rainfall (EMM 2017).

4.1.3 Hawkesbury Sandstone

At the Menangle Park site, located beside the Nepean River, groundwater levels are shallow (within 10 mbgl). Historically responses to rainfall and flood events are observed in the upper and middle Hawkesbury Sandstone (monitoring bores MPMB02 and MPMB03), while a slightly subdued and delayed response is observed in the lower Hawkesbury Sandstone (MPMB04) (Figure 4.1).

Throughout the monitoring year, groundwater levels remained relatively stable at all Menangle Park monitoring bores, with minor fluctuations corresponding to rainfall events consistent with historic observations. A data gap is present at MPMB04 from November 2023 due to datalogger failure, however manual water level measurements indicate a stable to slightly increasing water level for the remainder of the monitoring period (Figure 4.1).

At the Glenlee site, groundwater levels are typically shallow (less than 15 mbgl) (Figure 4.2). The datalogger at GLMB03 malfunctioned from October 2020 – April 2021 resulting in a loss of water level data, seen as a gap on the hydrograph. The groundwater level at GLMB03 remained relatively stable, around 71.5 mAHD, with no response to rainfall (Figure 4.2). This differs from MPMB04 which is screened across the same aquifer and shows a muted response to rainfall.

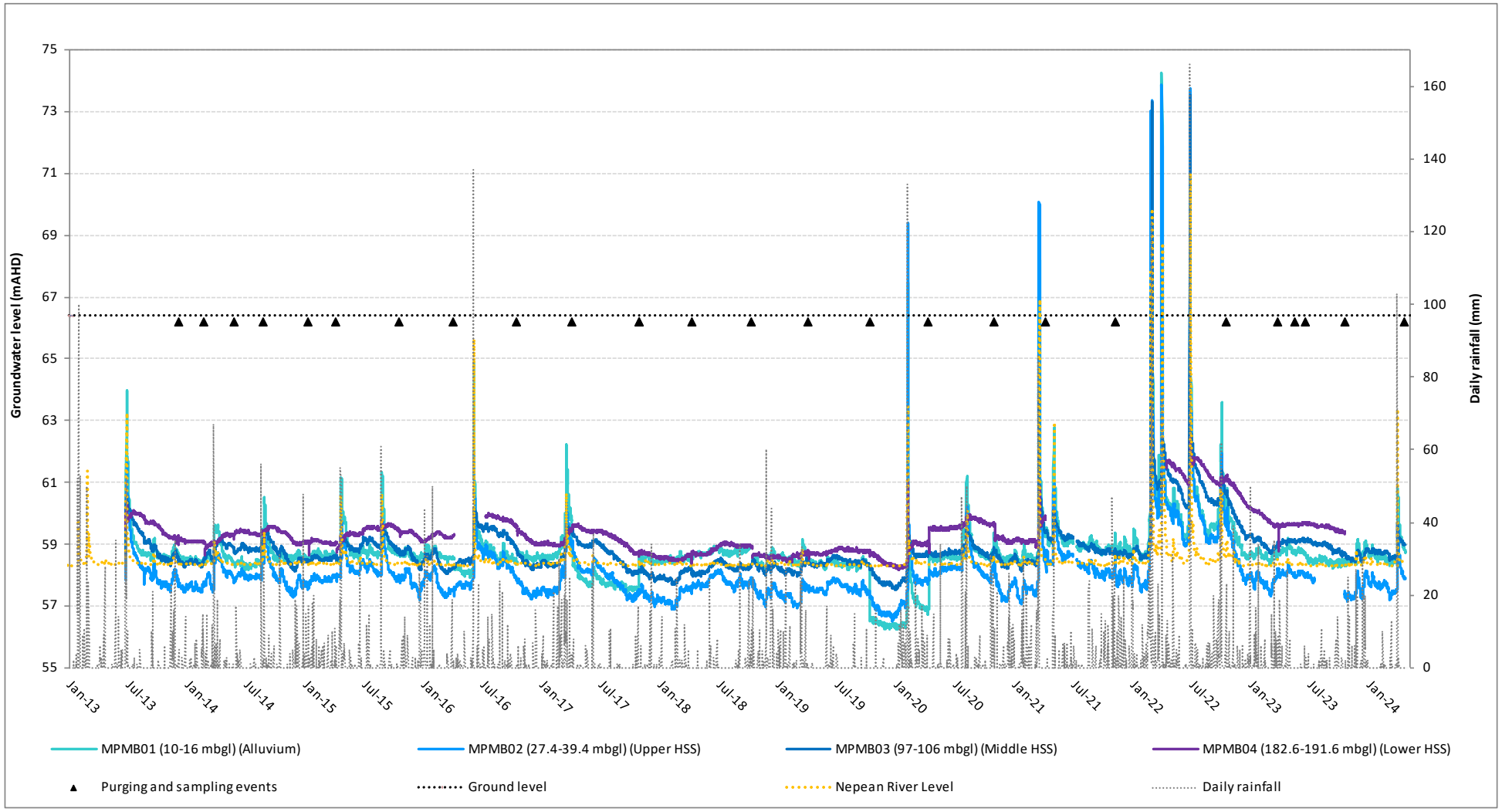


Figure 4.1 **Groundwater levels at the Menangle Park site**

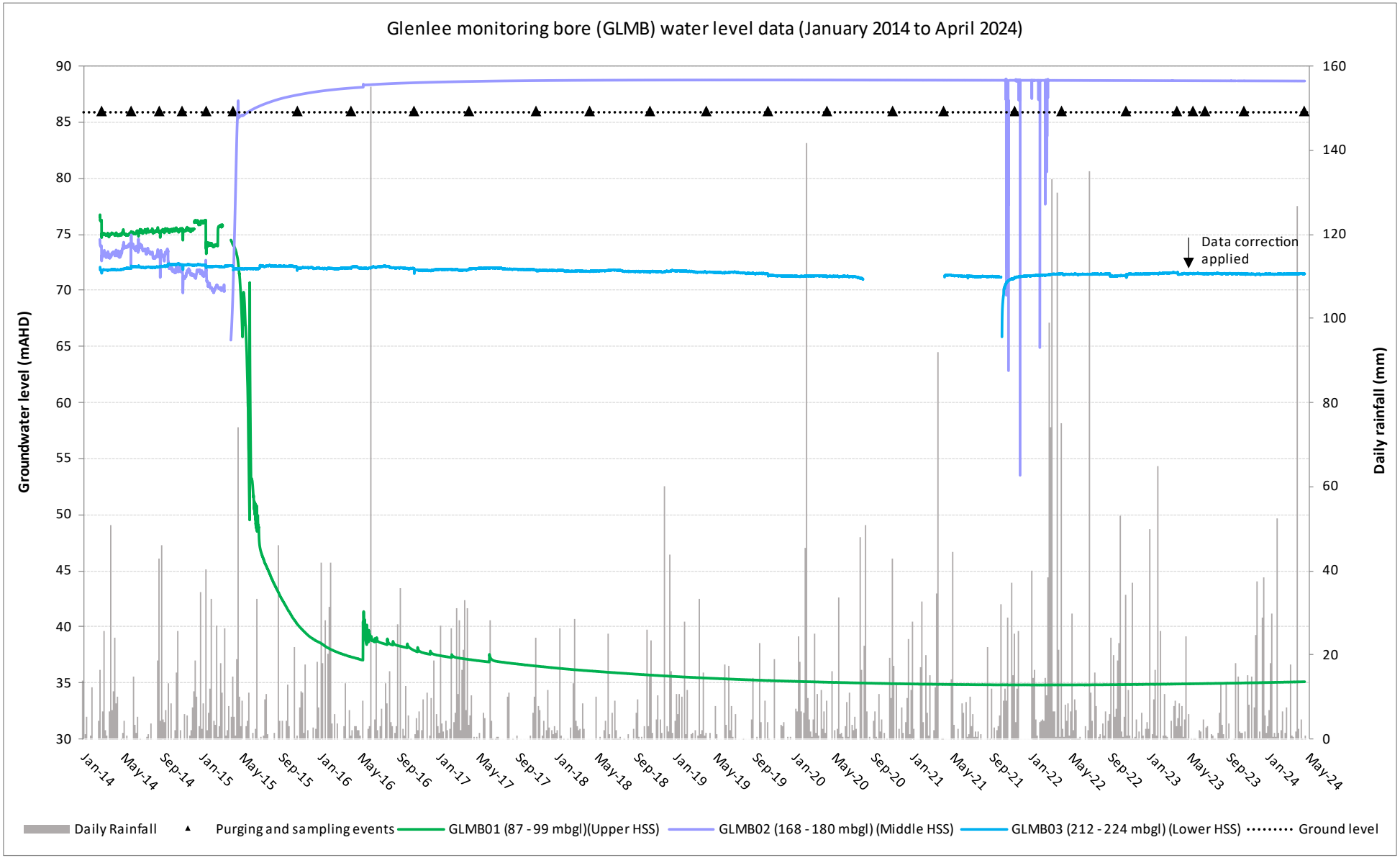


Figure 4.2 **Groundwater levels at the Glenlee site**

4.2 Spatial trends in the Hawkesbury Sandstone

The conceptual model (AGL 2013) and hydrogeological setting (Section 2.4) suggest that regional groundwater flow within the Hawkesbury Sandstone is from south to north, towards the incised river systems of the Sydney Basin.

The groundwater level elevations in the Hawkesbury Sandstone aquifer can be compared between the Glenlee and Menangle Park monitoring sites. Data collected at the CGP suggests that groundwater flow (in the Hawkesbury Sandstone) is more complex than the regional conceptual model. The data suggests that:

- The Nepean River in the vicinity of the Menangle Park site is a probable groundwater discharge area (as there is upward groundwater flow within the Hawkesbury Sandstone and there is no Ashfield Shale to act as a cap) although there is occasional groundwater recharge associated with flood events – shallow groundwater elevations here are between 57 mAHD and 61 mAHD and the Nepean River height is typically between 57 mAHD and 59 mAHD.

- At the Glenlee site (located north of the Menangle Park site), the deep sandstone aquifer has groundwater elevations between 71 mAHD and 73 mAHD which are higher than the deep sandstone aquifer at the Menangle Park site. The reason for this is unclear.

4.3 Groundwater-surface water interactions

Hydraulic connection between surface water and groundwater exists where the river is in direct contact with the underlying aquifer (Bouwer and Maddock 1997). A 'gaining' stream exists where the water table level in a connected aquifer is higher than the running level in a stream. In this situation groundwater will flow or discharge to the stream (Land and Water Australia 2007).

The Nepean River level shows a clear response to catchment rainfall and runoff (Figure 4.1). The river level is usually lower than the level in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining river at the Menangle Park site, except for short flood events, when recharge to the alluvial and shallow sandstone groundwater systems occur.

4.4 Vertical gradients

Vertical gradients indicate the potential for groundwater to flow vertically upward or downward at a particular location. A downward hydraulic gradient indicates a potential for downward flow from the shallower unit to the deeper unit, while an upward gradient indicates the opposite. It is noted that the actual flow direction and velocity is also governed by permeability, particularly the permeability of the confining units.

The following vertical gradient observations were made:

- There is an apparent upward hydraulic gradient at the Menangle Park site within the monitored zones of the Hawkesbury Sandstone; however, a downward gradient exists between the alluvium and the upper Hawkesbury Sandstone. The similar response to rainfall and flood events between the alluvial monitoring bore and the Hawkesbury Sandstone monitoring bores indicates connectivity between the two formations at this location, which is expected given the lack of a substantial confining layer between the formations.

- There is an apparent downward hydraulic gradient within the Hawkesbury Sandstone at the Glenlee site. This gradient is typical of these sandstone aquifers located away from the Nepean River at higher elevations.

5 Water quality

Groundwater and surface water sampling was undertaken twice in the monitoring year at Menangle Park, Glenlee and the Nepean River on 26 October 2023 and 30 April 2024. The results are summarised in this chapter and are compared to previous monitoring years (EMM 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023a; Parsons Brinckerhoff 2014a, 2014b and 2015e).

The 2023–2024 monitoring year water quality results are presented in Appendix B and the laboratory results are in Appendix C.

5.1 Groundwater quality

5.1.1 Physico-chemical parameters

Time series of laboratory EC and field pH for the CGP monitoring bores are presented in Figure 5.1 and Figure 5.2 respectively. Groundwater in the Hawkesbury Sandstone at the Menangle Park site in all aquifers (MPMB01-04) is classified as fresh to marginal. The fresh to marginal water quality at the Menangle Park site is likely due to the influence of rainfall recharge and connectivity with the Nepean River.

The EC recorded during the 2023–2024 monitoring year at the Menangle Park site remained fresh to marginal, consistent with historic observations.

Historically, slightly to moderately saline conditions were observed at the Glenlee sites GLMB01 and GLMB02, while the deeper groundwater monitored in GLMB03 is typically slightly saline. A decline in salinity was observed at GLMB03 from October 2021, which is likely a result of reconditioning the monitoring bore, where the screened interval was jetted and flushed with fresh water.

EC within the Hawkesbury Sandstone does not show a clear depth related trend at Menangle Park, however, decreases with depth at the Glenlee site. This decrease is likely a result of saline groundwater within the Ashfield Shale migrating into the underlying sandstone aquifer due to vertical leakage.

The pH at MPMB01 in the alluvium, is slightly acidic and was measured, with a calibrated handheld water quality meter, at pH 5.95 and 5.80 during the 2023–2024 monitoring year. The pH generally increases with depth in the Hawkesbury Sandstone and ranged from a pH of 6.70 at MPMB02 to a pH of 10.13 at MPMB04.

The pH has historically been variable at the Glenlee site ranging between a pH of 6.63 and 10.57. Contamination from the grouting of the sandstone monitoring bores, completed back in 2011–2012 is suspected to be contributing to the observed alkaline water quality. Throughout the monitoring year, pH at GLMB03 was recorded to be 10.00 and 9.06.

The Nepean River typically has relatively neutral pH ranging between 6.11 and 8.61. During the monitoring period slightly alkaline observations were recorded at the Nepean River to be pH 8.61 and 8.59.

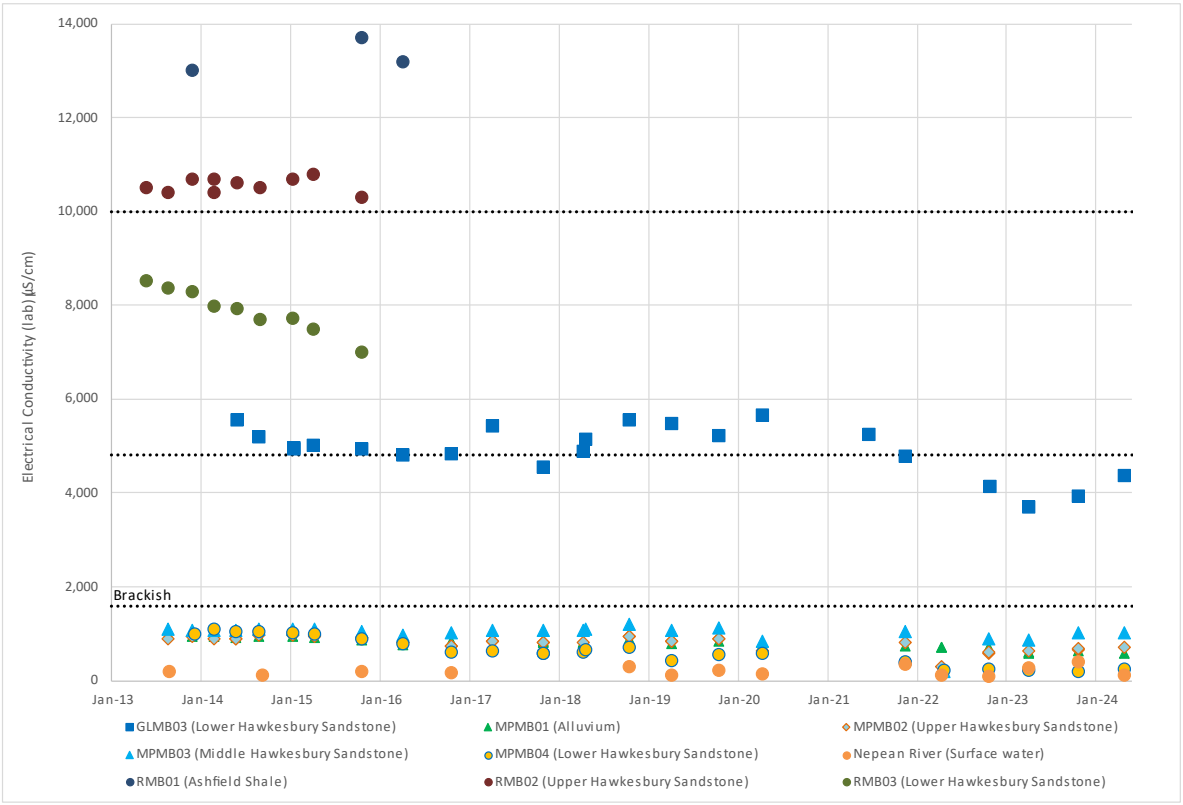


Figure 5.1 **Electrical conductivity (lab) time series for the CGP monitoring bores and Nepean River**

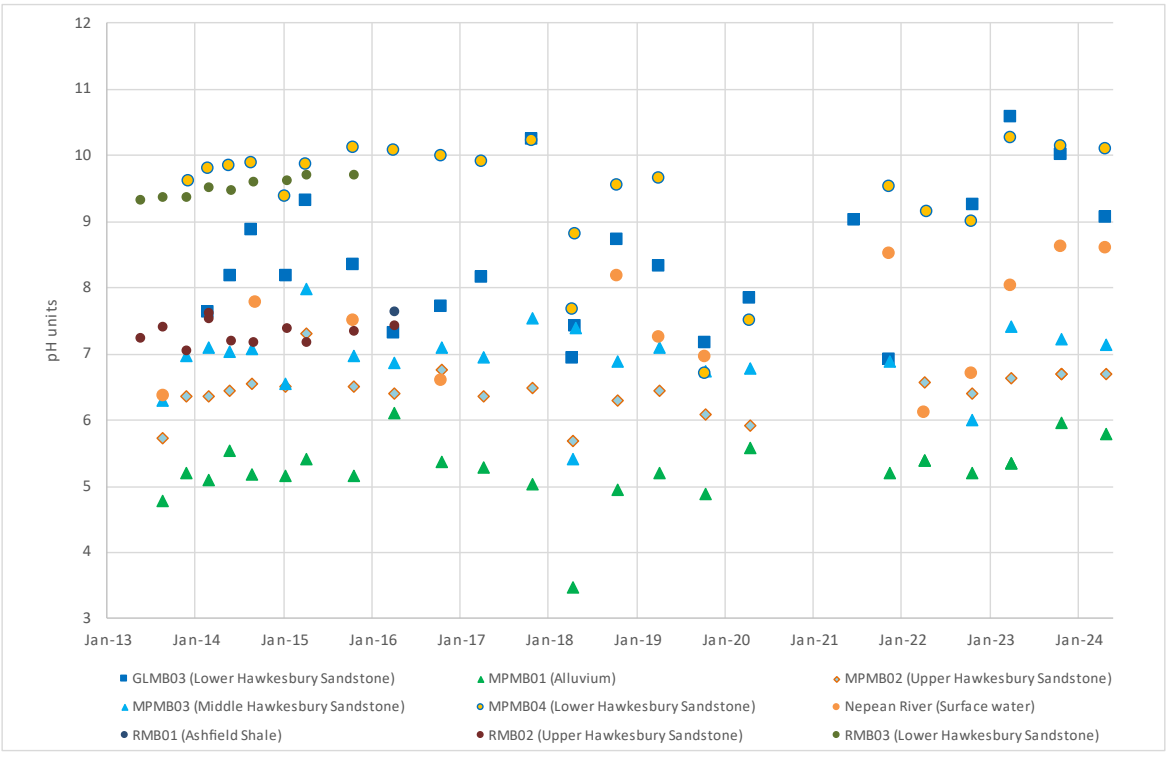


Figure 5.2 **pH (field) time series for the CGP monitoring bores and Nepean River**

5.1.2 Major ions

The major ion characteristics of the CGP monitoring bore groundwater samples are shown in a piper diagram Figure 5.3. A piper diagram is a graphical representation of the relative concentrations of major ions in water (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, Fl^{-}, HCO_3^{-}, CO_3^{2-} and SO_4^{2-}). In the CGP monitoring bores, the most abundant ions are sodium (Na^{+}), chloride (Cl^{-}), and bicarbonate (HCO_3^{-}).

All bores have a dominant sodium cation type. The anion type ranges from bicarbonate (MPMB03, MPMB04, and mostly GLMB03) to chloride (MPMB01). MPMB02 and the Nepean River are relatively mixed between bicarbonate and chloride anion types.

MPMB01 (alluvium) is consistently dominated by sodium chloride. Bores in the Lower Hawkesbury Sandstone (MPMB04 and GLMB03) are within their historical sodium-bicarbonate range. MPMB02 and MPMB03 are within their historical ranges of magnesium bicarbonate type and mixed composition type respectively. The Nepean River had a higher bicarbonate concentration in October 2023 than recorded historically, however returned within historical observations during the April 2024 monitoring event.

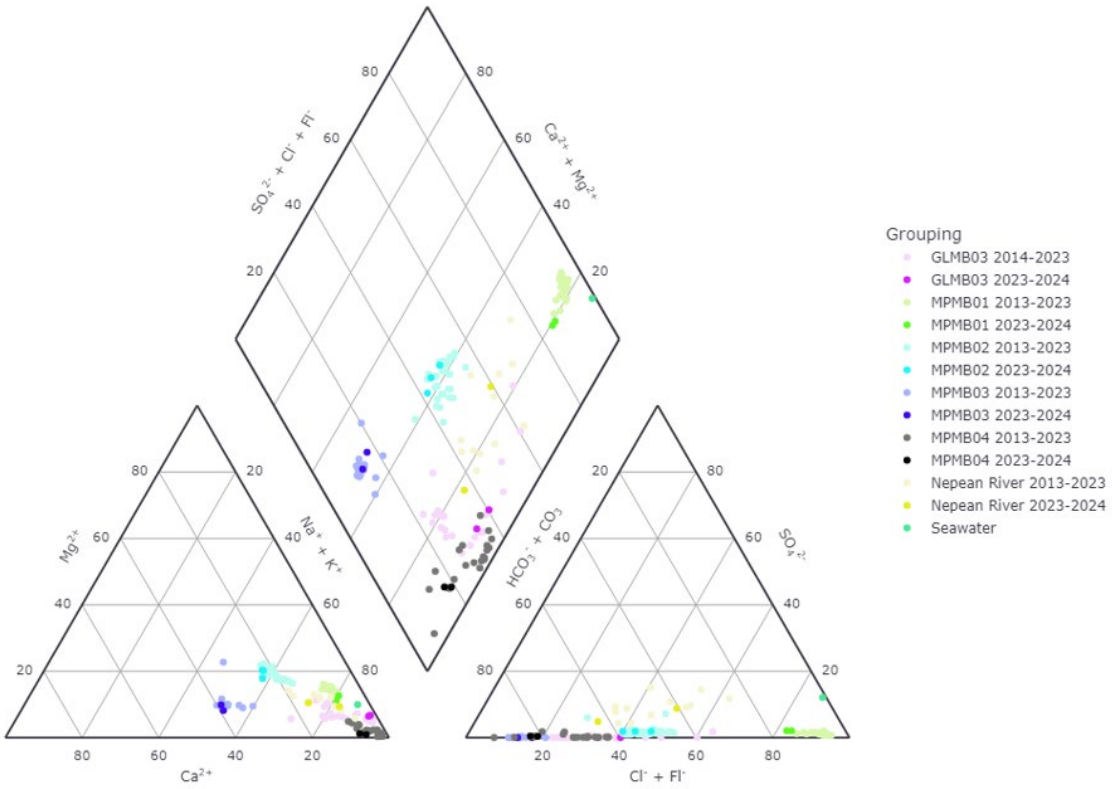


Figure 5.3 Major ion chemistry of groundwater for CGP monitoring bores

5.1.3 Dissolved metals

Concentrations of dissolved metals in groundwater for the 2023–2024 monitoring year are presented in Figure 5.4. The major findings for dissolved metals over this monitoring year are as follows:

- Dissolved metal concentrations are below the limit of reporting for beryllium, cadmium, chromium, mercury, selenium, uranium, and vanadium, consistent with historical observations. Antimony was detected for the first time, at the limit of recording (0.001 mg/L), at MPMB02 in October 2023. Concentrations of antimony dropped below the limit of recording during sampling in April 2024.
- Dissolved metal concentrations are generally similar in the alluvium and the Hawkesbury Sandstone. Dissolved metal concentrations across all sites were generally comparable to previous monitoring events.
- Elevated concentrations of lead (filtered) were recorded at MPMB01 during the October 2023 monitoring event, equal to the highest historical concentration of 0.009 mg/L in 2014.
- Consistent with previous years, barium and strontium is highest in GLMB03 and lowest in the Nepean River.
- An increasing trend in iron (filtered) concentrations at MPMB02 have been observed since April 2022. This continued throughout the monitoring year with the highest historical concentration of iron recorded during the April 2024 monitoring event at 6.79 mg/L. Iron concentrations remained within historical observations at all other sites.

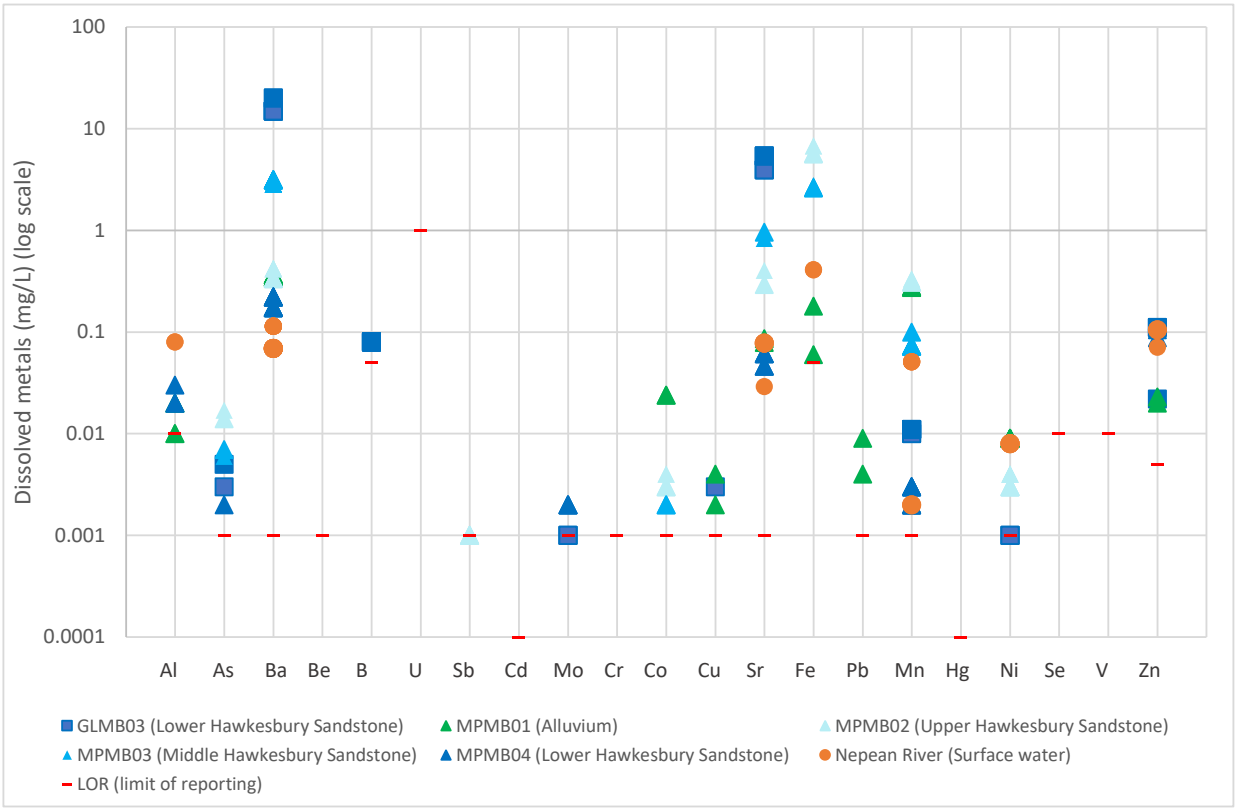


Figure 5.4 Dissolved metal concentrations in groundwater for CGP monitoring bores (2023–2024 monitoring year)

5.1.4 Nutrients

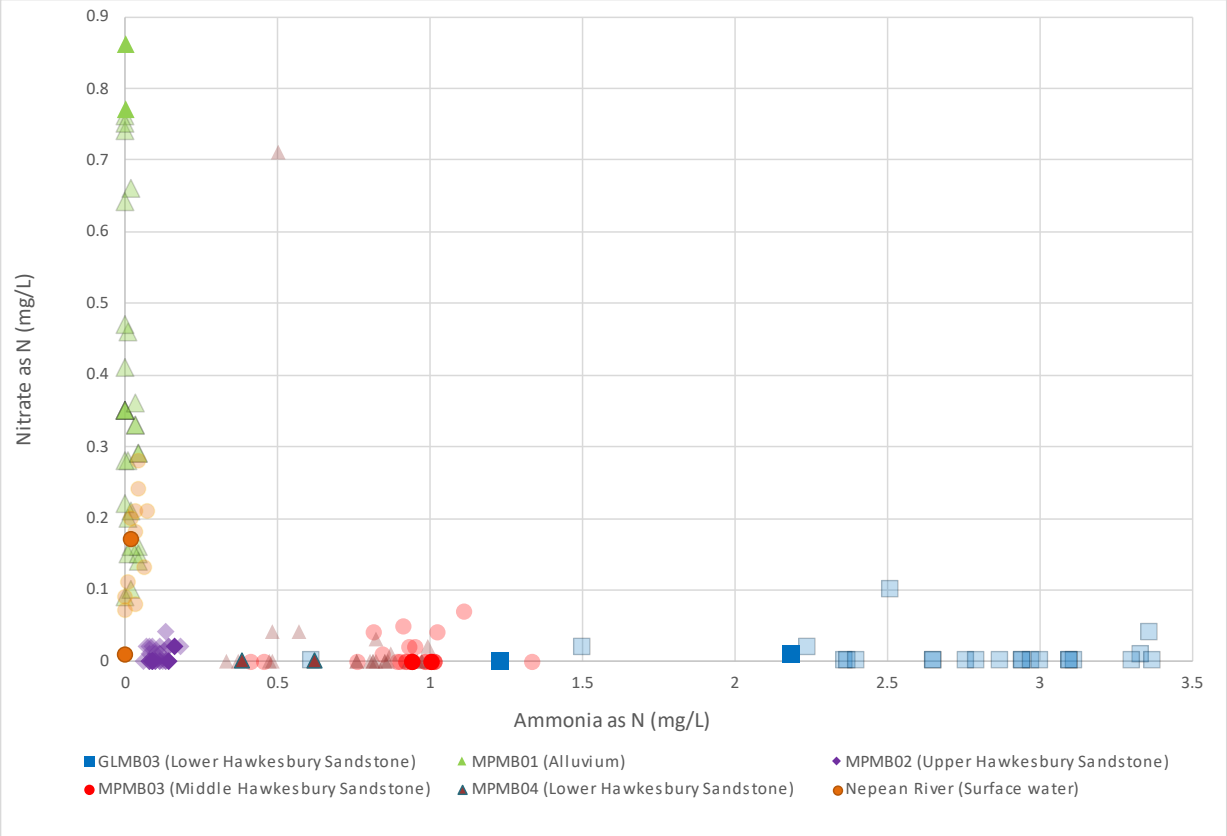
A plot showing ammonia versus nitrate in groundwater is presented in Figure 5.5, with the darker points representing data over the 2023–2024 monitoring year. The major findings for nutrients over the monitoring year are as follows:

- Elevated concentrations of reactive phosphorus (as P) were recorded during both the October 2023 (0.18 mg/L) and April 2024 (0.22 mg/L) monitoring events at GLMB03, higher than previous detections. Reactive phosphorus remained below the limit of reporting or within historical observations at all other sites.

- Nitrate (as N) has shown an increasing trend at MPMB01 since August 2014. The highest recorded concentration of nitrate was recorded in both the October 2023 (0.77 mg/L) and April 2024 (0.86 mg/L) monitoring events. Nitrite (as N) was also above historic concentrations in April 2024 at 0.03mg/L. As such Nitrite + Nitrate (as N) was above historic concentrations at 0.89 mg/L in April 2024.

- Total organic carbon (TOC) concentrations were generally comparable between the lower, middle and upper Hawkesbury Sandstone at the Menangle Park site and the Nepean River. Over the previous monitoring year in October 2022, GLMB03 recorded TOC concentrations five times greater than previously recorded at 439 mg/L. Throughout the current monitoring year, TOC concentrations were stable at 114 mg/L however, remain higher than previous observations prior to 2022.

- Nutrient concentrations remained within historical observations at all other sites.



Transparent colours illustrate historical results.

Figure 5.5 Ammonia versus nitrate concentrations in groundwater for CGP monitoring bores

5.1.5 Dissolved gasses

Dissolved gases naturally occur in the Hawkesbury Sandstone aquifers (at all depths) and are likely to have migrated from the deep Illawarra Coal Measures through the Narrabeen Group strata and into the Hawkesbury Sandstone. Dissolved methane is shown to be of mostly thermogenic origin (Parsons Brinckerhoff 2014). A time series plot of dissolved methane concentrations in groundwater is presented in Figure 5.6.

Dissolved methane concentrations remained within historical observations at all sites.

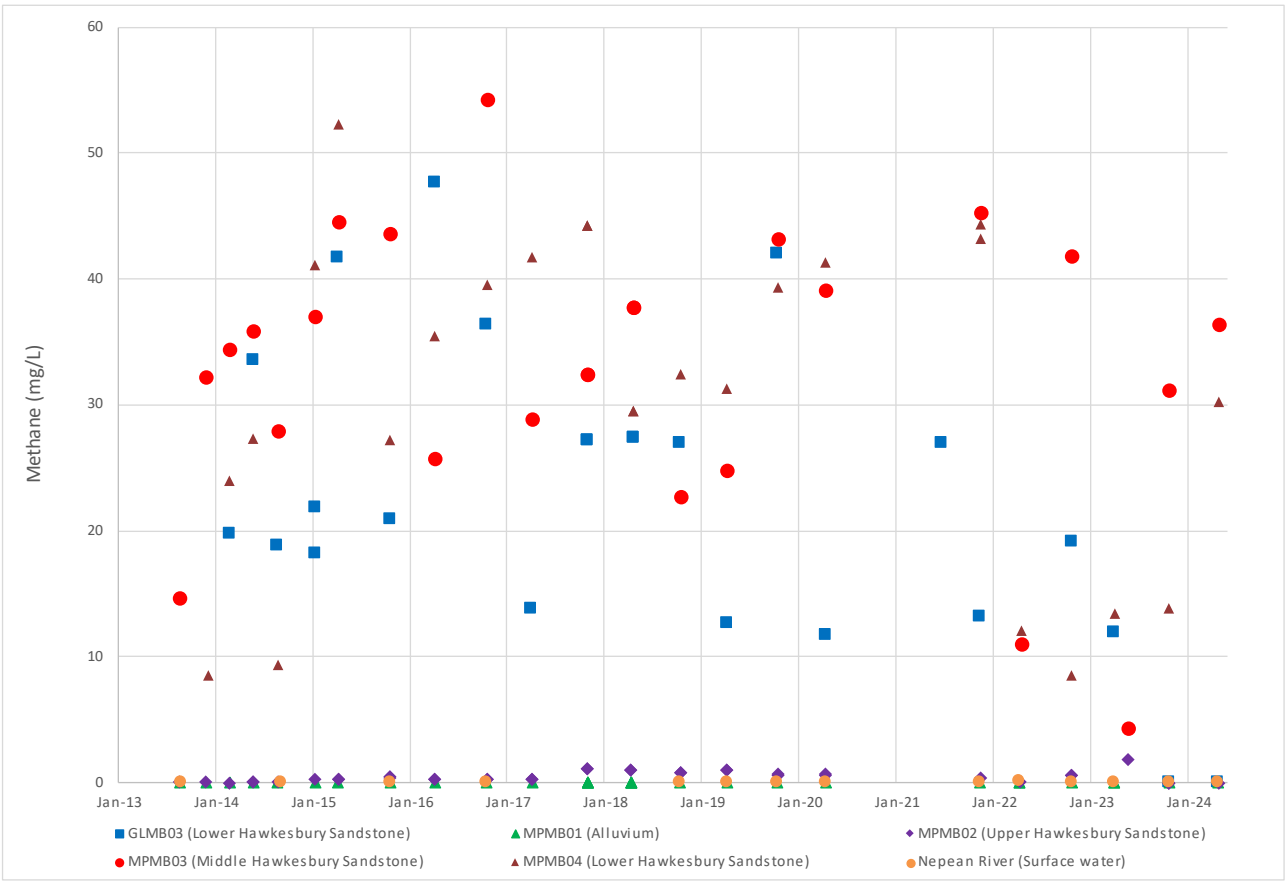


Figure 5.6 Dissolved methane time series for CGP monitoring bores and Nepean River

5.1.6 Dissolved hydrocarbons

Dissolved heavier hydrocarbons (i.e. >C_6) can occur naturally in groundwater, with concentrations derived from carbonaceous material in the adjacent strata (CSIRO 2011).

Throughout this monitoring period TRH levels were below the limit of recording, with the exception of a detection of 20 µg/L C_6-C_{10} at GLMB03 in October 2023. Dissolved TRH concentrations remained within historical observations at all sites.

The historical data for C_6-C_{10} detections at all monitoring points are shown in Figure 5.7.

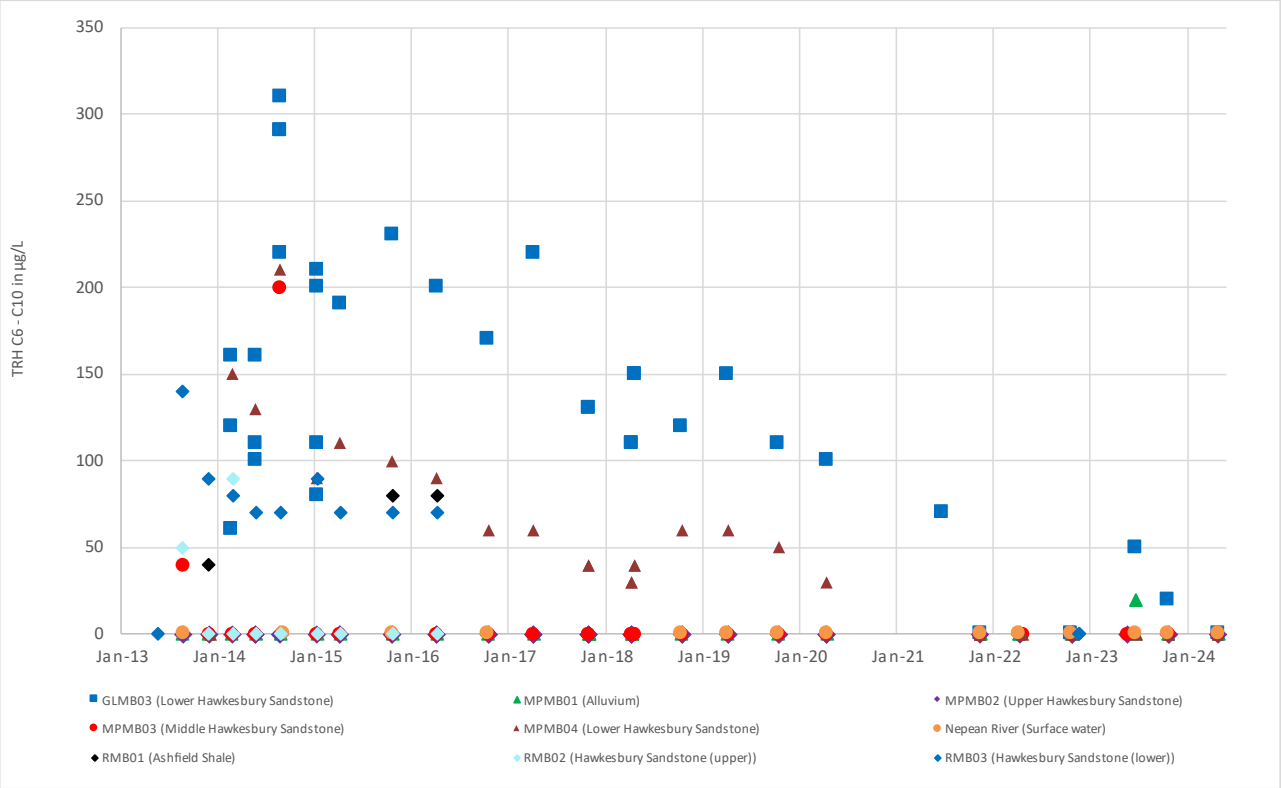


Figure 5.7 Dissolved TRH C_6-C_{10} time series for CGP monitoring bores and Nepean River

5.1.7 BTEX Compounds

No BTEX (benzene, toluene, ethyl benzene and xylene) compounds were recorded at MPMB01, MPMB02, MPMB03 and the Nepean River. Toluene concentrations above the limit of recording were observed at MPMB04 and GLMB03 during the October 2023 and April 2024 monitoring event, however the concentrations were within the range of historical observations. Figure 5.8 shows data trends for dissolved BTEX detections for all monitoring points.

Toluene has occasionally been detected in other monitoring sites at similar concentrations since monitoring commenced, including the former control site (Denham Court, RMB) located at a significant distance from development activities (e.g. EMM 2016) (Figure 5.8).

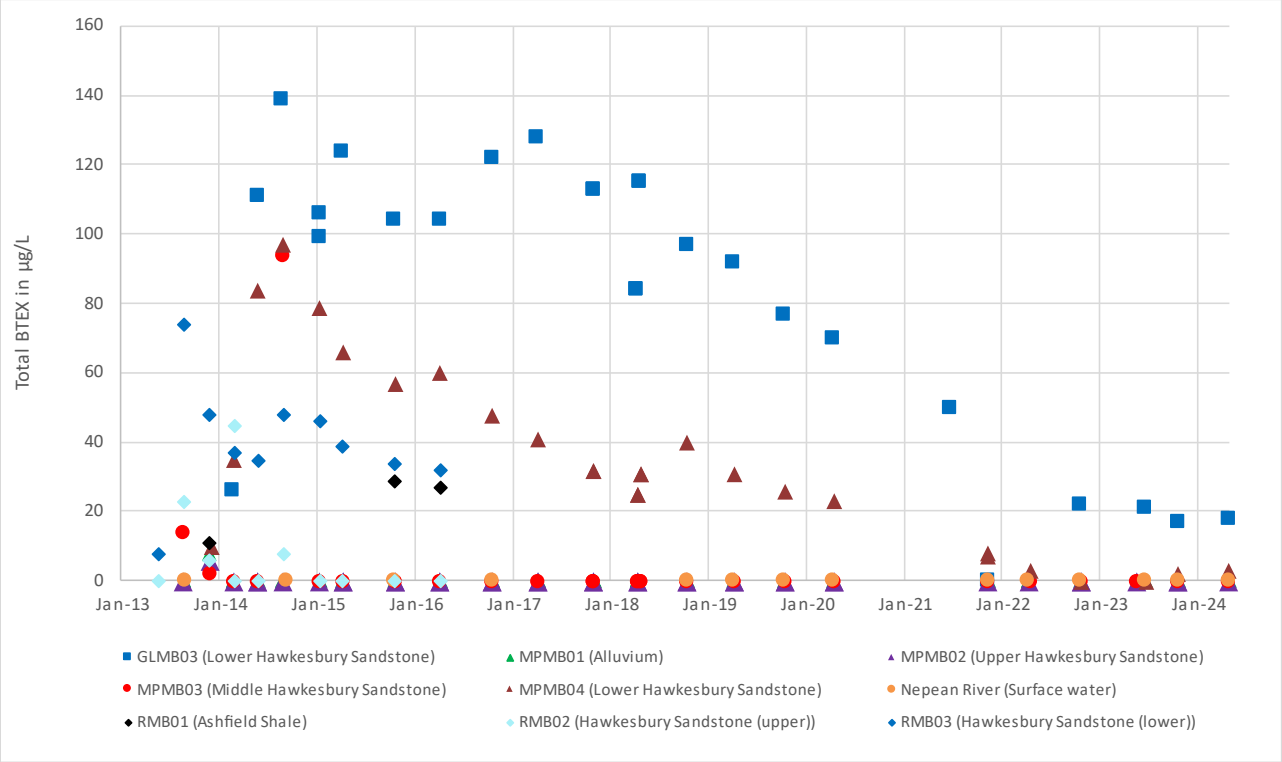


Figure 5.8 Dissolved BTEX time series for CGP monitoring bores and Nepean River

5.2 Surface water quality

Surface water quality results from the Nepean River are overall consistent with previous monitoring years, with the exception of elevated barium concentrations in both the October 2023 and April 2024 sampling events. The surface water quality results of the 2023–2024 monitoring year were compared to ANZECC (2000) guidelines for freshwater ecosystems (95% protection level).

- Salinity is fresh, with electrical conductivity measured at 405 and 109 µS/cm in October 2023 and April 2024 respectively; and continues to be typically lower than groundwater in the alluvium (Figure 5.1).
- The pH was slightly alkaline in both the October 2023 (8.61) and April 2024 (8.59) monitoring events. The pH of the Nepean River is generally higher than the pH of groundwater in the alluvium (Figure 5.2). Similar elevated pH readings have been observed in the past.
- Dominant major ions are sodium, chloride, and bicarbonate (Figure 5.3).

Dissolved metal concentrations in the Nepean River are typically lower than those of groundwater in the alluvium and Hawkesbury Sandstone units Figure 5.4) and are generally below the ANZECC 2000 guideline values (Appendix B). It is important to note that not all metals are included in the ANZECC 2000 guidelines for freshwater ecosystems.

- Aluminium concentration of 0.08 mg/L (April 2024) exceeded the guideline value of 0.055 mg/L but was within the range of historical observations.
- Zinc concentration of 0.071 mg/L (April 2024) exceeded the guideline value of 0.008 mg/L but was within the range of historical observations.
- Barium concentration was above historical observations with a reading of 0.114 mg/L in April 2024. No barium ANZECC guidelines are available for freshwater ecosystems.

Nutrient concentrations over the 2023–2024 monitoring year were low, within historical ranges, and within the ANZECC 2000 95% protection level guidelines.

Dissolved methane and heavier hydrocarbons were not detected.

6 Discussion and conclusions

Groundwater level data at nested monitoring bores was collected using dataloggers and manual water level measurements, identifying trends in the alluvium and Hawkesbury Sandstone aquifers. Water quality samples were collected at the Menangle Park, Glenlee and Nepean River sites.

A summary of the main findings for the 2023–2024 monitoring year regarding water levels are:

- Menangle Park Site:
  - Groundwater levels remained relatively stable and correspond to historic observations. The water level within all Menangle Park monitoring bores remained within 10 mbgl.
  - The groundwater level in the alluvium (MPMB01) showed a direct response to rainfall and flood events (Figure 4.1).
  - A response to rainfall and flood events was observed in the upper and middle Hawkesbury Sandstone (monitoring bores MPMB02 and MPMB03) (Figure 4.1).
  - A slightly subdued and delayed response to rainfall was generally observed in the lower Hawkesbury Sandstone (MPMB04) (Figure 4.1).
- Glenlee Site:
  - Groundwater levels remained relatively stable and correspond to historic observations. Groundwater levels remained below 15 mbgl at Glenlee (GLMB03) and do not show a clear response to rainfall (Figure 4.2).
  - The pressures in the VWP installed at GLMB01 and GLMB02 (installed in 2015) stabilised at lower piezometric pressure head levels compared with pressures observed from the former standpipe monitoring bores. The measured pressures are not representative of formation water levels.
- For the regional Hawkesbury Sandstone aquifer, groundwater elevations were higher at the Glenlee site (approximately 71–75 mAHD) than the Menangle Park site (approximately 57–61 mAHD).
- Vertical gradients vary between sites. An upward gradient is evident at Menangle Park and a downward gradient is evident at the Glenlee site.
- The Nepean River elevation is usually lower than the groundwater elevation in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining stream around the Menangle Park site, except for short periods during flood events when recharge to the underlying groundwater systems occurs.
- The groundwater level data collected in the alluvium and Hawkesbury Sandstone are indicative of natural systems in long-term equilibrium with seasonal rainfall recharge responses.

No long-term groundwater level drawdown trends attributable to CSG operations (which involves depressurisation and local dewatering of the deep coal seams) have been observed in the groundwater level data at any of the monitored locations.

The main findings for the 2023–2024 monitoring year regarding water quality are:

- Menangle Park Site:
  - Groundwater quality in the alluvium at the Menangle Park site (MPMB01) was characterised as fresh to marginal with a slightly acidic pH. Dissolved metal concentrations were typically low, and no dissolved hydrocarbons were detected.
  - Groundwater quality in the Hawkesbury Sandstone ranged from fresh to marginal at the Menangle Park sites (MPMB02, MPMB03, MPMB04). The groundwater become more alkaline with depth, corresponding to previous observations.
  - Nutrient levels in MPMB01 have shown an increasing trend and exceeded historical levels in both October 2023 and April 2024 for nitrates. Given ammonia was not detected, potential sources of nitrate in the groundwater at MPMB01 could be related to fertiliser runoff, nitrate-rich surface water infiltration, or historical nitrate contamination (long-term leaching of fertilisers or manure). Nutrient levels remained stable and within historical observations at all other sites.
  - An anomalous elevated concentration of lead (filtered) was recorded at MPMB01, equal to the highest previously recorded concentration (in 2014). The data does not indicate a trend at this point in time. Lead concentrations levels were within historical observations at all other sites.
  - Elevated concentrations of iron (filtered) were recorded at MPMB02, which were greater than historic observations during the April 2024 monitoring event and potentially indicative of an increasing trend in the last two monitoring years. The presence of ammonia at MPMB02 alongside elevated iron concentrations suggests that iron reduction is actively occurring, likely from naturally occurring iron-rich minerals within the Hawkesbury Sandstone (SCA 2005). Iron concentrations remained within historic observations at all other sites.
  - Dissolved methane was present at Menangle Park bores and toluene at MPMB04, which is consistent with previous monitoring data. Dissolved hydrocarbons (methane and toluene) were observed to occur at the former control site (Denham Court) located a significant distance from any development activities, indicating a natural source may be present.
- Glenlee Site:
  - Groundwater quality in the Hawkesbury Sandstone was historically slightly saline however, a decline in salinity was observed at GLMB03 from October 2021, which is likely a result of reconditioning the monitoring bore. The salinity remained within the brackish classification throughout the monitoring year.
  - Elevated concentrations of reactive phosphorus were recorded at GLMB03 during both the October 2023 and April 2024 monitoring events. This trend is likely related to changes in groundwater chemistry following bore reconditioning in late 2021. The changes observed include a reduction in iron concentrations, reduced bicarbonate alkalinity, and a rise in pH values. These changes are consistent with conditions that promote the increased mobility of phosphorus, as lower iron concentrations reduce phosphorus adsorption capacity and high pH values can enhance phosphorus solubility. Reactive phosphorus remained below the limit of reporting or within historical observations at all other sites.

- Dissolved methane and toluene was detected at GLMB03, which is consistent with previous monitoring data. Dissolved hydrocarbons (methane and toluene) were observed to occur at the former control site (Denham Court) located significant distance from any development activities, indicating a natural source.

No significant change in water quality was detected during the 2023–2024 monitoring year compared to the previous monitoring years (e.g. EMM 2022 and 2023a). No adverse water quality impacts attributable to CSG operations were observed at any of the monitored sites. Water quality results are not significantly different between the former control site (Denham Court) and monitoring sites located within the CGP footprint (Menangle Park and Glenlee).

To conclude, based on the available data, there are no observable impacts to groundwater levels or quality or surface water quality that are attributable to the CSG operations. There is no evidence of connectivity between the shallower monitored zones and the coal seams (except for the potential natural migration of gases through the Narrabeen Group strata) which corroborates the conceptual model developed during the Phase 1 studies (Parsons Brinckerhoff 2011). The presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and the targeted coal seams restricts depressurisation and impedes the vertical flow of groundwater.

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Glossary

Acidity	Base neutralising capacity.
Alkalinity	Acid neutralising capacity.
Alluvium	Unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans.
Alluvial aquifer	Permeable zones that store and produce groundwater from unconsolidated alluvial sediments. Shallow alluvial aquifers are generally unconfined aquifers.
Ammonia	A compound of nitrogen and hydrogen (NH3) that is a common by-product of animal waste and landfills but is also found naturally in reduced environments. Ammonia readily converts to nitrate in soils and streams.
Anion	An ion with a negative charge – usually non-metal ions when disassociated and dissolved in water.
Aquatic ecosystem	The stream channel, lake or estuary bed, water, and (or) biotic communities and the habitat features that occur therein.
Aquiclude	An impermeable unit that acts as a barrier to the flow of groundwater from one formation to another.
Aquifer	Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
Aquifer, confined	An aquifer that is overlain by low permeability strata. The hydraulic conductivity of the confining bed is significantly lower than that of the aquifer.
Aquifer, semi-confined	An aquifer overlain by a low-permeability layer that permits water to slowly flow through it. During pumping, recharge to the aquifer can occur across the leaky confining layer – also known as a leaky artesian or leaky confined aquifer.
Aquifer, unconfined	Also known as a water table aquifer. An aquifer in which there are no confining beds between the zone of saturation and the surface. The water table is the upper boundary of an unconfined aquifer.
Aquitard	A low permeability unit that can store groundwater and also transmit it slowly from one formation to another. Aquitards retard but do not prevent the movement of water to or from adjacent aquifers.
Australian Height Datum (AHD)	The reference point (very close to mean sea level) for all elevation measurements, and used for correlating depths of aquifers and water levels in bores.
Beneficial aquifer	An aquifer with a water resource of sufficient quality and quantity to provide either ecosystem protection, raw water for drinking water supply, and agricultural or industrial water.
Bore	A structure drilled below the surface to obtain water from an aquifer or series of aquifers.
Cation	An ion with a positive charge – usually metal ions when disassociated and dissolved in water.
Claystone	A non-fissile rock of sedimentary origin composed primarily of clay-sized particles (less than 0.004 mm).

Coal	A sedimentary rock derived from the compaction and consolidation of vegetation or swamp deposits to form a fossilised carbonaceous rock.
Coal seam	A layer of coal within a sedimentary rock sequence.
Coal seam gas (CSG)	Coal seam gas is a form of natural gas (predominantly methane) that is extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as milligram per litre (water sample) or micrograms per kilogram (sediment sample).
Conceptual model	A simplified and idealised representation (usually graphical) of the physical hydrogeologic setting and the hydrogeological understanding of the essential flow processes of the system. This includes the identification and description of the geologic and hydrologic framework, media type, hydraulic properties, sources and sinks, and important aquifer flow and surface-groundwater interaction processes.
Confining layer	Low permeability strata that may be saturated but will not allow water to move through it under natural hydraulic gradients.
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
Dual permeability aquifer	An aquifer in which groundwater flow is through both the primary porosity of the rock matrix and the secondary porosity of fractures and fissures.
Electrical conductivity (EC)	A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often used as a measure of water salinity.
Facies	An assemblage or association of mineral, rock, or fossil features reflecting the environment and conditions of origin of the rock. It refers to the appearance and peculiarities that distinguish a rock unit from associated or adjacent units.
Fault	A fracture in rock along which there has been an observable amount of displacement. Faults are rarely single planar units; normally they occur as parallel to sub-parallel sets of planes along which movement has taken place to a greater or lesser extent. Such sets are called fault or fracture zones.
Groundwater	The water contained in interconnected pores or fractures located below the water table in the saturated zone.
Groundwater level	The water level measured in a bore; this may be at or close to the water table in unconfined aquifers, or represent the average piezometric level across the screened interval in confined aquifers.
Groundwater flow	The movement of water through openings in sediment and rock within the zone of saturation.
Groundwater system	A system that is hydrogeologically more similar than different in regard to geological province, hydraulic characteristics and water quality, and may consist of one or more geological formations.
Hydraulic conductivity (K)	The rate at which water of a specified density and kinematic viscosity can move through a permeable medium (notionally equivalent to the permeability of an aquifer to fresh water).
Hydraulic gradient	The change in total hydraulic head with a change in distance in a given direction.

Hydraulic head	A specific measurement of water pressure above a datum. It is usually measured as a water surface elevation, expressed in units of length. In an aquifer, it can be calculated from the depth to water in a monitoring bore. The hydraulic head can be used to determine a hydraulic gradient between two or more points.
Hydrogeology	The study of the interrelationships of geologic materials and processes with water, especially groundwater.
Hydrology	The study of the occurrence, distribution, and chemistry of all surface waters.
Ion	An ion is an atom or molecule where the total number of electrons is not equal to the total number of protons, giving it a net positive or negative electrical charge.
Limit or reporting (LOR)	The concentration below which a particular analytical method cannot determine, with a high degree of certainty, a concentration.
Lithology	The study of rocks and their depositional or formational environment on a large specimen or outcrop scale.
Major ions	Constituents commonly present in concentrations exceeding 10 milligram per litre. Dissolved cations generally are calcium, magnesium, sodium, and potassium; the major anions are sulphate, chloride, fluoride, nitrate, and those contributing to alkalinity, most generally assumed to be bicarbonate and carbonate.
Methane (CH_4)	An odourless, colourless, flammable gas, which is the major constituent of natural gas. It is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds.
MicroSiemens per centimetre (µS/cm)	A measure of water salinity commonly referred to as EC (see also electrical conductivity). Most commonly measured in the field with calibrated field meters.
Monitoring bore	A non-pumping bore, is generally of small diameter that is used to measure the elevation of the water table and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
Normal fault	Where the fault plane is vertical or dips towards the downthrow side of a fault.
Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.
Permeable material	Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present.
Permian	The last period of the Palaeozoic era that finished approximately 252 million years before present.
pH	Potential of Hydrogen; the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per litre; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral, greater than 7 is alkaline and less than 7 is acidic).
Porosity	The proportion of open space within an aquifer, comprised of intergranular space, pores, vesicles and fractures.
Porosity, primary	The porosity that represents the original pore openings when a rock or sediment formed.
Porosity, secondary	The porosity caused by fractures or weathering in a rock or sediment after it has been formed.

Quaternary	The most recent geological period extending from approximately 2.6 million years ago to the present day.
Quality assurance	Evaluation of quality-control data to allow quantitative determination of the quality of chemical data collected during a study. Techniques used to collect, process, and analyse water samples are evaluated.
Recharge	The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. The addition of water to an aquifer.
Recharge area	A geographic area that directly receives infiltrated water from surface and in which there are downward components of hydraulic head in the aquifer. Recharge generally moves downward from the water table into the deeper parts of an aquifer then moves laterally and vertically to recharge other parts of the aquifer or deeper aquifer zones.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	Fresh water quality – water with a salinity <800 µS/cm. Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm. Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm. Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm. Moderately saline quality – water that is more saline than slightly saline water and generally waters between 10,000 and 20,000 µS/cm. Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 µS/cm. Seawater quality – water that is generally around 55,000 µS/cm. (Australian Water Resources Council 1988)
Sandstone	Sandstone is a sedimentary rock composed mainly of sand-sized minerals or rock grains (predominantly quartz).
Screen	A type of bore lining or casing of special construction, with apertures designed to permit the flow of water into a bore while preventing the entry of aquifer or filter pack material.
Sedimentary rock aquifer	These occur in consolidated sediments such as porous sandstones and conglomerates, in which water is stored in the intergranular pores, and limestone, in which water is stored in solution cavities and joints. These aquifers are generally located in sedimentary basins that are continuous over large areas and may be tens or hundreds of metres thick. In terms of quantity, they contain the largest volumes of groundwater.
Shale	A laminated sedimentary rock in which the constituent particles are predominantly of clay size.
Siltstone	A fine-grained rock of sedimentary origin composed mainly of silt-sized particles (0.004 to 0.06 mm).
Standing water level (SWL)	The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels.
Stratigraphy	The depositional order of sedimentary rocks in layers.

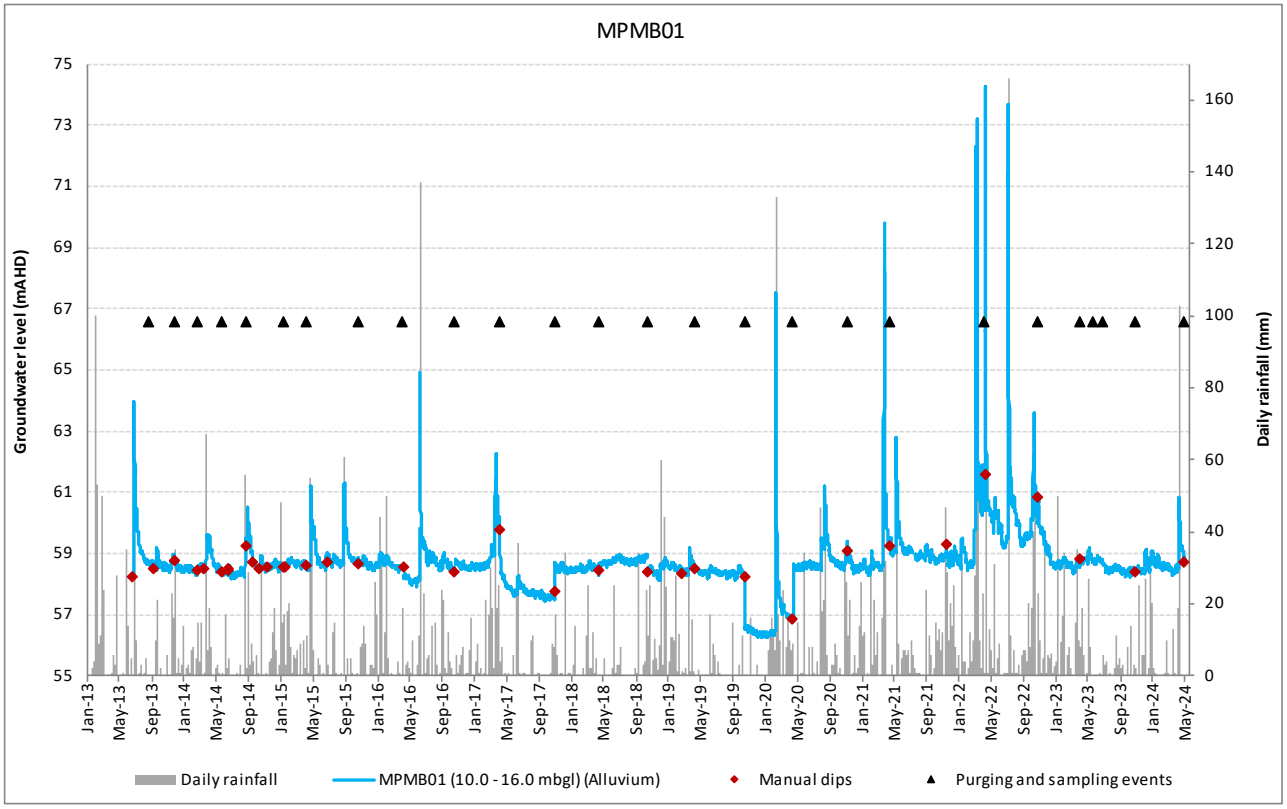
Surface water-groundwater interaction	This occurs in two ways: (1) streams gain water from groundwater through the streambed when the elevation of the water table adjacent to the streambed is greater than the water level in the stream; and (2) streams lose water to groundwater through streambeds when the elevation of the water table is lower than the water level in the stream.
Tertiary	Geologic time at the beginning of the Cainozoic era, 65 to 2.6 million years ago, after the Cretaceous and before the Quaternary.
Total Dissolved Solids (TDS)	A measure of the salinity of water, usually expressed in milligrams per litre (mg/L). See also EC.
Water quality	Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water quality data	Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists.
Well	Pertaining to a gas exploration well or gas production well.

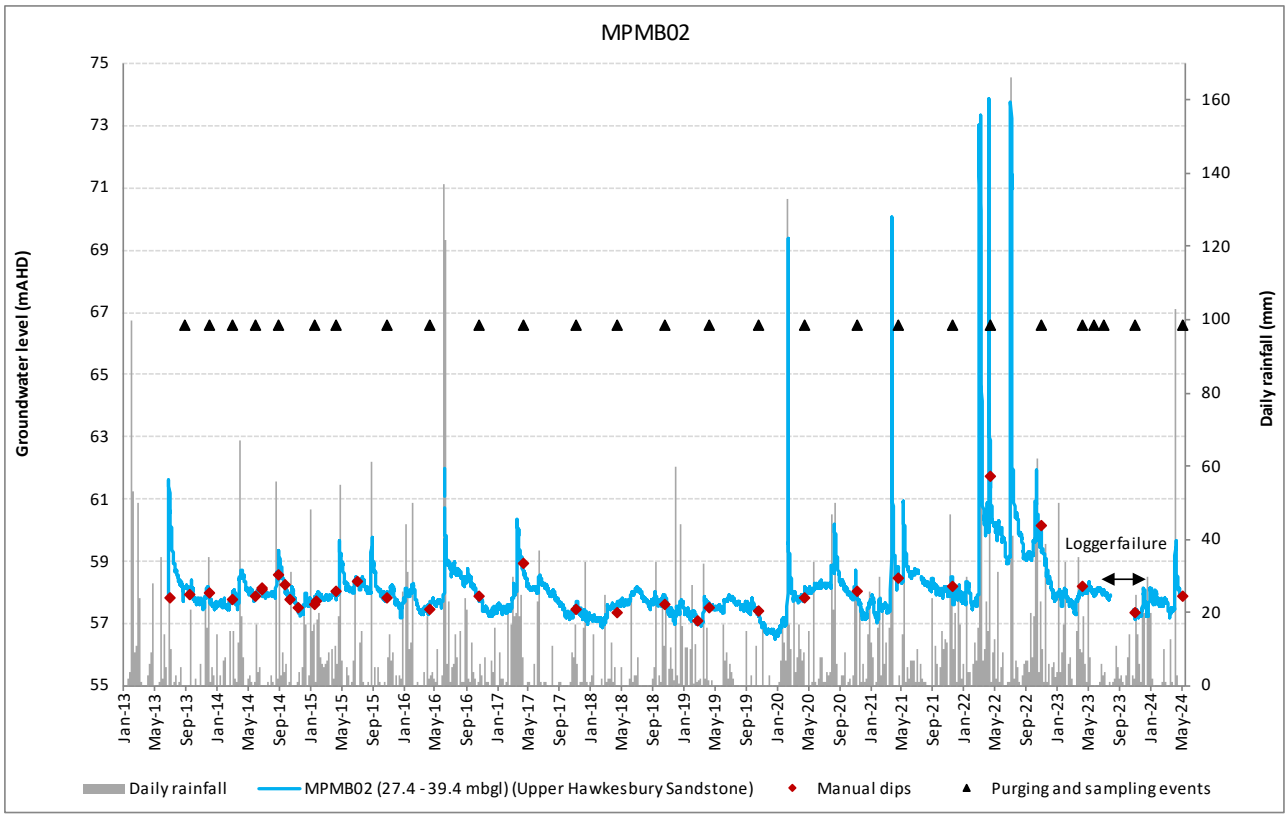
Abbreviations

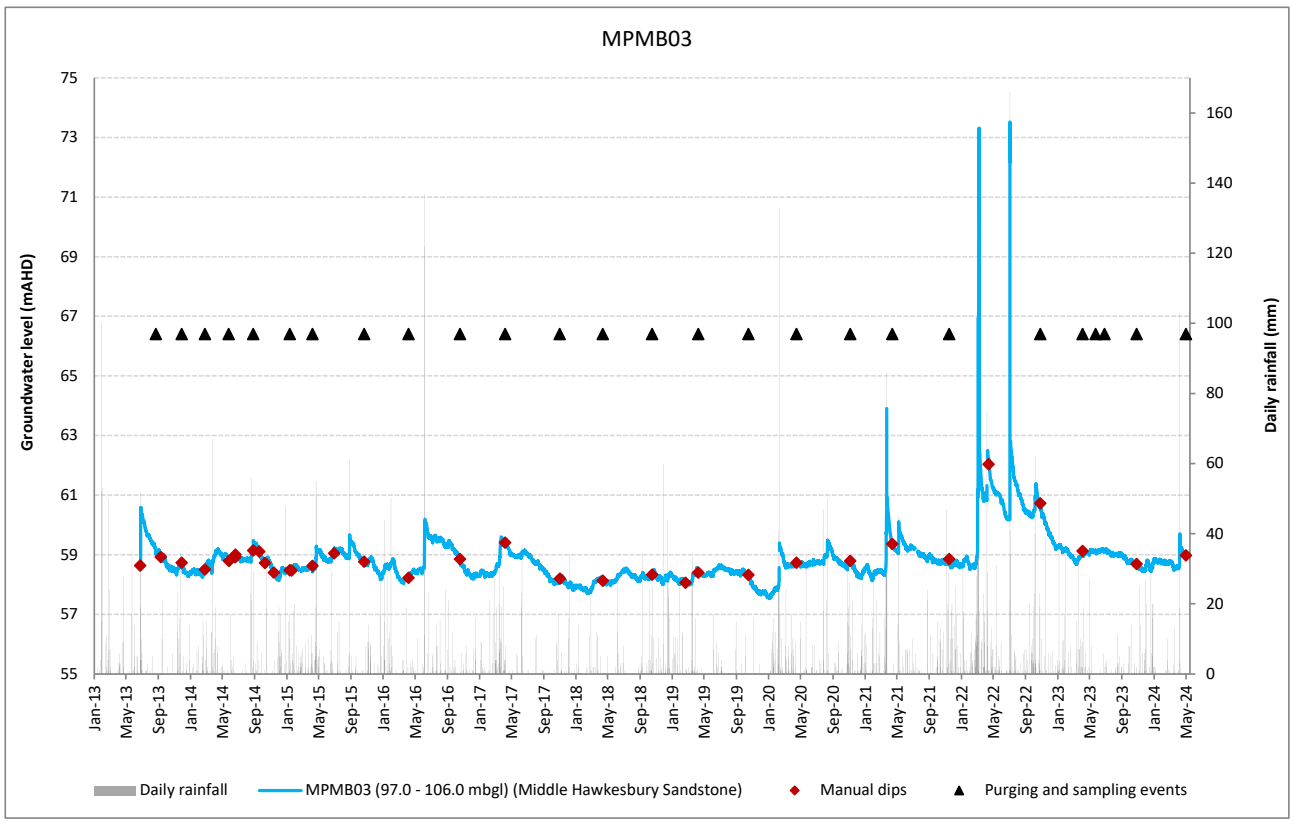
Abbreviation	Definition
AGL	AGL Upstream Investments Pty Ltd
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethyl benzene and xylenes
CDFM	Cumulative deviation from mean
CGP	Camden Gas Project
CSG	Coal seam gas
EC	Electrical conductivity
LOR	Limit of reporting
PAH	Polycyclic aromatic hydrocarbons
SCA	Sydney Catchment Authority
TDS	Total dissolved solids
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
VWP	Vibrating wire piezometer
°C	degrees Celsius
L/s	litres per second
m	metres
mAHD	metres Australian Height Datum
mbgl	metres below ground level
mg/L	milligrams per litre
µg/L	micrograms per litre
µS/cm	microSiemens per centimetre

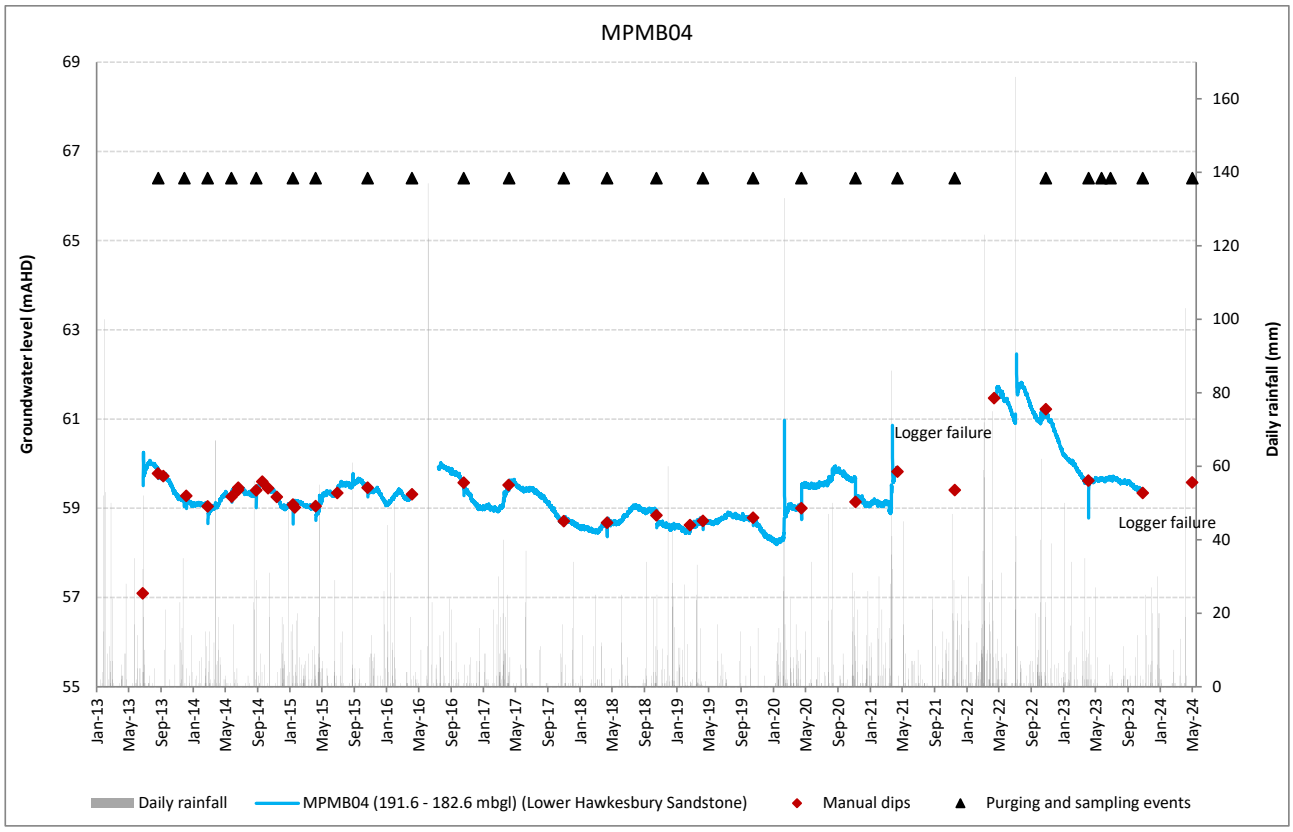
Appendix A
Groundwater hydrographs

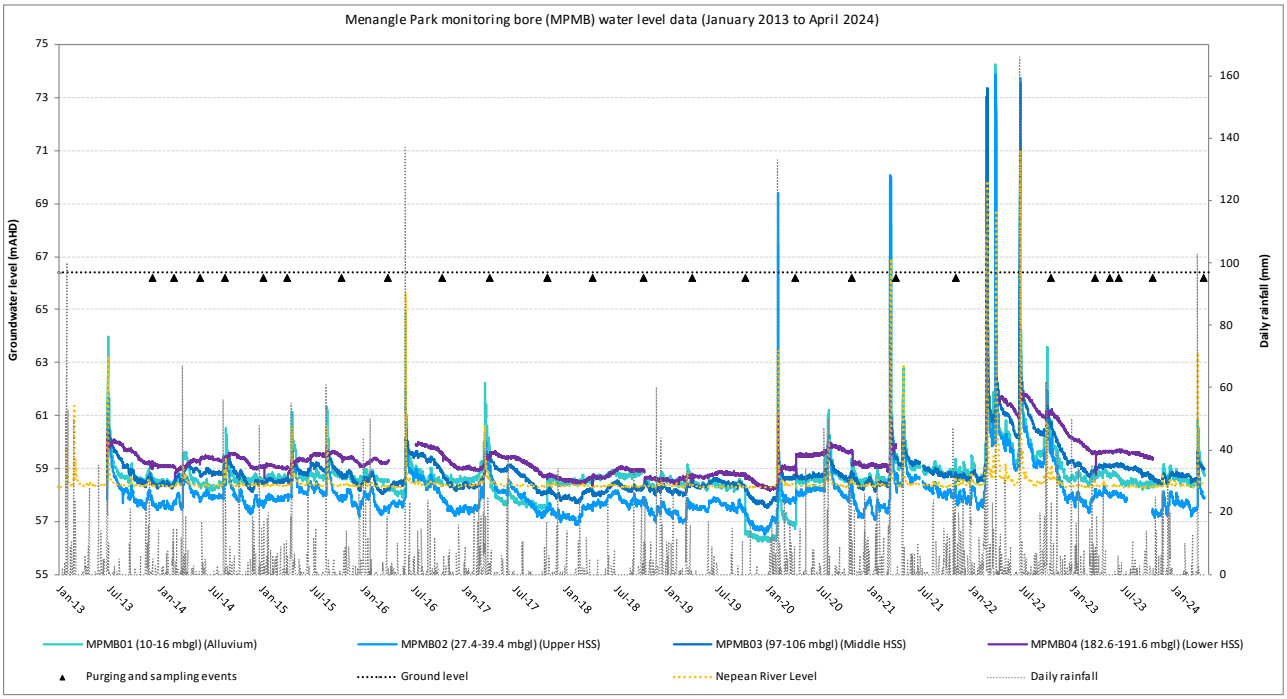
EMM
creating opportunities

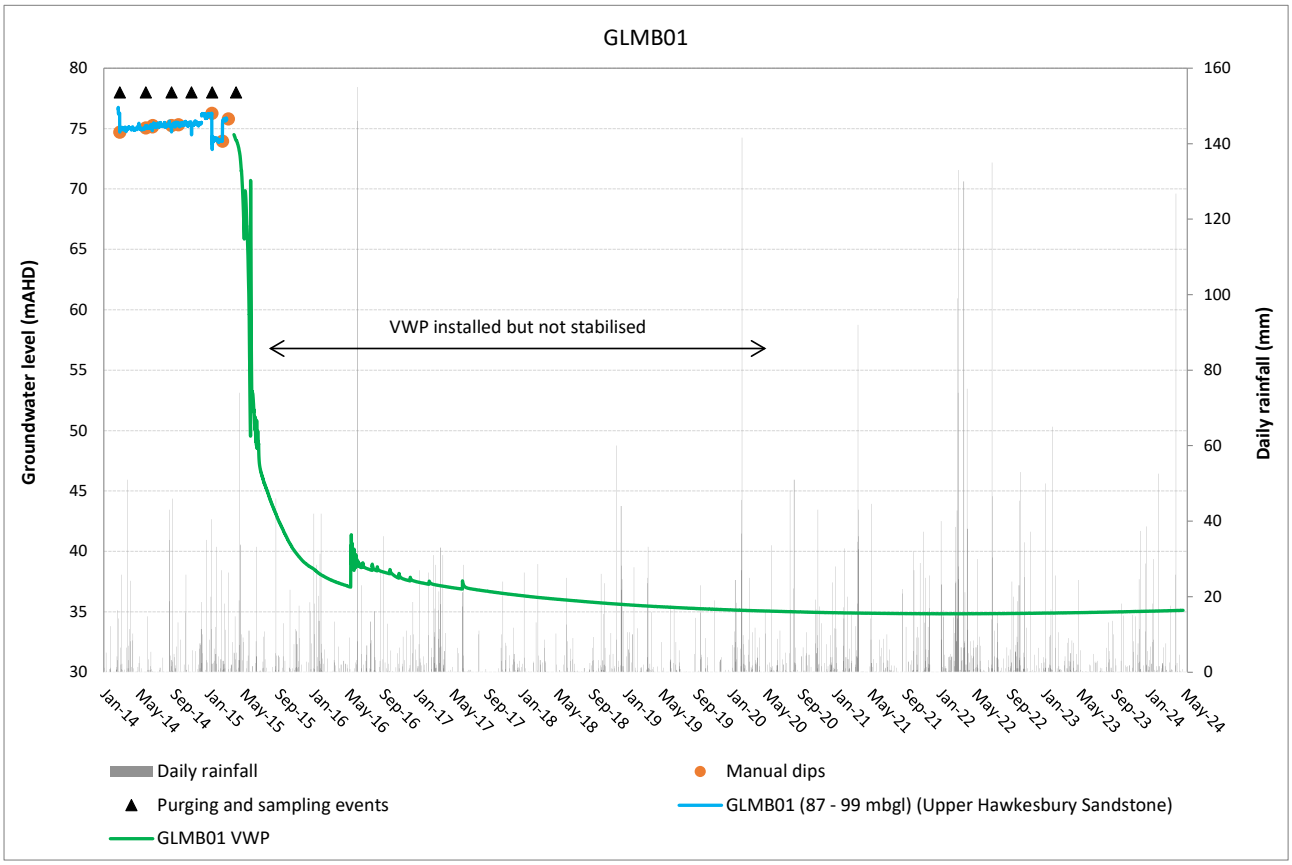

MPMB01
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Sep-23
Jan-24
May-24
Daily rainfall
MPMB01 (10.0 - 16.0 mbgl) (Alluvium)
Manual dips
Purging and sampling events

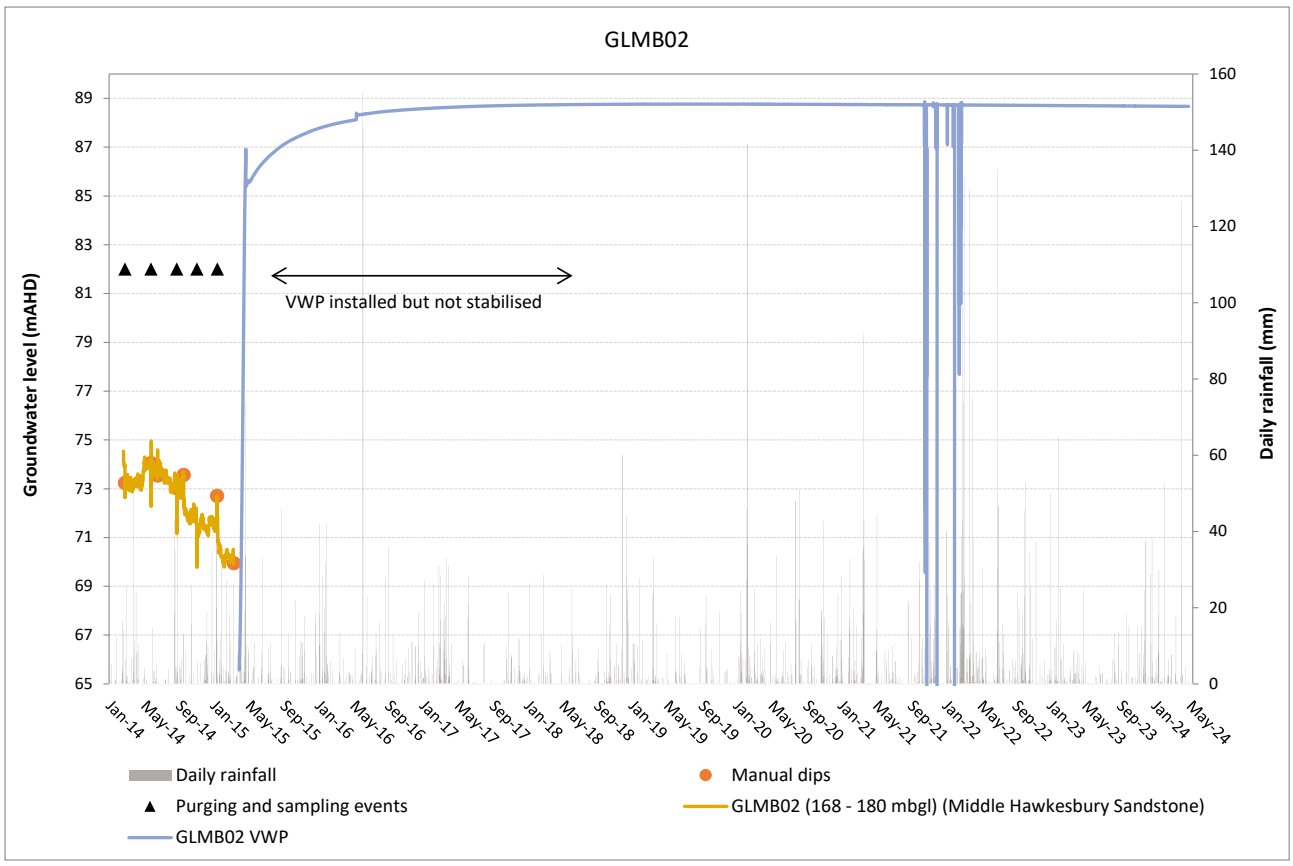

MPMB02
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Logger failure
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Sep-23
Jan-24
May-24
Daily rainfall
MPMB02 (27.4 - 39.4 mbgl) (Upper Hawkesbury Sandstone)
Manual dips
Purging and sampling events

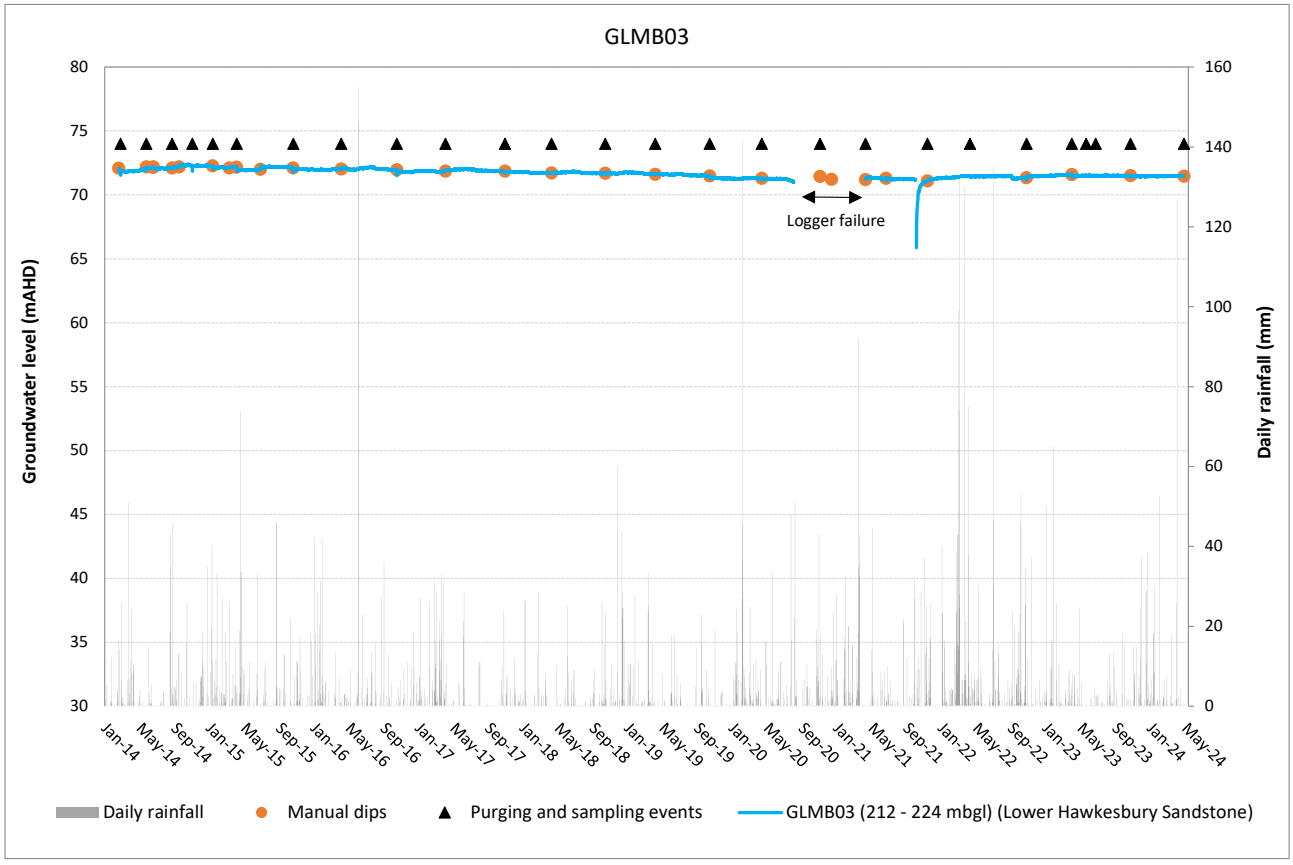

MPMB03
Groundwater level (mAHD)
Daily rainfall (mm)
75
73
71
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Sep-23
Jan-24
May-24
Daily rainfall
MPMB03 (97.0 - 106.0 mbgl) (Middle Hawkesbury Sandstone)
Manual dips
Purging and sampling events

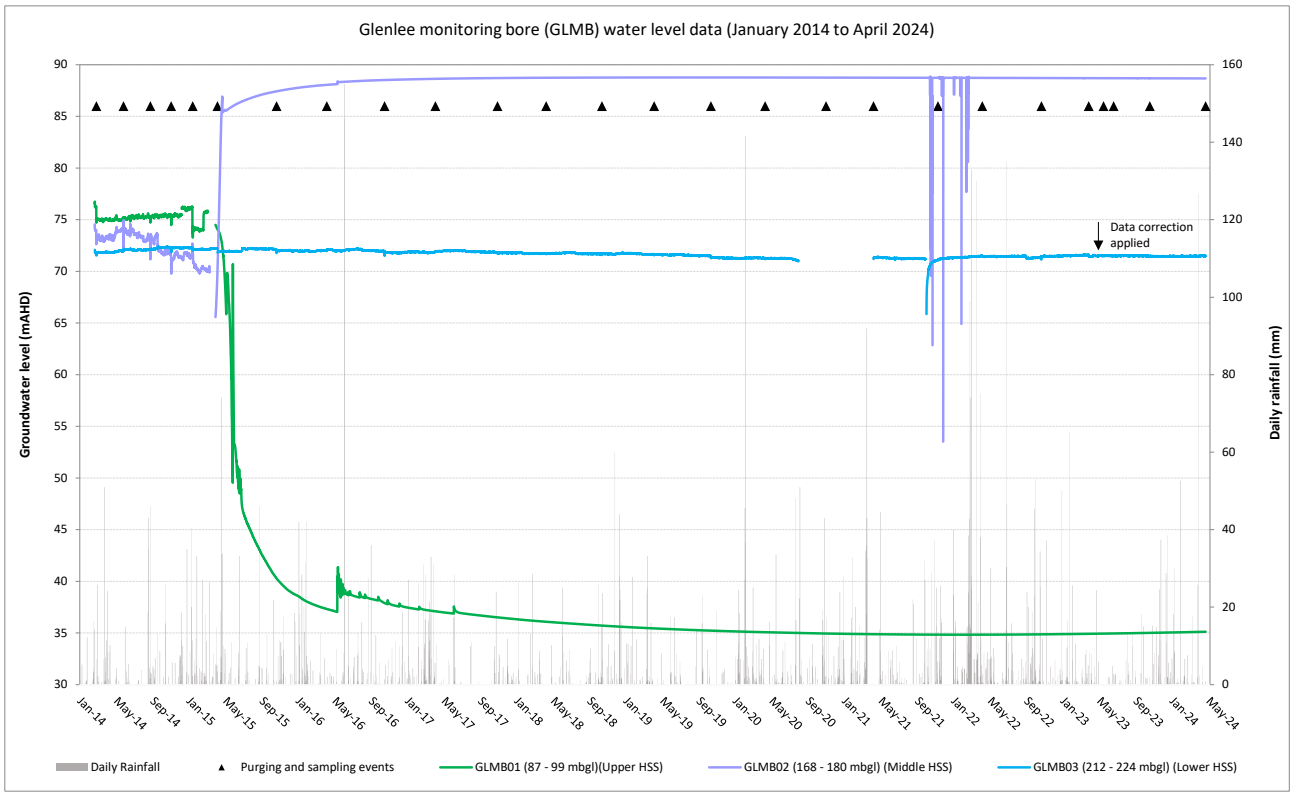

MPMB04
Groundwater level (mAHD)
Daily rainfall (mm)
69
67
65
63
61
59
57
55
160
140
120
100
80
60
40
20
0
Logger failure
Logger failure
Jan-13
May-13
Sep-13
Jan-14
May-14
Sep-14
Jan-15
May-15
Sep-15
Jan-16
May-16
Sep-16
Jan-17
May-17
Sep-17
Jan-18
May-18
Sep-18
Jan-19
May-19
Sep-19
Jan-20
May-20
Sep-20
Jan-21
May-21
Sep-21
Jan-22
May-22
Sep-22
Jan-23
May-23
Sep-23
Jan-24
May-24
Daily rainfall
MPMB04 (191.6 - 182.6 mbgl) (Lower Hawkesbury Sandstone)
Manual dips
Purging and sampling events


Menangle Park monitoring bore (MPMB) water level data (January 2013 to April 2024)
Groundwater level (mAHD)
Daily rainfall (mm)
MPMB01 (10-16 mbgl) (Alluvium)
MPMB02 (27.4-39.4 mbgl) (Upper HSS)
MPMB03 (97-106 mbgl) (Middle HSS)
MPMB04 (182.6-191.6 mbgl) (Lower HSS)
Purging and sampling events
Ground level
Nepean River Level
Daily rainfall


GLMB01
Groundwater level (mAHD)
Daily rainfall (mm)
VWP installed but not stabilised
Daily rainfall
Manual dips
Purging and sampling events
GLMB01 (87 - 99 mbgl) (Upper Hawkesbury Sandstone)
GLMB01 VWP


GLMB02
Groundwater level (mAHD)
Daily rainfall (mm)
VWP installed but not stabilised
Daily rainfall
Manual dips
Purging and sampling events
GLMB02 (168 - 180 mbgl) (Middle Hawkesbury Sandstone)
GLMB02 VWP


GLMB03
Groundwater level (mAHD)
Daily rainfall (mm)
Logger failure
Daily rainfall
Manual dips
Purging and sampling events
GLMB03 (212 - 224 mbgl) (Lower Hawkesbury Sandstone)


Glenlee monitoring bore (GLMB) water level data (January 2014 to April 2024)
Groundwater level (mAHD)
Daily rainfall (mm)
Data correction applied
Daily Rainfall
Purging and sampling events
GLMB01 (87 - 99 mbgl)(Upper HSS)
GLMB02 (168 - 180 mbgl) (Middle HSS)
GLMB03 (212 - 224 mbgl) (Lower HSS)

Appendix B

Water quality summary table

EMM
creating opportunities

	Location Code	GLMB03	GLMB03	MPMB01	MPMB01	MPMB02	MPMB02 (QA)	MPMB02	MPMB02 (QA)	MPMB03	MPMB03	MPMB04	MPMB04	NR	NR	TB	TB	TS	ANZECC freshwater
	Date	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	26 Oct 2023	30 Apr 2024	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	20 Oct 2023	29 Apr 2024	29 Apr 2024	95% protection
	Unit	EQL																	
Field parameters																			
Electrical Conductivity (field)	mg/L		3862	4194	479.8	579	568	568	734	734	822	1005	138.5	240.8	342.3	120.2	-	-	-	-
pH (field)	µS/cm		10	9.06	5.95	5.8	6.7	6.7	6.7	6.7	7.23	7.14	10.13	10.08	8.61	8.59				
TDS	mg/L		2509	2723	354.3	377	373.5	373.5	474.5	474.5	617.5	650	103.35	156	237.9	78	-	-	-	-
Analytical results – general																				
Electrical Conductivity (Lab)	µS/cm	1.00	3,930	4,380	622	594	652	682	720	719	1,010	1,010	205	253	405	109	-	-	-	-
pH (Lab)	-	0.01	9.84	10.1	6.28	6.38	7.17	7.29	7.31	7.31	7.86	7.85	9.24	9.38	8.10	7.38				
TDS	mg/L	10	2,390	3,030	303	375	320	326	392	396	512	596	110	136	200	70	-	-	-	-
TSS	mg/L	5	54	10	10	6	24	20	17	18	77	17	21	6	7	8	-	-	-	-
Analytical results – alkalinity																				
Alkalinity (Bicarbonate as $CaCO_3$)	mg/L	1	552	452	29	26	156	170	180	176	472	470	54	71	116	18	-	-	-	-
Alkalinity (Carbonate as $CaCO_3$)	mg/L	1	588	925	<1	<1	<1	<1	<1	<1	<1	<1	27	31	<1	<1	-	-	-	-
Alkalinity (Hydroxide) as $CaCO_3$	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	-
Alkalinity (total) as $CaCO_3$	mg/L	1	1,140	1,380	29	26	156	170	180	176	472	470	80	102	116	18	-	-	-	-
Inorganics																				
Anions Total	meq/L	0.01	44.5	47.8	5.15	5.06	7.36	7.30	7.22	7.27	12.2	11.4	2.05	2.69	4.17	1.09	-	-	-	-
Bromide	µg/L	10	1,380	1,280	294	314	194	198	226	233	106	110	60	71	105	45	-	-	-	-
Bromine (filtered)	µg/L	100	1,800	1,800	400	300	300	300	300	300	200	200	100	<100	200	<100	-	-	-	-
Calcium (filtered)	mg/L	1	14	22	7	8	27	27	31	31	90	86	3	3	7	3	-	-	-	-
Cations Total	meq/L	0.01	41.9	47.9	5.01	4.72	6.21	6.16	6.65	6.78	11.3	10.6	1.79	2.30	3.96	0.90	-	-	-	-
Chloride	mg/L	1	770	718	159	158	146	134	124	128	98	73	16	23	59	23	-	-	-	-
Cyanide Total	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	-	-	-	0.007
Fluoride	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	<0.1	<0.1	-	-	-	-
Magnesium (filtered)	mg/L	1	62	68	13	11	24	24	23	23	23	18	<1	<1	8	2	-	-	-	-
Reactive Silica	mg/L	0.05	2.57	2.02	16.5	15.6	10.2	10.2	10.4	10.8	8.87	8.98	3.39	4.27	0.39	2.79	-	-	-	-
Potassium (filtered)	mg/L	1	32	35	1	1	4	4	3	3	14	12	3	4	5	1	-	-	-	-
Ionic Balance	%	0.01	3.01	0.04	1.34	3.44	8.49	8.44	4.12	3.52	3.77	3.84	-	-	2.54	-	-	-	-	-
Sodium (filtered)	mg/L	1	811	926	82	78	64	63	72	68	105	104	36	47	65	13	-	-	-	-
Sulfate as SO_4 - Turbidimetric (filtered)	mg/L	1	<1	<10	4	4	6	6	6	7	<1	<1	<1	<1	9	4	-	-	-	-
Metals																				
Aluminium (filtered)	mg/L	0.01	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.03	<0.01	0.08	-	-	-	0.055
Antimony (filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	ID[1]
Arsenic (filtered)	mg/L	0.001	0.003	0.005	<0.001	<0.001	0.014	0.014	0.017	0.017	0.006	0.007	<0.001	0.002	<0.001	<0.001	-	-	-	0.024
Barium (filtered)	mg/L	0.001	15.0	20.1	0.365	0.346	0.338	0.335	0.422	0.426	2.86	3.14	0.174	0.221	0.069	0.114	-	-	-	-
Beryllium (filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	ID[1]
Boron (filtered)	mg/L	0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	0.37
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	0.0002
Chromium (III+VI) (filtered)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	ID[1]
Cobalt (filtered)	mg/L	0.001	<0.001	<0.001	0.024	0.024	0.003	0.003	0.004	0.003	0.002	0.002	<0.001	<0.001	<0.001	<0.001	-	-	-	ID[1]
Copper (filtered)	mg/L	0.001	0.003	<0.001	0.004	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	0.0014
Iron (filtered)	mg/L	0.05	<0.05	<0.05	0.18	0.06	5.48	5.68	6.79	5.88	2.74	2.62	<0.05	<0.05	<0.05	0.41	-	-	-	ID[1]
Lead (filtered)	mg/L	0.001	<0.001	<0.001	0.009	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	0.0034
Manganese (filtered)	mg/L	0.001	0.010	0.011	0.279	0.274	0.299	0.309	0.333	0.299	0.100	0.073	0.003	0.002	0.002	0.051	-	-	-	1.9
Mercury (filtered)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	0.0006
Molybdenum (filtered)	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	-	-	-	ID[1]
Nickel (filtered)	mg/L	0.001	0.001	<0.001	0.009	0.009	0.002	0.003	0.004	0.003	<0.001	<0.001	<0.001	<0.001	0.008	<0.001	-	-	-	0.011
Selenium (filtered)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	0.011
Strontium (filtered)	mg/L	0.001	3.93	5.39	0.079	0.086	0.300	0.294	0.403	0.378	0.833	0.961	0.046	0.061	0.078	0.029	-	-	-	-
Uranium (filtered)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	ID[1]
Vanadium (filtered)	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	ID[1]
Zinc (filtered)	mg/L	0.005	0.111	0.022	0.020	0.023	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.088	0.105	<0.005	0.071	-	-	-	0.008
TRH																				
C10-C16	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C10-C16 (F2 minus Naphthalene)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C10-C40 (Sum of total)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C16-C34	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C34-C40	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C6-C10	µg/L	20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	-
C6-C10 (F1 minus BTEX)	µg/L	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	-
Analytical results – nutrients																				
Ammonia as N	mg/L	0.01	1.23	2.18	<0.01	<0.01	0.14	0.14	0.16	0.15	0.94	1.00	0.38	0.62	<0.01	0.02	-	-	-	0.9
Nitrite + Nitrate as N	mg/L	0.01	<0.01	0.02	0.77	0.89	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.17	-	-	-	-
Nitrite (as N)	mg/L	0.01	<0.01	0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-
Nitrate (as N)	mg/L	0.01	<0.01	0.01	0.77	0.86	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.17	-	-	-	0.7
TOC	mg/L	1	114	114	<1	<1	2	2	<1	<1	<1	<1	5	7	4	6	-	-	-	-
Organic																				
Methane	mg/L	0.01	17.6	16.4	0.027	<0.01	1.02	0.991	1	0.932	31.2	36.4	13.9	30.3	<0.01	<0.01	-	-	-	-
Ethene	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-	-
NA																				
Butane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-
Butene	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-	-
Phosphate total (as P)	MG/L	0.01	0.16	0.12	0.03	<0.01	0.05	0.06	0.04	0.03	0.08	0.03	0.03	0.02	0.02	<0.01	-	-	-	-
Propane	mg/L	0.01	0.053	0.056	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-
Reactive Phosphorus as P	mg/L	0.01	0.18	0.22	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-
Propene	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-	-
BTEX																				
Benzene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	16	0.95
Ethylbenzene	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	15	ID[1]

		Location Code	GLMB03	GLMB03	MPMB01	MPMB01	MPMB02	MPMB02 (QA)	MPMB02	MPMB02 (QA)	MPMB03	MPMB03	MPMB04	MPMB04	NR	NR	TB	TB	TS	ANZECC freshwater
		Date	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	26 Oct 2023	30 Apr 2024	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	26 Oct 2023	30 Apr 2024	20 Oct 2023	29 Apr 2024	29 Apr 2024	95% protection
	Unit	EQL																		
Toluene	µg/L	2	17	18	<2	<2	<2	<2	<2	<2	<2	<2	2	3	<2	<2	<2	<2	17	ID[1]
Xylene (m & p)	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	17	ID[1]
Xylene (o)	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	17	0.35
Xylene Total	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	34	
Total BTEX	µg/L	1	17	18	<1	<1	<1	<1	<1	<1	<1	<1	2	3	<1	<1	<1	<1	82	
Naphthalene (VOC)	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.022	0.016
Phenols																				
2,4,5-Trichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
2,4,6-Trichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	0.02
2,4-Dichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	0.16
2,4-Dimethylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
2,6-Dichlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
2-Chlorophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	0.49
2-Nitrophenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID
2-Methylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
3&4-Methylphenol (m&p-cresol)	µg/L	2	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-	-	-
Pentachlorophenol	µg/L	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-	-	0.01
4-chloro-3-methylphenol	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Phenol	µg/L	1	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	0.32
TPH																				
+C10-C36 (Sum of total)	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-
C15-C28	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-
C10-C14	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-
C29-C36	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-
C6-C9	µg/L	20	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	-
PAH																				
Acenaphthene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Acenaphthylene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
Benz(a)anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Benzo(a) pyrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	ID[1]
Benzo(a)pyrene TEQ calc (Zero)	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	-	-	-	-
Benzo(b+j)fluoranthene	mg/L	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-	-	-
Benzo(g,h,i)perylene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Benzo(k)fluoranthene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Chrysene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Dibenz(a,h)anthracene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Fluoranthene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
Fluorene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Indeno(1,2,3-c,d)pyrene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-
Naphthalene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	0.016
PAHs (Sum of total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
Phenanthrene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	ID[1]
Pyrene	µg/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-	-	-

Notes:

1. ID = Insufficient data to derive a reliable trigger value.

Appendix C
Laboratory Reports

EMM
creating opportunities

CERTIFICATE OF ANALYSIS

Work Order	: **ES2337057**	Page	: 1 of 13
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS KAITLYN BRODIE	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9493 9500	Telephone	: +61 2 8784 8555
Project	: AGL Camden Gas Project E230690	Date Samples Received	: 26-Oct-2023 17:15
Order number	: ----	Date Analysis Commenced	: 27-Oct-2023
C-O-C number	: ----	Issue Date	: 03-Nov-2023 09:40
Sampler	: KAITLYN BRODIE		
Site	: ----		
Quote number	: SY/416/16 - AGL Camden Planned Event		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EP080: Positive result for ES2337057-05 has been confirmed by re-analysis.
- It has been noted that Reactive P is greater than Total P, however this difference is within the limits of experimental variation on various samples
- Ionic Balance out of acceptable limits for sample 3 &7 due to analytes not quantified in this report.
- EP075(SIM): Particular sample phenolic surrogate recovery low due to matrix interferences.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	[26-Oct-2023]	26-Oct-2023 13:30	26-Oct-2023 14:00	26-Oct-2023 14:00	26-Oct-2023 14:30
Compound	CAS Number	LOR	Unit	ES2337057-001	ES2337057-002	ES2337057-003	ES2337057-004	ES2337057-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	9.84	6.28	7.17	7.86	9.24
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	3930	622	652	1010	205
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	2390	303	320	512	110
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	54	10	24	77	21
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	1.38	0.294	0.194	0.106	0.060
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	588	<1	<1	<1	27
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	552	29	156	472	54
Total Alkalinity as CaCO3	----	1	mg/L	1140	29	156	472	80
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	4	6	<1	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	770	159	146	98	16
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	14	7	27	90	3
Magnesium	7439-95-4	1	mg/L	62	13	24	23	<1
Sodium	7440-23-5	1	mg/L	811	82	64	105	36
Potassium	7440-09-7	1	mg/L	32	1	4	14	3
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.01	<0.01	<0.01	0.02
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	0.003	<0.001	0.014	0.006	<0.001
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	15.0	0.365	0.338	2.86	0.174
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.024	0.003	0.002	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	[26-Oct-2023]	26-Oct-2023 13:30	26-Oct-2023 14:00	26-Oct-2023 14:00	26-Oct-2023 14:30
Compound	CAS Number	LOR	Unit	ES2337057-001	ES2337057-002	ES2337057-003	ES2337057-004	ES2337057-005
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued								
Copper	7440-50-8	0.001	mg/L	**0.003**	**0.004**	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	**0.010**	**0.279**	**0.299**	**0.100**	**0.003**
Nickel	7440-02-0	0.001	mg/L	**0.001**	**0.009**	**0.002**	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	**0.009**	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	**0.111**	**0.020**	<0.005	<0.005	**0.088**
Molybdenum	7439-98-7	0.001	mg/L	**0.001**	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L	**3.93**	**0.079**	**0.300**	**0.833**	**0.046**
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L	<0.05	**0.18**	**5.48**	**2.74**	<0.05
Bromine	7726-95-6	0.1	mg/L	**1.8**	**0.4**	**0.3**	**0.2**	**0.1**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**2.57**	**16.5**	**10.2**	**8.87**	**3.39**
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<0.1	**0.1**	**0.2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**1.23**	<0.01	**0.14**	**0.94**	**0.38**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	**0.77**	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.77**	<0.01	<0.01	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.16**	**0.03**	**0.05**	**0.08**	**0.03**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.18**	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	[26-Oct-2023]	26-Oct-2023 13:30	26-Oct-2023 14:00	26-Oct-2023 14:00	26-Oct-2023 14:30
Compound	CAS Number	LOR	Unit	ES2337057-001	ES2337057-002	ES2337057-003	ES2337057-004	ES2337057-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance - Continued								
ø Total Anions	----	0.01	meq/L	**44.5**	**5.15**	**7.36**	**12.2**	**2.05**
ø Total Cations	----	0.01	meq/L	**41.9**	**5.01**	**6.21**	**11.3**	**1.79**
ø Ionic Balance	----	0.01	%	**3.01**	**1.34**	**8.49**	**3.77**	**----**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**114**	<1	**2**	<1	**5**
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	**17600**	**27**	**1020**	**31200**	**13900**
Ethene	74-85-1	10	µg/L	<10	<10	<10	<10	<10
Ethane	74-84-0	10	µg/L	**269**	<10	<10	<10	<10
Propene	115-07-1	10	µg/L	<10	<10	<10	<10	<10
Propane	74-98-6	10	µg/L	**53**	<10	<10	<10	<10
Butene	25167-67-3	10	µg/L	<10	<10	<10	<10	<10
Butane	106-97-8	10	µg/L	<10	<10	<10	<10	<10
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	**1.4**	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	**2.1**	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
				Sampling date / time	[26-Oct-2023]	26-Oct-2023 13:30	26-Oct-2023 14:00	26-Oct-2023 14:00	26-Oct-2023 14:30
Compound	CAS Number	LOR	Unit		ES2337057-001	ES2337057-002	ES2337057-003	ES2337057-004	ES2337057-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		**20**	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		**20**	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		**17**	<2	<2	<2	**2**
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
				Sampling date / time	[26-Oct-2023]	26-Oct-2023 13:30	26-Oct-2023 14:00	26-Oct-2023 14:00	26-Oct-2023 14:30
Compound	CAS Number	LOR	Unit		ES2337057-001	ES2337057-002	ES2337057-003	ES2337057-004	ES2337057-005
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
^ Sum of BTEX	----	1	µg/L		**17**	<1	<1	<1	**2**
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**20.2**	**27.0**	**23.0**	**32.9**	**21.1**
2-Chlorophenol-D4	93951-73-6	1.0	%		**16.7**	**64.0**	**41.6**	**64.7**	**21.2**
2.4.6-Tribromophenol	118-79-6	1.0	%		**15.1**	**86.0**	**40.0**	**73.0**	**13.4**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**66.9**	**97.4**	**56.3**	**78.2**	**68.7**
Anthracene-d10	1719-06-8	1.0	%		**72.7**	**98.5**	**61.3**	**86.6**	**74.5**
4-Terphenyl-d14	1718-51-0	1.0	%		**74.7**	**96.5**	**60.8**	**90.2**	**79.1**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**85.7**	**90.8**	**92.3**	**94.0**	**99.0**
Toluene-D8	2037-26-5	2	%		**82.2**	**87.2**	**86.6**	**91.1**	**100**
4-Bromofluorobenzene	460-00-4	2	%		**97.3**	**100**	**102**	**103**	**104**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	NR	QA1	TB	TRIP SPIKE 15	----
			Sampling date / time	26-Oct-2023 15:15	[26-Oct-2023]	20-Oct-2023 00:00	20-Oct-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2337057-006	ES2337057-007	ES2337057-008	ES2337057-009	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.10**	**7.29**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**405**	**682**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**200**	**326**	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**7**	**20**	----	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**0.105**	**0.198**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**116**	**170**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**116**	**170**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**9**	**6**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**59**	**134**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**7**	**27**	----	----	----
Magnesium	7439-95-4	1	mg/L	**8**	**24**	----	----	----
Sodium	7440-23-5	1	mg/L	**65**	**63**	----	----	----
Potassium	7440-09-7	1	mg/L	**5**	**4**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.001**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.014**	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.069**	**0.335**	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	**0.003**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	NR	QA1	TB	TRIP SPIKE 15	----
			Sampling date / time	26-Oct-2023 15:15	[26-Oct-2023]	20-Oct-2023 00:00	20-Oct-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2337057-006	ES2337057-007	ES2337057-008	ES2337057-009	--------
				Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.002**	**0.309**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.008**	**0.003**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L	**0.078**	**0.294**	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	**5.68**	----	----	----
Bromine	7726-95-6	0.1	mg/L	**0.2**	**0.3**	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**0.39**	**10.2**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	**0.1**	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	**0.14**	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.01**	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.01**	<0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.02**	**0.06**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----
EN055: Ionic Balance								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	NR	QA1	TB	TRIP SPIKE 15	----
			Sampling date / time	26-Oct-2023 15:15	[26-Oct-2023]	20-Oct-2023 00:00	20-Oct-2023 00:00	----
Compound	CAS Number	LOR	Unit	ES2337057-006	ES2337057-007	ES2337057-008	ES2337057-009	--------
				Result	Result	Result	Result	----
EN055: Ionic Balance - Continued								
ø Total Anions	----	0.01	meq/L	**4.17**	**7.30**	----	----	----
ø Total Cations	----	0.01	meq/L	**3.96**	**6.16**	----	----	----
ø Ionic Balance	----	0.01	%	**2.54**	**8.44**	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**4**	**2**	----	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	<10	**991**	----	----	----
Ethene	74-85-1	10	µg/L	<10	<10	----	----	----
Ethane	74-84-0	10	µg/L	<10	<10	----	----	----
Propene	115-07-1	10	µg/L	<10	<10	----	----	----
Propane	74-98-6	10	µg/L	<10	<10	----	----	----
Butene	25167-67-3	10	µg/L	<10	<10	----	----	----
Butane	106-97-8	10	µg/L	<10	<10	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TRIP SPIKE 15	----
				Sampling date / time	26-Oct-2023 15:15	[26-Oct-2023]	20-Oct-2023 00:00	20-Oct-2023 00:00	----
Compound	CAS Number	LOR	Unit		ES2337057-006	ES2337057-007	ES2337057-008	ES2337057-009	--------
					Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	**14**	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	**15**	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	**15**	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	**17**	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	**18**	----
^ **Total Xylenes**	----	2	µg/L		<2	<2	<2	**35**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TRIP SPIKE 15	----
				Sampling date / time	26-Oct-2023 15:15	[26-Oct-2023]	20-Oct-2023 00:00	20-Oct-2023 00:00	----
Compound	CAS Number	LOR	Unit		ES2337057-006	ES2337057-007	ES2337057-008	ES2337057-009	--------
					Result	Result	Result	Result	----
EP080: BTEXN - Continued									
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	**79**	**----**
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	**18**	**----**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**32.1**	**30.4**	**----**	**----**	**----**
2-Chlorophenol-D4	93951-73-6	1.0	%		**63.8**	**63.5**	**----**	**----**	**----**
2.4.6-Tribromophenol	118-79-6	1.0	%		**64.2**	**66.0**	**----**	**----**	**----**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**76.7**	**69.4**	**----**	**----**	**----**
Anthracene-d10	1719-06-8	1.0	%		**88.3**	**76.5**	**----**	**----**	**----**
4-Terphenyl-d14	1718-51-0	1.0	%		**94.6**	**80.8**	**----**	**----**	**----**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**90.6**	**89.7**	**93.3**	**96.0**	**----**
Toluene-D8	2037-26-5	2	%		**87.1**	**86.2**	**90.4**	**95.5**	**----**
4-Bromofluorobenzene	460-00-4	2	%		**101**	**100**	**104**	**117**	**----**

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72	143
Toluene-D8	2037-26-5	75	131
4-Bromofluorobenzene	460-00-4	73	137

CERTIFICATE OF ANALYSIS

Work Order	: **ES2413926**	Page	: 1 of 15
Client	: **EMM CONSULTING PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: J DEBOER	Contact	: Sepan Mahamad
Address	: Ground Floor Suite 1 20 Chandos Street St Leonards NSW NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: AGL Camden Gas Project E230690	Date Samples Received	: 30-Apr-2024 16:30
Order number	: ----	Date Analysis Commenced	: 01-May-2024
C-O-C number	: ----	Issue Date	: 08-May-2024 11:11
Sampler	: A SMEALLIE, J DEBOER		
Site	: ----		
Quote number	: SY/416/16 - AGL Camden Planned Event		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
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General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED009x:Poor spike recovery for Bromide due to matrix interferences
- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EP080: Positive results for ES2413926#1 and #5 have been confirmed by re-analysis.
- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- ED041G: LOR raised for Sulfate due to sample matrix
- TDS by method EA-015 may bias high for various samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- EK071: It has been noted that RP is greater than TP for sample 1, however this difference has been confirmed by reanalysis.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit	ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**10.1**	**6.38**	**7.31**	**7.85**	**9.38**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**4380**	**594**	**720**	**1010**	**253**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**3030**	**375**	**392**	**596**	**136**
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**10**	**6**	**17**	**17**	**6**
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**1.28**	**0.314**	**0.226**	**0.110**	**0.071**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	**925**	<1	<1	<1	**31**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**452**	**26**	**180**	**470**	**71**
Total Alkalinity as CaCO3	----	1	mg/L	**1380**	**26**	**180**	**470**	**102**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	**4**	**6**	<1	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**718**	**158**	**124**	**73**	**23**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**22**	**8**	**31**	**86**	**3**
Magnesium	7439-95-4	1	mg/L	**68**	**11**	**23**	**18**	<1
Sodium	7440-23-5	1	mg/L	**926**	**78**	**72**	**104**	**47**
Potassium	7440-09-7	1	mg/L	**35**	**1**	**3**	**12**	**4**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**0.02**	<0.01	<0.01	**0.03**
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.005**	<0.001	**0.017**	**0.007**	**0.002**
Boron	7440-42-8	0.05	mg/L	**0.08**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit	ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued								
Barium	7440-39-3	0.001	mg/L	**20.1**	**0.346**	**0.422**	**3.14**	**0.221**
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	**0.024**	**0.004**	**0.002**	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	**0.002**	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	**0.011**	**0.274**	**0.333**	**0.073**	**0.002**
Nickel	7440-02-0	0.001	mg/L	<0.001	**0.009**	**0.004**	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	**0.004**	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	**0.022**	**0.023**	<0.005	<0.005	**0.105**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**0.002**
Strontium	7440-24-6	0.001	mg/L	**5.39**	**0.086**	**0.403**	**0.961**	**0.061**
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L	<0.05	**0.06**	**6.79**	**2.62**	<0.05
Bromine	7726-95-6	0.1	mg/L	**1.8**	**0.3**	**0.3**	**0.2**	<0.1
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**2.02**	**15.6**	**10.4**	**8.98**	**4.27**
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	**0.1**	**0.1**	**0.3**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**2.18**	<0.01	**0.16**	**1.00**	**0.62**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit	ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	**0.01**	**0.03**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.01**	**0.86**	**0.02**	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.02**	**0.89**	**0.02**	<0.01	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.12**	<0.01	**0.04**	**0.03**	**0.02**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.22**	**0.01**	<0.01	<0.01	<0.01
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**47.8**	**5.06**	**7.22**	**11.4**	**2.69**
ø Total Cations	----	0.01	meq/L	**47.9**	**4.72**	**6.65**	**10.6**	**2.30**
ø Ionic Balance	----	0.01	%	**0.04**	**3.44**	**4.12**	**3.84**	**----**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**114**	<1	<1	<1	**7**
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	**16400**	<10	**1000**	**36400**	**30300**
Ethene	74-85-1	10	µg/L	<10	<10	<10	<10	<10
Ethane	74-84-0	10	µg/L	**282**	<10	<10	**16**	<10
Propene	115-07-1	10	µg/L	<10	<10	<10	<10	<10
Propane	74-98-6	10	µg/L	**56**	<10	<10	<10	<10
Butene	25167-67-3	10	µg/L	<10	<10	<10	<10	<10
Butane	106-97-8	10	µg/L	<10	<10	<10	<10	<10
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
				Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit		ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
					Result	Result	Result	Result	Result
EP075(SIM)A: Phenolic Compounds - Continued									
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
			Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit	ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	**18**	<2	<2	<2	**3**
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	**18**	<1	<1	<1	**3**
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	**21.5**	**32.4**	**28.8**	**26.7**	**27.4**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	GLMB03	MPMB01	MPMB02	MPMB03	MPMB04
				Sampling date / time	30-Apr-2024 10:30	30-Apr-2024 12:00	30-Apr-2024 12:30	30-Apr-2024 13:15	30-Apr-2024 14:00
Compound	CAS Number	LOR	Unit		ES2413926-001	ES2413926-002	ES2413926-003	ES2413926-004	ES2413926-005
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	1.0	%		14.1	63.5	57.1	54.5	30.6
2.4.6-Tribromophenol	118-79-6	1.0	%		56.3	67.0	52.6	46.0	76.7
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		74.5	67.4	60.0	59.6	63.4
Anthracene-d10	1719-06-8	1.0	%		86.1	78.8	64.5	65.0	73.0
4-Terphenyl-d14	1718-51-0	1.0	%		94.3	93.3	70.3	78.2	84.5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		101	99.4	113	115	103
Toluene-D8	2037-26-5	2	%		90.6	84.2	97.5	97.5	87.6
4-Bromofluorobenzene	460-00-4	2	%		92.9	90.8	102	102	95.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	NR	QA1	TB	TS	----
			Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit	ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.38**	**7.31**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**109**	**719**	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**70**	**396**	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**8**	**18**	----	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**0.045**	**0.233**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**18**	**176**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**18**	**176**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4**	**7**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**23**	**128**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**3**	**31**	----	----	----
Magnesium	7439-95-4	1	mg/L	**2**	**23**	----	----	----
Sodium	7440-23-5	1	mg/L	**13**	**68**	----	----	----
Potassium	7440-09-7	1	mg/L	**1**	**3**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.08**	<0.01	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.017**	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TS	----
				Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit		ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Barium	7440-39-3	0.001	mg/L		**0.114**	**0.426**	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.003**	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.051**	**0.299**	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.003**	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.071**	<0.005	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	----	----	----
Strontium	7440-24-6	0.001	mg/L		**0.029**	**0.378**	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.41**	**5.88**	----	----	----
Bromine	7726-95-6	0.1	mg/L		<0.1	**0.3**	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**2.79**	**10.8**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.1**	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.02**	**0.15**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	NR	QA1	TB	TS	----
			Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit	ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
				Result	Result	Result	Result	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.17**	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.17**	<0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	**0.03**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**1.09**	**7.27**	----	----	----
ø Total Cations	----	0.01	meq/L	**----**	**6.78**	----	----	----
ø Total Cations	----	0.01	meq/L	**0.90**	**----**	----	----	----
ø Ionic Balance	----	0.01	%	**----**	**3.52**	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**6**	<1	----	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	<10	**932**	----	----	----
Ethene	74-85-1	10	µg/L	<10	<10	----	----	----
Ethane	74-84-0	10	µg/L	<10	<10	----	----	----
Propene	115-07-1	10	µg/L	<10	<10	----	----	----
Propane	74-98-6	10	µg/L	<10	<10	----	----	----
Butene	25167-67-3	10	µg/L	<10	<10	----	----	----
Butane	106-97-8	10	µg/L	<10	<10	----	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TS	----
				Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit		ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
					Result	Result	Result	Result	----
EP075(SIM)A: Phenolic Compounds - Continued									
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TS	----
				Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit		ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
					Result	Result	Result	Result	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	16	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	17	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	15	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	17	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	17	----
^ Total Xylenes	----	2	µg/L		<2	<2	<2	34	----
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	82	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	22	----
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	NR	QA1	TB	TS	----
				Sampling date / time	30-Apr-2024 14:30	30-Apr-2024 00:00	29-Apr-2024 00:00	29-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit		ES2413926-006	ES2413926-007	ES2413926-008	ES2413926-009	--------
					Result	Result	Result	Result	----
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1.0	%		**27.9**	**25.5**	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**56.1**	**51.3**	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**51.0**	**43.0**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**62.0**	**54.2**	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**69.3**	**56.8**	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**78.2**	**62.6**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**103**	**109**	**111**	**112**	----
Toluene-D8	2037-26-5	2	%		**85.4**	**90.8**	**96.0**	**95.3**	----
4-Bromofluorobenzene	460-00-4	2	%		**93.0**	**97.4**	**99.6**	**100**	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	72	143
Toluene-D8	2037-26-5	75	131
4-Bromofluorobenzene	460-00-4	73	137

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