

Principal Healthcare Finance Pty Limited

# Opal Residential Aged Care Facility, Bayview

## Groundwater Impact Assessment

November 2025



# Question today *Imagine tomorrow* Create for the future

Opal Residential Aged Care Facility,  
Bayview  
Groundwater Impact Assessment

Principal Healthcare Finance Pty Limited

WSP  
Level 27, 680 George Street  
Sydney NSW 2000  
GPO Box 5394  
Sydney NSW 2001

Tel: +61 2 9272 5100  
Fax: +61 2 9272 5101  
wsp.com

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|--------------|--------------|------------|--------------------------------------------------------------------------------------|
| Prepared by: | David Hughes | 21/11/2025 |  |
| Reviewed by: | Ray Hatley   | 25/11/2025 |  |
| Approved by: | Ray Hatley   | 28/11/2025 |  |

WSP acknowledges that every project we work on takes place on First Peoples lands.  
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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# 1 Introduction

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## 1.1 Overview

This Groundwater Impact Assessment (GIA) has been prepared by WSP Australia Ltd (WSP) for Principal Healthcare Finance Pty Limited (Opal Healthcare) for its planned 177-bed Residential Aged Care Facility at 36–42 Cabbage Tree Road, Bayview, New South Wales (the ‘Site’). The report supports the State Significant Development Application (SSD-77240466) and addresses SEARs Items 12 and 13, focusing on groundwater conditions and contamination.

The Groundwater Impact Assessment has been prepared within the context of the groundwater related risks associated with the project site to specifically address the guidance provided by the NSW Department of Planning and Environment (DPE; currently the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW)) document titled “*Minimum requirements for building site groundwater investigations and reporting*”, dated October 2022 (DPE, 2022).

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## 1.2 Objective

The objectives of this GIA are:

- To estimate the likely short-term and long-term groundwater impacts that may eventuate at the planned development.
- To assess the suitability of a drained basement for the planned development and allow WaterNSW to issue a Water Supply Works Approval for the planned development, both during construction and operation phases.

This information will allow consideration of the effects of a drained basement and provide appropriate dewatering management planning.

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## 1.3 Scope of work

The scope of works undertaken as part of the GIA included the following:

- Review of planned geotechnical borehole locations for adequacy of hydrogeological investigations requirements.
- Completion of site geotechnical investigation borehole drilling at eight locations around the development site (outside the immediate footprint of the site) at locations which form a triangle.
- Installation of three groundwater monitoring wells (to 5 m depths based on the geotechnical borehole logs) in the SI boreholes to complete the hydrogeological investigations, with all monitoring wells screened between 2 and 5 mbgl.
- Monitoring well development (i.e. cleaning, de-silting) of the newly installed groundwater monitoring wells. These records can be used as evidence to support the functionality and confidence in groundwater level and quality data obtained from the monitoring wells.
- Installation and set-up of automatic pressure transducers (data and barometric loggers) in each monitoring well to record groundwater levels at 15-minute intervals. Note: the barometric logger was used to compensate the data for barometric influences (weather induces atmospheric changes). The datalogger continuous monitoring water level hydrograph plots provide the data to support an estimate of the probable maximum long-term water level.
- Carrying out of hydraulic (‘slug’) tests in each of the groundwater monitoring wells installed at the site to estimate the hydraulic conductivity of the screened rock and soil formations.

- Collection of groundwater samples from the three monitoring wells. Groundwater quality field parameters and samples were collected by a WSP Hydrogeologist. Samples were submitted to Australian Laboratory Services (ALS), a NATA accredited laboratory, under chain of custody procedures, where they were analysed as per the mandatory requirements listed in Table A.2 of the DPE (2022) guidelines.
- During sampling measurements of water pH, electrical conductivity, temperature and oxidation-reduction potential were recorded, whilst all field data and analytical results from these samples were used to inform an initial assessment of collected water disposal options, including disposal to stormwater.
- Data loggers were downloaded 3 months after installation as per the minimum requirements guidelines (DPE, 2022).

## 1.4 Relevant SEARs

This Groundwater Impact Assessment addresses the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in Table 1.1 below.

Table 1.1 SEARs Compliance table

| Environmental Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Response / Location in report                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <p>No. 12 – Ground and Groundwater Conditions</p> <ul style="list-style-type: none"> <li>— Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion.</li> <li>— Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulphate soil potential in an EPI provide a Salinity Management Plan or Acid Sulphate Management Plan that includes appropriate management measures and strategies.</li> </ul> | <p>Section 6</p> <p>Soils are addressed in the Preliminary Site Investigation (WSP, 2025b)</p>     |
| <p>No. 13 – Contamination and Remediation</p> <ul style="list-style-type: none"> <li>— In accordance with Chapter 4 of the State Environmental Planning Policy (Resilience and Hazards) 2021, assess and quantify any soil and groundwater contamination and demonstrate that the site is suitable (or will be suitable, after remediation) for the development</li> </ul>                                                                                                                                                                                                                                                  | <p>Section 4.5.5</p> <p>Soils are addressed in the Preliminary Site Investigation (WSP, 2025b)</p> |

## 1.5 The site

The general site identification details are provided in Table 1.2 and site aerials are provided in Figure 1.1 and Figure 1.2.

Table 1.2 Summary of general site information

|                                               |                                                                                                                                                                          |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site name</b>                              | Opal Bayview                                                                                                                                                             |
| <b>Site address</b>                           | 36-42 Cabbage Tree Road                                                                                                                                                  |
| <b>Site identification</b>                    | Part Lot 121 in DP 789400                                                                                                                                                |
| <b>Site area</b>                              | Approximately 6,000 m <sup>2</sup>                                                                                                                                       |
| <b>Current site use</b>                       | Site is currently in use as a retirement village, Aveo Bayview Gardens Retirement Living (BGRL)                                                                          |
| <b>Surrounding land uses</b>                  | The site is bound by Annam Road to the east, and the Aveo BGRL site to the north, west, and south. Residential premises are located beyond Annam Road and the Aveo BGRL. |
| <b>Local government area (LGA) and zoning</b> | Pittwater Council Local Government Area, Low Density Residential (R2)                                                                                                    |
| <b>Proposed site use</b>                      | Continued aged care use                                                                                                                                                  |



Figure 1.1 Context of site within the broader Aveo site



Figure 1.2 Development site

## 1.6 Proposed development

The proposed development will comprise the following:

- Demolition of the existing aged care building and driveway on the site;
- Construction of a three-storey residential aged care facility, accommodating:
  - 177 beds,
  - 1 level of basement parking,
  - Ground floor ancillary facilities;
- Construction of a community room, to be located on the Aveo Bayview Gardens Retirement Living (**Aveo BGRL**) site;
- Construction of a new driveway, to be located on the Aveo BGRL site;
- Torrens Title subdivision of the Opal Healthcare Bayview site from Aveo BGRL;
- Associated amenities and landscaping works;
- Augmentation of, and connection to, existing utilities as required.

The proposed basement level covers an area of approximately 2,745 m<sup>2</sup> and has a finished floor level (FFL) of RL 20.48 mAHD. It is assumed the basement will require a bulk excavation level (BEL) of RL 19.98 mAHD, 0.5 m below the FFL, with locally deeper areas to accommodate lift shafts and plant rooms. This GIA will be used to inform whether the final basement design should be drained or tanked.

Detailed Architectural plans are included in Architectural plans Appendix F.

## 2 Legislation, policies, and guidelines considerations

The following NSW state legislation, policies, and guidelines are applicable to the hydrogeological aspects of the planned development and have been considered during the preparation of this GIA.

- Water Management Act (2000) and Water Act (1912).
- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (DPIE, 2023).
- NSW Aquifer Interference Policy (NSW DPI 2012).
- Minimum requirements for groundwater investigations and reporting for building and construction sites (DPE, 2022).

# 3 Hydrogeological investigations

---

## 3.1 Overview

Two rounds of groundwater investigations at the Site were carried out by WSP in July/August 2025 and November 2025. These investigations were carried out to collect data required to comply with those data requirements presented in the publication *Minimum requirements for groundwater investigations and reporting for building and construction sites* (DPE, 2022), and comprised the following:

- Drilling of eight investigation boreholes at selected locations at the site (refer to the Geotechnical Investigation Report; WSP, 2025a)
- Installation of three new groundwater monitoring wells at the site (identified as BH01, BH02 and BH03).
- Development of monitoring wells installed at the site.
- Manual measurement of groundwater levels in all groundwater monitoring wells.
- Collection of groundwater samples collected from monitoring wells BH01, BH02 and BH03, and submission of these samples for laboratory analysis.
- Installation of automated water pressure transducers and data loggers ('water level loggers') in the three groundwater monitoring wells at the site and the monitoring and the recording of groundwater levels using these water level loggers.
- Performance of hydraulic tests using slug test methods on groundwater monitoring wells BH01, BH02 and BH03.

Further description of each of the above tasks comprising WSP's site investigations are discussed in the following sections of this GIA.

---

## 3.2 Drilling

The field investigation was managed by an experienced geotechnical engineer who was responsible for supervising drilling, soil logging, sample collection and engineering logs.

A total of eight investigation boreholes were drilled, with locations shown on Figure 3.1. Details of the drilling campaign are found in the Geotechnical Investigation Report (WSP, 2025a).

All wells were surveyed to an accuracy of +/-5mm using dGPS on 4<sup>th</sup> November 2025.



Figure 3.1 Test location plan at Opal Bayview

### 3.3 Well installation and development

Groundwater monitoring wells were installed in boreholes BH01, BH02 and BH03 which were used in this assessment and will also form part of the preferred groundwater investigation and monitoring system for the development moving forward.

Copies of the construction diagrams for these wells are included in Appendix A, whilst key features are summarised in Table 3.1.

Table 3.1 Groundwater monitoring well construction summary

| Well feature                         | Groundwater monitoring well |             |             |
|--------------------------------------|-----------------------------|-------------|-------------|
|                                      | BH01                        | BH02        | BH03        |
| Easting (metres east)                | 341927.8*                   | 341874.2    | 341908.8    |
| Northing (metres north)              | 6273575.4*                  | 6273564.8   | 6273521.2   |
| Ground level (mAHD)                  | 27.15                       | 23.83       | 25.38       |
| Top of well casing elevation (m AHD) | 27.03                       | 23.74       | 25.19       |
| Well head recess (m)                 | 0.12                        | 0.09        | 0.19        |
| Well cover type                      | Gatic cover                 | Gatic cover | Gatic cover |
| Borehole depth (m bgl)               | 10                          | 6           | 6.15        |

| Well feature                 | Groundwater monitoring well                                        |                                                                    |                                                                    |
|------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
|                              | BH01                                                               | BH02                                                               | BH03                                                               |
| Well depth (m bgl)           | 5                                                                  | 5                                                                  | 5                                                                  |
| Screen interval (m bgl)      | 3 to 5                                                             | 3 to 5                                                             | 3 to 5                                                             |
| Screened lithology           | Highly weathered sandstone and interbedded sandstone and siltstone | Highly weathered sandstone and interbedded sandstone and siltstone | Highly weathered sandstone and interbedded sandstone and siltstone |
| Upper bentonite seal (m bgl) | 0 to 2.5                                                           | 0 to 2.5                                                           | 0 to 2.5                                                           |
| Lower bentonite seal (m bgl) | 5 to 6                                                             | 5 to 6                                                             | 5 to 6.15                                                          |

\*Taken adjacent to the well due access being obscured by a parked car

Development of the groundwater monitoring wells was carried out on the 3<sup>rd</sup> July 2025 (BH01 and BH02) and 10<sup>th</sup> July 2025 (BH03) in accordance with the recommendations outlined in AS/NZS 5667.11:1998 “*Water Quality – Sampling*”.

Development involves the purging of water and water entrained sediment (if present) and drilling mud from individual wells using the ‘hand bailing’ technique. Individual single-use high density polyethylene (HDPE) bailers were used to develop each well.

Development of groundwater monitoring wells continued until three well water volumes were removed or until the well was purged dry. To aid development, once the wells were purged dry, clean water was poured down the well to flush the screen. Copies of the well development field records are presented in Appendix B.

### 3.4 Groundwater quality sampling

Groundwater samples were collected from groundwater monitoring wells BH02 and BH03 by a Hydrogeologist from WSP on 4<sup>th</sup> August 2025. No sample was collected from BH01 as this well was dry for the duration of the investigation.

Samples were collected after purging the wells dry using individual single-use high density polyethylene (HDPE) bailers, then waiting for the wells to sufficiently recharge before taking a representative groundwater sample. It was not possible to purge three well volumes of water due to the slow recharge rates of the wells.

Measurements of pH, EC, redox potential, and temperature were measured during sampling using a calibrated water quality meter.

Groundwater samples were stored in containers provided by the laboratory. The containers were filled, sealed, and labelled with the job number, date and location identifier.

Samples for dissolved heavy metals analysis were filtered through a 0.45 µm filter and then placed within the appropriate sample containers provided by the laboratory.

Samples were transported to the laboratories under Chain of Custody (COC) protocols via courier to ALS Environmental for analysis. The COC generally detailed the following information:

- site identification
- sampler’s name
- nature of the sample
- collection date
- analyses to be performed
- sample preservation method.

The samples were analysed for the analytes presented in Table 3.2, as per the *Minimum requirements for building site groundwater investigations and reporting* (DPE, 2022).

Table 3.2 Groundwater sample analyte suite

| Type                                            | Analyses                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical parameters                             | Alkalinity (bicarbonate, carbonate, hydroxide and total), electrical conductivity (EC), pH, redox potential (Eh), total dissolved solids (TDS), total hardness, temperature and dissolved oxygen (DO)                                                                                                                                                                 |
| Major anions                                    | Sulfate (SO <sub>4</sub> ), chloride (Cl), carbonates (CO <sub>3</sub> ), bromide (Br) and fluoride (F)                                                                                                                                                                                                                                                               |
| Major cations                                   | Calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K)                                                                                                                                                                                                                                                                                                           |
| Ionic balance                                   | Cation/anion balance (as a percentage)                                                                                                                                                                                                                                                                                                                                |
| Dissolved inorganics and dissolved heavy metals | Aluminium (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), boron (B), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), lithium (Li), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silica (dissolved SiO <sub>2</sub> ), silver (Ag), strontium (Sr), uranium (U), vanadium (V) and zinc (Zn) |
| Nutrients                                       | Ammonia (NH <sub>3</sub> ), nitrate (NO <sub>3</sub> ), total nitrogen (N), oxidised nitrogen (N), total phosphorus (P) and reactive phosphorus (P)                                                                                                                                                                                                                   |
| Microbiological organisms                       | Faecal coliforms, faecal streptococci and Escherichia coli                                                                                                                                                                                                                                                                                                            |
| Organics                                        | Benzene toluene ethylbenzene xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs) and total recoverable hydrocarbons (TRHs)                                                                                                                                                                                                                                         |

Copies of the field sampling summary sheets, COC, and sample receipt notification from the analytical laboratory are presented in Appendix E.

### 3.5 Groundwater level monitoring

Non-vented water level loggers were installed at monitoring wells BH01, BH02 and BH03 on 4<sup>th</sup> August 2025. A barometric logger was installed in groundwater monitoring well BH01 to allow barometric compensation of pressure data when estimating groundwater levels from this data.

All water level loggers were set to record water pressure (in kilopascals or metres head of water above the reference point of the instrument) and temperature (as degrees Celsius) at 15-minute intervals. The water level loggers used were of sufficient pressure rating at the locations installed to operate in accordance with the manufacturer's specifications and within their calibrated ranges.

Manual measurements of groundwater levels were taken using an electric water 'dipper' meter at the time of logger installation, during groundwater sampling events, prior to in-well hydraulic ('slug') testing and data logger download events; these data were collected to check the validity of groundwater levels estimated from data of the water pressure transducers and data loggers.

Measurements of pressure and temperature from each level logger was downloaded on the 4th of November 2025 (3 months after installation) using the *Win-Situ 5* software available from the *In-situ* website. Groundwater levels and elevations were then estimated from the data collected by the level logger using:

- the elevation of the water pressure transducer in each well
- the total pressure measured by the water level logger
- assumption regarding the density of the groundwater (in this case assumed to be 0.98 gram per millilitre)
- corrected for barometric effects using data obtained from the barometric logger

Given the magnitude of the water pressure measured by the water level loggers in the wells at the proposed development (which is typically less than 140 kPa) and negligible variation in groundwater salinity between locations, the use of 0.98 gram per millilitre for the density of groundwater (i.e., 9.80 kN/m<sup>3</sup>) is considered appropriate when estimating groundwater level elevations from the data sets generated.

---

## 3.6 Hydraulic ‘slug’ testing

Hydraulic ‘slug’ testing was carried out in BH02 and BH03 on 4<sup>th</sup> November 2025 following the completion of well development and once each monitoring well had sufficient time to recharge and a natural static groundwater level reached. One falling-head and one rising-head test was completed on each well.

No slug test was completed on BH01 as this well was dry for the duration of the investigation.

For falling head tests, a 1 m long solid slug with a diameter of 34 mm was quickly lowered into the groundwater monitoring well and below the initial elevation of the groundwater level to induce an abrupt increase in hydraulic head. The test induced head change in the well was then typically allowed to return (in this case ‘fall’) to about 90% or more of its pre-test elevation, with changes in the elevation of the test head monitored with time using a water level logger.

For rising head tests, carried out immediately following a falling head test, the same slug used for the falling head tests was quickly removed from the well and the induced head change allowed to return (in this case ‘rise’) to about 90% or more of its pre-test elevation. Changes in the elevation of the test head were again monitored with time using the water level logger in the well.

Due to the slow recovery rates, it was impractical to achieve 90% for all tests.

Groundwater levels were also manually dipped to check test completion once the water had stabilised.

## 4 Site setting and characterisation

### 4.1 Topography and surface drainage

The site slopes down to the southwest from approximately 30m Australian Height Datum (AHD) in the northeast to approximately 20 m AHD in the southwest.

Site water is expected to follow topography and flow across the site to the southwest.

The closest water body is an unnamed drainage channel located approximately 90 m west of the site, which drains to a tributary of Winnererremy Bay 400 m southeast of the site.

### 4.2 Rainfall

Rainfall data has been obtained from the closest BoM weather stations. The rainfall record and reliability of data for each of these stations are provided in Table 4.1, with average monthly rainfall provided in

Table 4.2.

Table 4.1 Rainfall station summary (BoM, 2025)

| Station                     | Rainfall record        |
|-----------------------------|------------------------|
| 66059 (Terry Hills AWS)     | 2004 – 2025 (21 years) |
| 66141 (Mona Vale Golf Club) | 1969 – 2025 (56 years) |

Table 4.2 Average rainfall (mm) across the monitoring period (excluding incomplete data sets)

| Station | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  | Annual |
|---------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|--------|
| 66059   | 109.4 | 139.3 | 175.0 | 119.1 | 73.7  | 120.8 | 77.8 | 71.0 | 66.4 | 79.9 | 97.3 | 84.8 | 1214.5 |
| 66141   | 109.8 | 131.0 | 134.4 | 116.4 | 103.0 | 123.5 | 69.0 | 73.3 | 61.9 | 74.3 | 90.9 | 71.1 | 1158.6 |

### 4.3 Geological setting

#### 4.3.1 Background

A review of the Sydney 1:100,000 Geological Map Series Sheet 9130 (Geological Survey of NSW, 1983) indicates that the site is underlain by Middle Triassic (base) to Middle Triassic (top) Siliciclastic sedimentary rock derived from Narrabeen Group, Gosford Subgroup, Newport Formation consisting of interbedded laminite, shale and sandstone; white quartz to quartz-lithic, very fine- to medium-grained sandstone; minor shale breccia and pebble polymictic conglomerate (at base of sandstone units); minor red clays.

The NSW Soil and Land Information System Soil Essentials Report obtained through eSPADE indicated the site is underlain by a brownish-black fine sandy loam and yellowish-brown sandy clay loam.

#### 4.3.2 Site information

The subsurface conditions encountered beneath the site during the investigation are summarised in the Geotechnical Investigation Report (WSP, 2025a). A summary of the ground conditions encountered is presented in Table 4.3. No potential asbestos containing material was noted.

Table 4.3 Stratigraphic layers identified at Opal Bayview site (from WSP, 2025a)

| Unit | Layer                                                      | Depth Range (m BGL) | Description                                                                                            |
|------|------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------|
| 1a   | Asphalt and Concrete (Road)                                | 0 – 0.15            | Dark grey, angular aggregate                                                                           |
| 1b   | Gravelly Sand and Silty Sand (Fill)                        | 0.15 – 0.50         | Fine to coarse grained, grey to brown, well graded, and fine to medium grained, sub-angular gravels    |
| 2    | Silty Clay (Residual Soil)                                 | 0.40 – 3.00         | Pale grey to brown, mottled red-orange high plasticity, very stiff to hard                             |
| 3    | Interbedded Sandstone and Siltstone (Class 3) <sup>1</sup> | 1.70 +              | Pale grey and brown, stained red-orange, low to medium strength with localised very low strength bands |

(1) Rock unit classified in accordance with classification of sandstones and shales in the Sydney region (Pells, Mostyn, Bertuzzi & Wong, 2019).

## 4.4 Acid sulfate soils

As stated in the Preliminary Site Investigation (WSP, 2025b):

The CSIRO Atlas of Australian Acid Sulfate Soils indicated that the site is located in an area of “extremely low probability of occurrence” of acid sulfate soils.

The site is Class 5 and not subject to Acid Sulfate Soil development controls under the Pittwater LEP, 2014. The LEP notes works within 500 metres of adjacent Class 1, 2, 3, or 4 land that is below 5 metres AHD and by which the watertable is likely to be lowered below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land, present an environmental risk.

## 4.5 Hydrogeology

### 4.5.1 Regional hydrogeology

Broadly the *Hawkesbury Sandstone* underlying the site, forms a low-yielding porous and fractured rock aquifer of moderate significance throughout the Sydney region. Typical characteristics of the regional aquifer in the Hawkesbury Sandstone are summarised in the following points:

- Dual porosity, although flow is generally via fractures and bedding planes, as matrix permeability is minimal.
- Typically, unconfined but can be locally semi-confined where mudstone and shale lenses or clay-rich horizons are present.
- Hydraulic conductivity generally decreases with depth due to the rock becoming tighter with fewer discontinuities.
- Anisotropic, with the majority of flow being horizontal via bedding planes and limited vertical flow via vertical joints.
- Shallow perched aquifers are common, found on the competent/weathered sandstone interface.
- The groundwater table follows topography, often within 5 to 15 m of the surface.
- Recharge is dominated by infiltration of rainfall via outcrop and shallow regolith.
- Fresh to slightly saline groundwater quality.

### 4.5.2 Regulated groundwater source

The *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023* divides the Greater Metropolitan Region of the east coast of NSW into 13 groundwater sources, of which this planned development is within the Sydney Central Basin Groundwater Source (SCBGS). The water sharing plan classifies the SCBGS as a porous rock groundwater source.

### 4.5.3 Groundwater elevations

A summary of groundwater level data collected during the investigation (from 4th August 2025 to 4<sup>th</sup> November 2025, 3 month period) are presented in Table 4.4 and Table 4.5.

Table 4.4 Groundwater level statistical summary in metres above Australian Height Datum (mAHD)

| Groundwater monitoring well | Ground elevation (mAHD) | Groundwater level summary (mAHD) |         |        |         |
|-----------------------------|-------------------------|----------------------------------|---------|--------|---------|
|                             |                         | Minimum                          | Average | Median | Maximum |
| BH01                        | 27.15                   | Dry                              | Dry     | Dry    | Dry     |
| BH02                        | 23.83                   | *19.01                           | 20.81   | 20.80  | 21.40   |
| BH03                        | 25.38                   | *20.20                           | 22.71   | 22.79  | 23.08   |

\*minimum groundwater levels were recorded after the wells were purged dry for groundwater sampling.

Table 4.5 Groundwater level statistical summary in metres below ground level (mbgl)

| Groundwater monitoring well | Ground elevation (mAHD) | Groundwater level summary (mbgl) |         |        |         |
|-----------------------------|-------------------------|----------------------------------|---------|--------|---------|
|                             |                         | Minimum                          | Average | Median | Maximum |
| BH01                        | 27.15                   | Dry                              | Dry     | Dry    | Dry     |
| BH02                        | 23.83                   | 2.39                             | 2.98    | 2.99   | 4.78    |
| BH03                        | 25.38                   | 2.30                             | 2.66    | 2.58   | 5.17    |

Hydrographs showing the groundwater levels for the period measured in each of the monitoring wells are presented in Figure 1.1, alongside daily rainfall data from Terrey Hills AWS weather station (BoM station number 66059). The monitoring period included several wet periods, including 6 days where daily rainfall totals were greater than 20 mm.

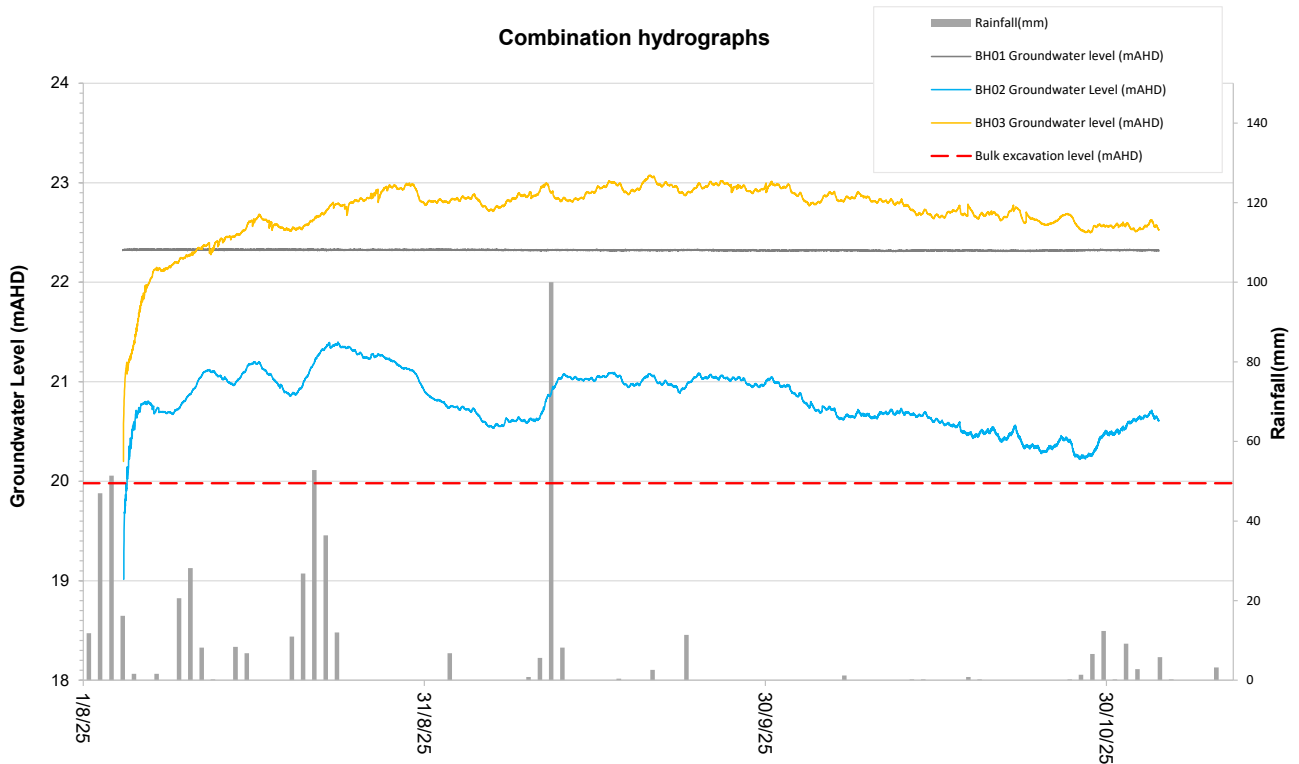


Figure 4.1 Hydrographs for monitoring wells BH01, BH02 and BH03.

Groundwater levels in both BH02 and BH03 show response to rainfall events indicating a good aquifer connection with surface, with larger magnitude responses observed in BH03.

Note, groundwater levels in BH01 are shown to be constant as water level remained below the level of the pressure transducer for the duration of the investigation.

Individual hydrographs for each monitoring well are presented in Appendix C.

#### 4.5.4 Aquifer hydraulic conductivity

Estimates of horizontal hydraulic conductivity,  $K_h$ , derived from those slug tests carried out by WSP at the site are summarised in Table 4.6. All tests were analysed using the unconfined Hvorslev Method (1951) and Hyder et. al. (1994) using the analytical application *Aqtesolv<sup>TM</sup>*. Solutions for each test are presented in Appendix D.

No slug test was performed on BH01 as the well was dry for the duration of the investigation.

Table 4.6 Summary of slug test estimates of horizontal hydraulic conductivity

| Borehole | Groundwater monitoring well |                                                                              |           |                                                  |                                  |                                  |
|----------|-----------------------------|------------------------------------------------------------------------------|-----------|--------------------------------------------------|----------------------------------|----------------------------------|
|          | Test interval (m bgl)       | Lithology and Pells class of test interval                                   | No. tests | Estimate of horizontal hydraulic conductivity, K |                                  |                                  |
|          |                             |                                                                              |           | Minimum                                          | Geometric mean                   | Maximum                          |
| BH02     | 3 - 5                       | Highly weathered Sandstone and interbedded Sandstone and Siltstone (Class 3) | 2         | 2.20E-08 m/sec<br>1.90E-03 m/day                 | 2.68E-08 m/sec<br>2.31E-03 m/day | 3.61E-08 m/sec<br>3.11E-03 m/day |
| BH03     | 3 - 5                       | Highly weathered Sandstone and interbedded Sandstone and Siltstone (Class 3) | 2         | 1.37E-08 m/sec<br>1.18E-03 m/day                 | 2.36E-08 m/sec<br>2.04E-03 m/day | 4.27E-08 m/sec<br>3.69E-03 m/day |

Hydraulic testing elsewhere in the Sydney Basin Hawkesbury Sandstone indicates a bulk hydraulic conductivity with values of horizontal hydraulic conductivity ranging between about 0.002 m/day (about  $2 \times 10^{-8}$  m/sec) to 0.1 m/day ( $1 \times 10^{-6}$  m/sec) (Tannetta and Hewitt, 2004).

#### 4.5.5 Groundwater quality

Groundwater samples were collected by WSP from groundwater monitoring wells installed in boreholes BH02 and BH03. No sample was taken from BH01 as the well was dry for the duration of the investigation.

A summary of groundwater analytical results and accompanying exceedances of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) 2018 toxicant default guideline values (DGVs) for the 95% protection of organisms in marine waters (which is the end disposal point for surface water runoff at and surrounding the site given drainage from the site is expected to ultimately drain to Pittwater) is presented in Table 4.7. Copies of the analytical certificates for these samples are included in Appendix E.

The analytical suite was selected as per the mandatory requirements listed in Table A.2 of the DPE (2022) guidelines.

Table 4.7 Summary of groundwater analytical results and exceedances of DGVs

| Analyte / parameter                                   | Units    | DGV 95% marine waters | Groundwater monitoring well |      |
|-------------------------------------------------------|----------|-----------------------|-----------------------------|------|
|                                                       |          |                       | BH02                        | BH03 |
| General water quality parameters - field measurements |          |                       |                             |      |
| pH                                                    | pH units | N/A                   | 6.45                        | 6.39 |
| Electrical conductivity                               | µS/cm    | N/A                   | 352.8                       | 633  |
| Dissolved oxygen (saturated)                          | %        | N/A                   | 58.0                        | 57.9 |
| Temperature                                           | °C       | N/A                   | 18.1                        | 18.6 |

| Analyte / parameter             | Units    | DGV 95% marine waters | Groundwater monitoring well |        |
|---------------------------------|----------|-----------------------|-----------------------------|--------|
|                                 |          |                       | BH02                        | BH03   |
| Redox potential                 | mV       | N/A                   | 93.8                        | 89.7   |
| Physical parameters             |          |                       |                             |        |
| pH                              | pH units | N/A                   | 6.35                        | 6.4    |
| Electrical Conductivity @ 25°C  | µS/cm    | N/A                   | 396                         | 700    |
| Total Dissolved Solids @180°C   | mg/L     | N/A                   | 368                         | 522    |
| Redox Potential                 | mV       | N/A                   | 138                         | 143    |
| pH Redox                        | pH Unit  | N/A                   | 6.16                        | 6.25   |
| Hydroxide Alkalinity as CaCO3   | mg/L     | N/A                   | <1                          | <1     |
| Carbonate Alkalinity as CaCO3   | mg/L     | N/A                   | <1                          | <1     |
| Bicarbonate Alkalinity as CaCO3 | mg/L     | N/A                   | 51                          | 64     |
| Total Alkalinity as CaCO3       | mg/L     | N/A                   | 51                          | 64     |
| Total Hardness as CaCO3         | mg/L     | N/A                   | 33                          | 31     |
| Dissolved Oxygen                | mg/L     | N/A                   | 9.3                         | 9.2    |
| Major Anions                    |          |                       |                             |        |
| Bromide                         | mg/L     | N/A                   | 0.185                       | 1.02   |
| Iodide                          | mg/L     | N/A                   | 0.144                       | <0.010 |
| Silicon as SiO2                 | mg/L     | N/A                   | 45.9                        | 47.4   |
| Sulfate as SO4                  | mg/L     | N/A                   | 92                          | 204    |
| Chloride                        | mg/L     | N/A                   | 24                          | 38     |
| Fluoride                        | mg/L     | N/A                   | <0.1                        | <0.1   |
| Major cations                   |          |                       |                             |        |
| Calcium                         | mg/L     | N/A                   | 10                          | 9      |
| Magnesium                       | mg/L     | N/A                   | 2                           | 2      |
| Sodium                          | mg/L     | N/A                   | 67                          | 128    |
| Potassium                       | mg/L     | N/A                   | 2                           | 5      |
| Ionic balance                   | %        |                       |                             |        |

| Analyte / parameter                   | Units | DGV 95% marine waters | Groundwater monitoring well |         |
|---------------------------------------|-------|-----------------------|-----------------------------|---------|
|                                       |       |                       | BH02                        | BH03    |
| Total Anions                          | meq/L | N/A                   | 3.61                        | 6.6     |
| Total Cations                         | meq/L | N/A                   | 3.63                        | 6.31    |
| Ionic Balance                         | %     | N/A                   | 0.24                        | 2.24    |
| Dissolved inorganics and heavy metals |       |                       |                             |         |
| Aluminium                             | mg/L  | 0.037                 | 0.04                        | 0.08    |
| Antimony                              | mg/L  | N/A                   | <0.001                      | <0.001  |
| Arsenic                               | mg/L  | 0.14                  | <0.001                      | 0.002   |
| Beryllium                             | mg/L  | N/A                   | <0.001                      | <0.001  |
| Barium                                | mg/L  | N/A                   | 0.018                       | 0.018   |
| Cadmium                               | mg/L  | 0.0055                | <0.0001                     | <0.0001 |
| Chromium                              | mg/L  | 0.0044                | 0.001                       | 0.004   |
| Cobalt                                | mg/L  | 0.001                 | 0.002                       | 0.003   |
| Copper                                | mg/L  | 0.0013                | 0.006                       | 0.007   |
| Lead                                  | mg/L  | 0.0044                | <0.001                      | <0.001  |
| Lithium                               | mg/L  | N/A                   | 0.003                       | 0.004   |
| Manganese                             | mg/L  | 0.08                  | 0.048                       | 0.05    |
| Molybdenum                            | mg/L  | N/A                   | <0.001                      | <0.001  |
| Nickel                                | mg/L  | 0.07                  | 0.002                       | 0.003   |
| Selenium                              | mg/L  | N/A                   | <0.01                       | <0.01   |
| Silver                                | mg/L  | 0.0014                | <0.001                      | <0.001  |
| Strontium                             | mg/L  | N/A                   | 0.034                       | 0.054   |
| Uranium                               | mg/L  | N/A                   | <0.001                      | <0.001  |
| Vanadium                              | mg/L  | 0.1                   | <0.01                       | <0.01   |
| Zinc                                  | mg/L  | 0.008                 | 0.013                       | 0.023   |
| Boron                                 | mg/L  | N/A                   | 0.14                        | 0.35    |
| Iron                                  | mg/L  | N/A                   | <0.05                       | 0.17    |
| Mercury                               | mg/L  | 0.0004                | <0.0001                     | <0.0001 |
| Nutrients                             |       |                       |                             |         |
| Ammonia as N                          | mg/L  | 0.91                  | 0.04                        | 0.09    |
| Nitrite as N                          | mg/L  | N/A                   | <0.01                       | <0.01   |

| Analyte / parameter          | Units      | DGV 95% marine waters | Groundwater monitoring well |       |
|------------------------------|------------|-----------------------|-----------------------------|-------|
|                              |            |                       | BH02                        | BH03  |
| Nitrate as N                 | mg/L       | N/A                   | 0.11                        | 0.03  |
| Nitrite + Nitrate as N       | mg/L       | N/A                   | 0.11                        | 0.03  |
| Total Kjeldahl Nitrogen as N | mg/L       | N/A                   | <0.5                        | <3.0  |
| Total Nitrogen as N          | mg/L       | N/A                   | <0.5                        | <3.0  |
| Total Phosphorus as P        | mg/L       | N/A                   | 0.29                        | 3.39  |
| Reactive Phosphorus as P     | mg/L       | N/A                   | <0.01                       | <0.01 |
| Microbiological organisms    |            |                       |                             |       |
| Thermotolerant Coliforms     | CFU/100 mL | N/A                   | 12000                       | 8500  |
| Escherichia coli             | CFU/100 mL | N/A                   | ~2                          | ~160  |
| Faecal Streptococci          | CFU/100 mL | N/A                   | 100                         | 66    |
| Organics                     |            |                       |                             |       |
| Naphthalene                  | µg/L       | 70                    | <1.0                        | <1.0  |
| Acenaphthylene               | µg/L       | N/A                   | <1.0                        | <1.0  |
| Acenaphthene                 | µg/L       | N/A                   | <1.0                        | <1.0  |
| Fluorene                     | µg/L       | N/A                   | <1.0                        | <1.0  |
| Phenanthrene                 | µg/L       | 2                     | <1.0                        | <1.0  |
| Anthracene                   | µg/L       | 0.4                   | <1.0                        | <1.0  |
| Fluoranthene                 | µg/L       | 1.4                   | <1.0                        | <1.0  |
| Pyrene                       | µg/L       | 0.2                   | <1.0                        | <1.0  |
| Benz(a)anthracene            | µg/L       | N/A                   | <1.0                        | <1.0  |
| Chrysene                     | µg/L       | N/A                   | <1.0                        | <1.0  |
| Benzo(b+j)fluoranthene       | µg/L       | N/A                   | <1.0                        | <1.0  |
| Benzo(k)fluoranthene         | µg/L       | N/A                   | <1.0                        | <1.0  |
| Benzo(a)pyrene               | µg/L       | 0.2                   | <0.5                        | <0.5  |

| Analyte / parameter                        | Units | DGV 95% marine waters | Groundwater monitoring well |      |
|--------------------------------------------|-------|-----------------------|-----------------------------|------|
|                                            |       |                       | BH02                        | BH03 |
| Indeno(1.2.3.cd)pyrene                     | µg/L  | N/A                   | <1.0                        | <1.0 |
| Dibenz(a,h)anthracene                      | µg/L  | N/A                   | <1.0                        | <1.0 |
| Benzo(g,h,i)perylene                       | µg/L  | N/A                   | <1.0                        | <1.0 |
| Sum of polycyclic aromatic hydrocarbons    | µg/L  | N/A                   | <0.5                        | <0.5 |
| Benzo(a)pyrene TEQ (zero)                  | µg/L  | N/A                   | <0.5                        | <0.5 |
| Phenol-d6                                  | %     | N/A                   | 23.2                        | 24.6 |
| 2-Chlorophenol-D4                          | %     | N/A                   | 47.3                        | 64.7 |
| 2,4,6-Tribromophenol                       | %     | N/A                   | 45.2                        | 64.3 |
| 2-Fluorobiphenyl                           | %     | N/A                   | 68.7                        | 84.1 |
| Anthracene-d10                             | %     | N/A                   | 68.4                        | 87.4 |
| 4-Terphenyl-d14                            | %     | N/A                   | 70.2                        | 84.8 |
| C6 - C9 Fraction                           | µg/L  | N/A                   | <20                         | <20  |
| C10 - C14 Fraction                         | µg/L  | N/A                   | <50                         | <50  |
| C15 - C28 Fraction                         | µg/L  | N/A                   | <100                        | <100 |
| C29 - C36 Fraction                         | µg/L  | N/A                   | <50                         | <50  |
| C10 - C36 Fraction (sum)                   | µg/L  | N/A                   | <50                         | <50  |
| C6 - C10 Fraction                          | µg/L  | N/A                   | <20                         | <20  |
| C6 - C10 Fraction minus BTEX (F1)          | µg/L  | N/A                   | <20                         | <20  |
| >C10 - C16 Fraction                        | µg/L  | N/A                   | <100                        | <100 |
| >C16 - C34 Fraction                        | µg/L  | N/A                   | <100                        | <100 |
| >C34 - C40 Fraction                        | µg/L  | N/A                   | <100                        | <100 |
| >C10 - C40 Fraction (sum)                  | µg/L  | N/A                   | <100                        | <100 |
| >C10 - C16 Fraction minus Naphthalene (F2) | µg/L  | N/A                   | <100                        | <100 |
| Benzene                                    | µg/L  | 700                   | <1                          | <1   |

| Analyte / parameter   | Units | DGV 95% marine waters | Groundwater monitoring well |      |
|-----------------------|-------|-----------------------|-----------------------------|------|
|                       |       |                       | BH02                        | BH03 |
| Toluene               | µg/L  | 180                   | <2                          | <2   |
| Ethylbenzene          | µg/L  | 80                    | <2                          | <2   |
| meta- & para-Xylene   | µg/L  | 75                    | <2                          | <2   |
| ortho-Xylene          | µg/L  | N/A                   | <2                          | <2   |
| Total Xylenes         | µg/L  | N/A                   | <2                          | <2   |
| Sum of BTEX           | µg/L  | N/A                   | <1                          | <1   |
| Naphthalene           | µg/L  | 70                    | <5                          | <5   |
| 1,2-Dichloroethane-D4 | %     | N/A                   | 118                         | 111  |
| Toluene-D8            | %     | N/A                   | 123                         | 117  |
| 4-Bromofluorobenzene  | %     | N/A                   | 133                         | 129  |

Notes: µS/cm – microSiemens per centimetre

mg/L – milligrams per litre

CFU / 100 ml – coliform forming units per 100 ml of sample volume

µg/L – micrograms per litre

BTEXN – benzene, toluene, ethylbenzene, xylene and naphthalene

Concentrations in red-shaded boxes – exceeds the relevant 95% LOSP toxicant DVG for marine water.

The results show that the groundwater encountered is fresh, with relatively low electrical conductivity and total dissolved solids. pH is slightly acidic and high the water is oxygenated, consistent with recently recharged rainwater.

There are exceedances of Aluminium, Cobalt, Copper and Zinc above the ANZG 2018 toxicant default guideline values (DGVs) for the 95% protection of organisms in marine waters. In urban setting, of which Sydney is typical, these exceedances are a common feature of urban development.

## 4.6 Receptors

### 4.6.1 Groundwater abstraction and drainage

The Preliminary Site Investigation (WSP, 2025b) states the following:

A search of the WaterNSW online database<sup>1</sup> for registered groundwater bores identified 5 registered bores within a 500 m radius of the site. The bores were registered for the purposes of water supply, irrigation and other purposes. Bore depth ranged from 150 -168 mbgl north and east of the site at a high elevation, to 1.5, 30 and 60 mbgl south and west of the site at a lower elevation.

The closest bore (GW106813) is greater than 200 m from the proposed excavation.

<sup>1</sup> <https://realtimedata.watnsw.com.au>

#### 4.6.2 Groundwater-dependent ecosystems

Groundwater-dependent ecosystems (GDEs) are natural communities of plants, animals and other organisms which are dependent on access to groundwater on a constant or intermittent basis to sustain aquatic and terrestrial ecosystems such as vegetation, springs, wetlands, and rivers (DPIE, 2020). In New South Wales the NSW State GDEs Policy (DLWC, 2012) is designed to protect the valuable ecosystems which rely on groundwater for survival, so that wherever possible the ecological processes and biodiversity of these GDEs are maintained or restored.

A search of the Australian GDE Atlas potential<sup>2</sup> GDEs and the NSW High Ecological Value Aquatic Ecosystems (HEVAE) GDE within the project area and surroundings indicates the following:

- There are no **aquatic GDEs** within 1 km of the site.
- There are no **subterranean GDEs** within 1 km of the site
- There is one low potential **terrestrial GDE** within 1 km of the site.
- There are no **high priority GDEs** listed in the Water Sharing Plan for the Greater Metropolitan Region Groundwater Resources 2023 (DPIE, 2023) within 10 km of the site.
- There are no **high priority NSW HEVAE GDE** within 1 km of the site.

#### 4.6.3 Springs and creeks

No natural springs have been identified at the site and no springs listed in the *Greater Metropolitan Regional Groundwater Water Sharing Plan 2023* (DPIE, 2023) are within 500 m of the site.

There is one third-order creek (Cahill Creek) within 500 m of the site.

#### 4.6.4 Culturally-significant groundwater sites

No culturally significant sites are identified within the *Greater Metropolitan Regional Groundwater Water Sharing Plan 2023* (DPIE, 2023).

#### 4.6.5 Nearby contaminated sites

The Preliminary Site Investigation (WSP, 2025b) summarises the following:

An online search of the NSW EPA *Protection of the Environment Operations Act 1997* public register found no notices or licenses, either current or former, for the site or properties within 500 m of the site.

A search of the NSW EPA online contaminated sites database<sup>3</sup> did not identify the site or surrounding properties as currently being regulated by the NSW EPA, or as having been notified to NSW EPA as potentially contaminated. No former gas works, waste management facilities, or other sites with contamination issues regulated by the EPA are located on or within 500 m of the site.

No properties within a 500 m radius of the site are listed under the NSW EPA PFAS investigation program.

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<sup>2</sup> GDE potential describes ecosystems in terms of their “potential to be interacting with groundwater”. The term “potential” is used to reflect the uncertainty inherent in identifying ecosystems as groundwater-dependent using desktop methods. Finer scale studies or fieldwork are needed to confirm this analysis.

<sup>3</sup> [www.epa.nsw.gov.au/prclmapp/searchregister](http://www.epa.nsw.gov.au/prclmapp/searchregister)

# 5 Analytical modelling – groundwater inflow and radius of influence assessment

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## 5.1 Objective and approach

The objective of the modelling was to estimate potential future groundwater inflows to the basement and to assess the impact on surrounding groundwater users and the environment due to groundwater drawdown resulting from basement dewatering.

Two separate analytical models were utilised:

1. Marinelli and Niccoli (2000) – to estimate inflows to the excavation, outlined in Section 5.3.
  2. Bear (1979) – to estimate radius of influence as a result of drawdown from dewatering, outlined in Section 5.4.
- 

## 5.2 Conceptual hydrogeological model

The following bullet points summarise the conceptual hydrogeological model (CHM) at and surrounding the site:

- The groundwater system comprises of an unconfined perched aquifer within the base of the residual soils and weathered zone above competent bedrock. This is evidenced by water levels fluctuating within 0.81 m of the highly weathered sandstone/residual soil and more competent sandstone interface at both BH02 and BH03.
- Groundwater flow is likely dominated by fracture flow in the weathered zone.
- The ratio of horizontal to vertical hydraulic conductivity of the Hawkesbury Sandstone is assumed to be 10:1, evidenced by the predominantly horizontal fractures and bedding plane noted in bore logs and observed in core photographs.
- Groundwater recharge is expected to be derived primarily from the infiltration of excess rainfall, evidenced by the response of groundwater levels to rainfall events during the investigation period. Recharge is estimated to be 5% of the annual average rainfall.
- The perched system is not spatially homogenous, shown by different responses to rainfall in BH02 and BH03 and BH01 remaining dry.
- Once the perched aquifer has been locally dewatered during construction, ongoing take is likely to be low, except for during high rainfall events.
- The bulk horizontal hydraulic conductivity (i.e., that of both the rock matrix and the discontinuities in the rock mass) of the weathered zone which is expected to form the walls of the excavation, and possibly part or all of the floor, of the planned excavation is estimated to be in the order of  $3.69\text{E-}03$  m/d. This interval is underlain by competent sandstone bedrock (Hawkesbury Sandstone).

## 5.3 Marinelli and Niccoli (2000) solution for groundwater flow estimation

### 5.3.1 Approach

An assessment of groundwater inflow was conducted to estimate the potential seepage resulting from excavation associated with the proposed development. To quantify this, an analytical solution presented by Marinelli and Niccoli (2000) was utilised, as shown in Figure 5.1. A Python-based analytical script of the solution was employed within an Excel spreadsheet environment. A steady-state analytical solution was adopted.

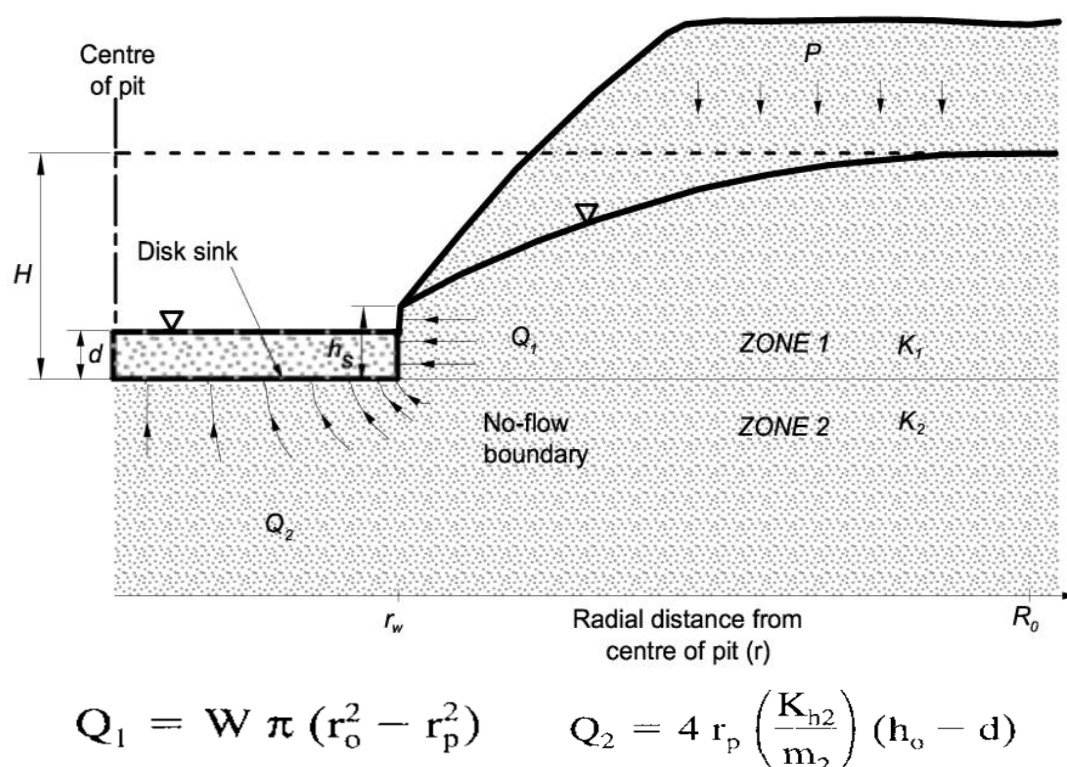


Figure 5.1 Analytical solution from Marinelli and Niccoli (2000)

### 5.3.2 Inflow modelling results

The analytical model inputs and resulting groundwater inflow are presented in Table 5.1. The estimated total groundwater seepage for the project is **0.35 ML/year**.

Table 5.1 Model inputs and inflow results

|               | Parameter                                         | Units          | Value    |
|---------------|---------------------------------------------------|----------------|----------|
| <b>INPUTS</b> | Basement area                                     | m <sup>2</sup> | 2746     |
|               | Distributed recharge                              | m/d            | 1.66E-04 |
|               | Horizontal hydraulic conductivity, K <sub>h</sub> | m/d            | 3.69E-03 |
|               | Vertical hydraulic conductivity, K <sub>v</sub>   | m/d            | 3.69E-04 |

|                | Parameter                     | Units        | Value       |
|----------------|-------------------------------|--------------|-------------|
|                | Anisotropy ratio, $K_h/K_v$   | -            | 10          |
|                | Bulk excavation level, BEL    | mAHD         | 19.98       |
|                | Static groundwater level, SWL | mAHD         | 23.08       |
| <b>OUTPUTS</b> | <b>Modelled inflow</b>        | <b>l/s</b>   | <b>0.01</b> |
|                | <b>Modelled inflow</b>        | <b>ML/yr</b> | <b>0.35</b> |

### 5.3.3 Assumptions

The following assumptions were adopted in the model:

- Distributed recharge was estimated to be 5% of annual rainfall.
- The hydraulic conductivity values adopted were based on the maximum values obtained by analysis of on-site slug testing.
- The modelled aquifer units had a  $K_h:K_v$  anisotropy ratio of 10:1, typical of the Hawkesbury Sandstone aquifer.
- Static water levels adopted were based on the maximum measured water level recorded during the investigation period.
- The bulk excavation level is 0.5 m less than the proposed finished floor level.
- The model assumes steady state conditions.
- Storm or flood event circumstances occurring during construction are not accommodated in the estimates provided.

## 5.4 Bear (1979)

### 5.4.1 Approach

An assessment of the radius of influence as result of dewatering was completed to assess the potential impact on nearby receptors. To quantify this, an analytical solution presented by Bear (1979) was utilised, as shown below:

$$R = 1.5 \sqrt{\frac{KH_r t}{S_y}}$$

Where:

$R$  = radius of influence

$K$  = horizontal hydraulic conductivity

$H$  = dewatering depth

$t$  = time since dewatering commenced

$S_y$  = specific yield

### 5.4.2 Radius of influence results

The analytical model inputs and resulting radius of influence after 10 years (3650 days) are presented in Table 5.2.

Table 5.2 Model inputs and radius of influence results.

|                | Parameter                                | Units    | Value       |
|----------------|------------------------------------------|----------|-------------|
| <b>INPUTS</b>  | Horizontal hydraulic conductivity, $K_h$ | m/d      | 3.69E-03    |
|                | Dewatering depth, H                      | m/d      | 3.1         |
|                | Time since dewatering commenced, t       | d        | 3650        |
|                | Specific yield, $S_y$                    | %        | 5           |
| <b>OUTPUTS</b> | <b>Radius of influence, R</b>            | <b>m</b> | <b>43.4</b> |

### 5.4.3 Assumptions

The following assumptions were adopted in the model:

- The hydraulic conductivity values adopted were based on the maximum values obtained by analysis of on-site slug testing.
- Dewatering depth was estimated to be the difference between the maximum measured water level recorded during the investigation period and the bulk excavation level.
- The bulk excavation level is 0.5 m less than the proposed finished floor level.
- Aquifer is unconfined.
- The aquifer is composed of isotropic homogenous material.
- The specific yield of the aquifer is 5%.
- The model assumes steady state conditions.

## 5.5 Settlement

The primary aquifer at and surrounding the site is located within relatively low permeability, competent massive, high strength sandstone and siltstone (Hawkesbury Sandstone) bedrock and overlying residual weathered material. As such those predicted changes in the elevation of the water table attributable to dewatering and any depressurisation due to the proposed development is expected to result in negligible consolidation and settlement.

## 5.6 Groundwater drainage quality

At this stage it is not possible to definitively state what the quality and geochemistry of the groundwater that will collect in the excavation and basement will be, however, the analyses of groundwater samples carried out provide a reasonable indication of likely water quality. It is proposed that groundwater seepage collected in the excavation will be treated onsite and then disposed of to the local stormwater system under Council approval.

If deemed appropriate, approval for the disposal of groundwater effluent to stormwater will need to comply with the appropriate level of protection (LOP) “trigger levels” marine water quality outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (published by ANZG 2018) and fulfill the requirements for approval to discharge defined by Council.

The use of the LOPs for dewater disposal assessments assumes Pittwater, a marine water environment, is classified as a slightly (95% LOP) disturbed ecosystems (as defined in Section 3.1 of the guidelines) given they receive surface water

runoff from urban catchments which include various types of land uses and accompanying activities, all of which impact surface water quality.

Consideration needs to be given in particular to the potential presence of elevated metals (likely due to elevated silt content) and will be monitored as per the strategy outlined in Section 7.1

As indicated previously, discharge to the stormwater system will be subject to the approval of the relevant authority, either the Northern Beaches Council.

# 6 Groundwater Impact Assessment

## 6.1 Minimal impact considerations

The Aquifer Interference Policy (AIP) includes a set of minimal impact considerations for assessing the impacts of aquifer interference activities including those regulated under the WMA 2000, the Water Act 1912 and those decided under the terms and conditions of other legislation. It indicates the term ‘aquifer’ is commonly understood to mean a groundwater system of sufficient hydraulic conductivity to allow water to move in it, and which can yield productive volumes of groundwater, however, notes those criteria and considerations in the AIP are equally applicable to low-yielding and/or saline groundwater systems.

The area surrounding the site is underlain by silty clay residual soils and the Hawkesbury Sandstone. These soils and rock are of relatively low yield and are a ‘less productive groundwater source’ as outlined in the AIP.

Table 1 of the AIP outlines minimal impact considerations for both highly productive and less-productive groundwater sources. The AIP also states ‘*if ... predicted impacts are less than the Level 1 minimal impact considerations, then these impacts will be considered as acceptable*’. An assessment of the ‘minimal impact considerations’ defined in the AIP for a less-productive groundwater source and responses to these are presented in Table 6.1.

Table 6.1 Minimal impact considerations under the Aquifer Interference Policy

| AIP level 1 minimum impact consideration                                                                                                                                                                                                                                                                                                                                                                                                                                     | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Sharing Plan and Groundwater source                                                                                                                                                                                                                                                                                                                                                                                                                                    | Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023 – Sydney Basin Central Groundwater Source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Aquifer                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Porous rock                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Less productive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Water table</b><br>Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic ‘post-water sharing plan’ variations, 40 m from any high priority: <ul style="list-style-type: none"> <li>— groundwater dependent ecosystem (GDE), or</li> <li>— culturally significant site</li> <li>— listed in the schedule of the relevant water sharing plan.</li> </ul> A maximum of a 2 m declines cumulative at any water <i>supply</i> work. | <b>Water table</b><br>The closest high priority HEAVE GDEs to the site are located 2.7 km or more to the south of the site. Given both construction-phase and long-term drawdown (due to the necessitated dewatering works and inclusion of a drained basement) is estimated to extend no more than 45 m from the site boundary, the planned development is not expected to impact these GDEs.<br>No registered water supply works are in the estimated zone of groundwater drawdown (depressurisation). As such the proposed dewatering works and long-term drainage into the planned basement of the planned development are not expected to result in a decline of more cumulative 2 m decline in the water table at any water supply work. |
| <b>Water pressure</b><br>A cumulative water pressure head decline of no more than 2 m at any water supply work.                                                                                                                                                                                                                                                                                                                                                              | <b>Water pressure</b><br>No registered water supply works are in the estimated zone of groundwater drawdown (depressurisation). As such the proposed dewatering works and long-term drainage into the planned basement of the planned development are not expected to result in a decline of more than 2 m of the water level in any water supply work.                                                                                                                                                                                                                                                                                                                                                                                        |

| AIP level 1 minimum impact consideration                                                                                                                        | Assessment                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water quality</b><br>Any change in groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. | <b>Water quality</b><br>The proposed development (incorporating a drained basement) is not expected to lower the beneficial use category of groundwater beyond 45 m of the site. |

Based on the assessment presented in Table 6.1, the proposed development is expected to have impacts that are less than the Level 1 minimum impact considerations, which according to the AIP minimal consideration requirements, would be considered as acceptable.

## 6.2 Water sharing plan rules for water access approval

The site is in the Greater Metropolitan Region Groundwater Sources (of Sydney) and Sydney Basin Central Groundwater Source. A summary of the rules in this Water Sharing Plan for the granting of water access licences, compared against the results of the groundwater impact assessment, is presented in Table 6.2. These rules are to be used as a guide only and actual licence conditions are granted at the discretion of WaterNSW.

Table 6.2 Water Sharing Plan rules and groundwater impact assessment considerations

| Water Sharing Plan rule                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>To minimise interference between neighbouring water supply works, no water supply works will be granted or amended within the following distances of <u>existing bores</u>:</p> <ul style="list-style-type: none"> <li>— 400 m from an aquifer access licenced bore on another landholding, or</li> <li>— 100 m from a basic landholder rights bore on another landholding, or</li> <li>— 50 m from a property boundary (unless written consent from the neighbour), or</li> <li>— 1000 m from a local or major water utility bore, or</li> <li>— 200 m from a NSW Office of Water monitoring bore (unless written consent provided by <i>WaterNSW</i> / NSW Office of Water).</li> </ul> | <p>The proposed development (and therefore the proposed water supply works) will be located more than:</p> <ul style="list-style-type: none"> <li>— 400 m from an aquifer access licenced bore on another landholding</li> <li>— 100 m from a basic landholder rights bore on another landholding</li> <li>— 1000 m from a local or major water utility bore, and</li> <li>— 200 m from a NSW Office of Water monitoring bore.</li> </ul> <p>Given the planned development includes the excavation of basements levels below the water table (in the perched aquifer system, primarily), drainage of water from the bedrock aquifer into the planned drained basement is predicted to occur within 45 m of the site and therefore neighbouring properties. However, there are no known registered groundwater supply bores located on any neighbouring properties and it is unlikely a water supply well will be installed near any neighbouring property give the urbanised and developed nature of the area and low yielding aquifer.</p> |

| Water Sharing Plan rule                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>To protect bores located near contamination, no water supply works are to be granted or amended within:</p> <ul style="list-style-type: none"> <li>— 250 m of contamination as identified in the plan, or</li> <li>— 250 to 500 m of contamination as identified in the plan unless no drawdown or water will occur within 250 m of the contamination source, or</li> <li>— Greater than 500 m of contamination as identified in the plan if necessary to protect the water source, the environment or public health and safety.</li> </ul> <p><i>The plan though also lists circumstances in which these distances may be varied.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>There are no sites in the predicted zone of groundwater drawdown with ‘Declaration of Significantly Contaminated Land’ notifications on the <i>NSW Environment Protection Agency</i> online public search register.</p> <p>The closest site is the “significantly contaminated land” site is located 1.4 km southwest of the proposed development.</p>                                                                                                                                                     |
| <p>To protect bores located near sensitive environmental areas, no water supply works will be granted or amended within the following distances of high priority Groundwater Dependent Ecosystems (non-karst) as identified within the plan:</p> <ul style="list-style-type: none"> <li>— 100 m from bores used solely for extracting basic landholder rights, or</li> <li>— 200 m from bores used for all other access licences.</li> </ul> <p>No water supply works will be granted or amended within the following distances from these identified features:</p> <ul style="list-style-type: none"> <li>— 500 m of high priority karst GDEs, or</li> <li>— Greater than 500 m of a high priority karst GDE if the Minister is satisfied that the work is likely to cause drawdown at the perimeter if the high priority karst GDE, or</li> <li>— 40 m of a river or stream or lagoon (third-order or above), or</li> <li>— 40 m from a first or second-order stream, unless: <ul style="list-style-type: none"> <li>(i) the water supply work is drilled into underlying parent material and slotted intervals commence deeper than 30 m, or</li> <li>(ii) the Minister is satisfied that a hydrogeological study, submitted by the applicant and assessed as adequate by the Minister, demonstrates that the water supply work will have no more than minimal impact on base flows in the river.</li> </ul> </li> <li>— 100 m from the top of an escarpment.</li> </ul> | <p>The planned development will be located more than:</p> <ul style="list-style-type: none"> <li>— 1,000 m from the nearest GDE</li> <li>— 100 m from any registered bores used solely for extracting basic landholders (water) rights</li> <li>— 200 m of the closest registered bore licenced for water supply purposes</li> <li>— 40 m from a river, third-order or above stream or lagoon</li> <li>— 500 m from a high-priority karst GDE, and</li> <li>— 100 m from the top of an escarpment.</li> </ul> |

| Water Sharing Plan rule                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Assessment                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>To protect groundwater dependent culturally sensitive sites, no water supply works will be granted or amended within the following distances of groundwater-dependent culturally significant sites as identified in the plan:</p> <ul style="list-style-type: none"> <li>— 100 m for bores used for extracting groundwater for basic landholder rights, or</li> <li>— 200 m for bores used for all other aquifer access licences</li> </ul> <p><i>The plan though also lists circumstances in which these distances may be varied.</i></p> | <p>Based on a review of the Water Sharing Plan there are no groundwater-dependent culturally significant sites within 1 km of site-associated dewatering works. As such the proposed development is not expected to interfere or interact with any groundwater dependent culturally sensitive sites.</p> |
| <p>Available Water Determinations (AWDs):</p> <ul style="list-style-type: none"> <li>— 100% stock and domestic, total and major utilities and specific purpose access licences</li> <li>— 1 ML/unit of share aquifer access licences.</li> </ul> <p>AWD for aquifer access licences may be reduced in response to a growth in use.</p>                                                                                                                                                                                                        | <p>Groundwater inflows are estimated to be <i>less</i> than 3 ML/year. As such this development could be considered as a ‘minor aquifer interference activity’ and therefore will not require a water access licence.</p>                                                                                |
| <p>Trading Rules</p> <ul style="list-style-type: none"> <li>— <u>Into</u> the groundwater source – not permitted.</li> <li>— <u>Within</u> the groundwater source – permitted subject to local impact assessment.</li> <li>— <u>Conversion</u> to another category of access licence – not permitted.</li> </ul>                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                          |

## 6.3 Water access rights, licenses, and approvals

To use groundwater in NSW, the following are required:

- a *Water Access Licence* (WAL, in a specific water source) plus allocation.
- a *Water Supply Work Approval* (WSWA) to construct, replace, or modify and operate a specified water supply work (including an excavation below the water table) at a specific location
- a *Water Use Approval* (WUS) to use water for a particular purpose at a particular location, such as for town water supply.

A water supply work approval and a water use approval are often combined into a single approval as they are both location-specific. A WAL holder must apply to nominate an approved water supply work in the water source designated on the WAL before groundwater can be taken (in this case the *Sydney Central Basin Groundwater Source*).

### 6.3.1 Water supply works approval (WSWA)

Water use approvals authorise the holder to use water for a particular purpose (such as construction dewatering) under the Water Management Act 2000 (NSW). A WSWA is an approval to ‘take’ water from a particular location. For the proposed development, a water supply works approval is required. Guidance and an application form can be accessed via

the following weblinks: [New water supply work and/or water use approvals](#) and [New water supply work and/or water use approval](#).

The WSWA will be provided by WaterNSW and must be given to Council.

### 6.3.2 *Water access license (WAL)*

Predicted maximum long term groundwater inflows to the planned drained basement during operation of the development are expected to be *less* than 3 ML/year. As such this development could be considered as a ‘minor aquifer interference activity’ which are generally exempt from the full extent of the Water Management Act and therefore may not require a licence, as presented in the [Dewatering exemptions](#) webpage (DCCEEW, 2025).

This webpage includes examples of where the exemption may apply, one of which is the ‘temporary dewatering to allow safe and efficient excavation during building construction’. Ultimately the decision as to whether a licence will be required for the long-term passive collection of groundwater seepage in the planned basement will be at the discretion of WaterNSW.

Water take must still be reported annually using the [Record of groundwater take under exemption](#) form, and reported to NRAR 28 days before the end of the water year (by 28 July).

### 6.3.3 *Condition of WSWA*

WSWA approval conditions for construction dewatering typically include the monitoring the following and formally record all results with date and time references for each entry for inclusion in a dewatering report:

- dewatering volumes (weekly meter readings) during the construction period,
- groundwater levels (continuous or daily measurements) during the construction period,
- water quality (weekly testing and monthly sampling and analysis) during the construction period

The approval holder must provide a copy of the dewatering completion report and all monitoring data to WaterNSW within eight (8) weeks of the completion of building construction.

# 7 Dewatering Monitoring and Management Strategy

## 7.1 Requirements

Hydrogeological monitoring will be required to meet the requirements of the NSW Government presented in the document titled *Minimum Requirements for Building Site Groundwater Investigations and Reporting* (DPE, 2022). This document prescribes certain requirements that must be complied with to meet the requirements of the Water Management Act 2000, relevant Water Sharing Plans and the NSW Aquifer Interference Policy.

The recommended monitoring should be carried out using the following groundwater monitoring wells, including using the automated water-pressure transducers and data loggers currently installed in these wells:

- BH01 – located in the north east of the site
- BH02 – located in the west of the site
- BH03 – located in the south of the site

Should any of these groundwater monitoring wells be damaged or lost, they shall be replaced with like for like replacement wells.

The monitoring and reporting presented in Table 7.1 is recommended during the remaining duration of project construction.

Table 7.1 Summary of monitoring and reporting requirements

| Item                | Monitoring                                                                                                                                                                                                                                                                                        | Monitoring Frequency                                                                                                                                                                                                                                                                                                                                                   | Reporting |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Groundwater levels  | Monitoring of groundwater levels in all groundwater monitoring wells installed around the basement excavation (i.e., BH01 to BH03 inclusive).<br><br>[Automated water pressure transducers and data loggers, also referred to as ‘water level loggers’, to be retained in all wells at the site.] | Monthly data logger downloads at hourly intervals                                                                                                                                                                                                                                                                                                                      | Monthly   |
| Groundwater quality | Sampling and laboratory analysis of collected groundwater from in-excavation sumps and discharge water for those analytes nominated by DPE (2022).                                                                                                                                                | Sampling and laboratory testing to be conducted monthly throughout construction-stage activities and dewatering.<br><br>Additionally, weekly measurements of pH, turbidity, temperature, redox and EC of groundwater and any discharge water until construction works are complete, extending to monthly during building operation for as long a dewatering continues. |           |
| Inflow rates        | If required, groundwater inflows to be measured using calibrated meters.                                                                                                                                                                                                                          | Weekly meter readings throughout construction dewatering and then monthly during building operations for as long as dewatering is carried out.                                                                                                                                                                                                                         | Weekly    |

| Item                | Monitoring                                                                                         | Monitoring Frequency                                                                                                                           | Reporting |
|---------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Quantity of dewater | If required, a calibrated flow meter connected to any dewater or treated effluent pump-out system. | Weekly meter readings throughout construction dewatering and then monthly during building operations for as long as dewatering is carried out. | Weekly    |

## 7.2 Threshold criteria – construction dewatering

Table 7.2 summarises the proposed thresholds and actions to be adopted during construction-stage dewatering. A Dewatering Completion Report will be prepared on completion of construction and forwarded to Northern Beaches Council and WaterNSW.

Table 7.2 Proposed inflow threshold and actions for temporary dewatering

| THRESHOLD DESCRIPTION | THRESHOLD / TRIGGER LEVEL                                                                | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green – Alert         | Groundwater inflow at various time-steps <80% than that presented in Table 5.1           | <ul style="list-style-type: none"> <li>— Continue work</li> <li>— Maintain monitoring at the nominated intervals and compare this with water disposal volumes.</li> <li>— Forward monitoring reports and accompanying data sets to all stakeholders (refer to Section 7.3).</li> </ul>                                                                                                                                                                                                                                   |
| Amber – Alarm         | Actual groundwater inflows $\geq 80\%$ and $\leq 110\%$ of predicted groundwater inflows | <ul style="list-style-type: none"> <li>— Continue excavation.</li> <li>— Review monitoring data and compare with predicted inflows presented in Table 5.1.</li> <li>— Increase frequency of monitoring of (i) groundwater inflows to 24-hour intervals, and (ii) groundwater levels to hourly, until notified otherwise by the nominated engineers in consultation with the Builder.</li> <li>— Notify stakeholders (refer to Section 7.3).</li> </ul>                                                                   |
| Red – Action          | Groundwater inflow $> 110\%$ of predicted inflows                                        | <ul style="list-style-type: none"> <li>— Cease excavation immediately.</li> <li>— Notify stakeholders (refer to Section 7.3).</li> <li>— Inspect walls and floor of excavation for any areas of enhanced groundwater inflow and unforeseen change(s) in ground conditions (e.g., previously unknown fracture zones).</li> <li>— Undertake a risk assessment and develop an action plan to mitigate ongoing unacceptable inflow volumes including the grouting of any localised high-flow geological features.</li> </ul> |

## 7.3 Stakeholders

Northern Beaches Council (Council) and WaterNSW are the only stakeholders. They should be contacted within seven days should any *alarm* or *action* items be triggered, and/or any unforeseen adverse impact groundwater at or immediately surrounding the site. Copies of all monitoring reports and accompanying data sets should also be sent to Council and WaterNSW.

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## 7.4 Completion reporting

Opal Healthcare is required to provide WaterNSW with a plan for the ongoing measurement (this document), and a Dewatering Completion Report (DCR), for the Gateway development including: recording and reporting of groundwater take, water level monitoring and water quality monitoring at the frequencies required by the *Minimum Requirements for Building Site Groundwater Investigations and Reporting – Information for Developers and Consultants* (DPE, 2022) within the documented building management system prior to application for an Occupation Certificate. A copy of the DCR and all monitoring data to WaterNSW within eight weeks of the completion of building construction.

The approval holder must arrange for the installation of a meter to measure ongoing take of groundwater prior to application for an Occupation Certificate.

## 8 Conclusions

Predicted maximum inflows to the planned drained basement during the construction and operation phase of the development are expected to be **0.35 ML/year**.

Based on this, the passive collection of groundwater in the planned drained basement during the long-term operation of the development will not require a Water Access Licence from *WaterNSW*; this decision will be at the discretion of *WaterNSW*. During ongoing take, inflows will likely be below this as the perched aquifer system is dewatered.

This annual volume of groundwater intake is expected to have minimal impact to the surrounding groundwater system, neighbouring properties, and other water supply works. The maximum modelled groundwater drawdown extent remains within 45 m from the edge of the proposed development basement over a 10-year period.

Additionally, the planned development is not expected to:

- adversely impact groundwater quality
- interfere with any off-site soil and/or groundwater contamination which could be expected to constitute a significant risk or harm to human health or the environment, or
- interfere and/or impact any ASS.

Based on the hydrogeological investigation, modelling and impact assessment, it is considered that a drained basement is suitable for the Opal Bayview development. There is no need for a tanked basement. However, this decision will be at the discretion of Northern Beaches Council.

## 9 Limitations

This Report is provided by WSP Australia Pty Limited (*WSP*) for Principal Healthcare Finance Pty Limited (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated 29<sup>th</sup> April 2025.

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# Appendix A

Well logs





CLIENT : Bloompark  
LOCATION : Bayview 5 Main Drive

PROJECT : Opal Bayview SI

HOLE NO : BH01

FILE / JOB NO : PS223670  
SHEET : 1 OF 2

|                                               |                                 |                             |
|-----------------------------------------------|---------------------------------|-----------------------------|
| POSITION : E: 341927, N: 6273574 (MGA2020-56) | SURFACE ELEVATION : 28.00 (AHD) | ANGLE FROM HORIZONTAL : 90° |
| RIG TYPE : GEO205                             | MOUNTING : Track                | CONTRACTOR : Terratest      |
| DATE STARTED : 30/6/2025                      | DATE COMPLETED : 1/7/2025       | DATE LOGGED : 1/7/2025      |
| LOGGED BY : HW                                | CHECKED BY : BMS                |                             |

| DRILLING                                                                    |             |                     | MATERIAL  |             | PIEZOMETER CONSTRUCTION DETAILS |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|-----------------------------------------------------------------------------|-------------|---------------------|-----------|-------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|---------------|--------------------------------------|-------------------------------|--------------------|
| PROGRESS                                                                    |             | GROUND WATER LEVELS | DEPTH (m) | GRAPHIC LOG | GROUP SYMBOL                    | MATERIAL DESCRIPTION<br>Soil Type, Colour, Plasticity or Particle Characteristic<br>Secondary and Minor Components                       | ID<br>BH01 | Type<br>Standpipe | Stick Up & RL | Tip Depth & RL<br>5.00 m 23.00 m AHD | Installation Date<br>1/7/2025 | Static Water Level |
| DRILLING & CASING                                                           | WATER       |                     |           |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
| AD/T                                                                        | 100% RETURN | Not Encountered     | 0.0       |             | CH                              | FILL: Brick paver, brown grey                                                                                                            | BH01       |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 0.10m     |             |                                 | FILL SAND: Fine to coarse grained, grey to brown, well graded                                                                            |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 0.15m     |             |                                 | FILL: CONCRETE, pale grey                                                                                                                |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 0.30m     |             |                                 | 0.15-0.30: Aggregate is angular, 5-20mm                                                                                                  |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 0.50m     |             |                                 | FILL Silty SAND: fine to medium grained, grey to dark brown, poorly graded, low plasticity silt                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 1.0       |             |                                 | CLAY: high plasticity, orange-brown to red-brown, with fine grained sand, trace fine grained gravel                                      |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 2.0       |             |                                 | 1.00m: becoming pale grey, slightly mottled red                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 2.50m     |             |                                 | 2.00m: with fine to medium grained ironstone gravel, sub-angular to sub-rounded                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 3.0       |             |                                 | SANDSTONE: fine grained, pale grey to pale brown, heavily stained red to orange-red, inferred highly weathered, very low to low strength |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 3.07m     |             |                                 | INTERBEDDED SANDSTONE (80%) AND SILTSTONE (20%): fine grained, brown to pale grey, thinly to medium bedded at 0°-10°                     |            |                   |               |                                      |                               |                    |
| HQ3                                                                         | 100% RETURN | Not Encountered     | 4.0       |             |                                 | 5.00m: becoming dark brown to grey-brown                                                                                                 |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 5.0       |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 6.0       |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 7.0       |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 7.90m     |             |                                 | INTERBEDDED SILTSTONE (80%) AND SANDSTONE (20%): pale grey to pale red-brown, medium bedded at 0°-5°, sandstone is fine grained          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 8.0       |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 8.47m     |             |                                 | INTERBEDDED SANDSTONE (80%) AND SILTSTONE (20%): medium to coarse grained, pale grey to brown-grey, thinly to medium bedded at 5°-10°    |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 9.0       |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 10.00m    |             |                                 | Hole Terminated at 10.00 m<br>Target depth<br>Groundwater monitoring well installed                                                      |            |                   |               |                                      |                               |                    |
|                                                                             |             |                     | 10.0      |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |
| See Explanatory Notes for details of abbreviations & basis of descriptions. |             |                     |           |             |                                 |                                                                                                                                          |            |                   |               |                                      |                               |                    |

WSP-AU 6.00.0.0 JB.GLB Log IS AU PIEZOMETER INSTALLATION 2 PS223670-GINT.GPJ <<DrawingFile>> 25/7/2025 12:57 10.03.00.09 Dated Lab and In Situ Tool - DGD | Lib: WSP 6.00.0.0 2024-06-03 Proj: WSP 6.00.0.0 2024-06-03



CLIENT : Bloompark  
LOCATION : Bayview 5 Main Drive

PROJECT : Opal Bayview SI

HOLE NO : BH02

FILE / JOB NO : PS223670  
SHEET : 1 OF 2

POSITION : E: 341877, N: 6273566 (MGA2020-56) SURFACE ELEVATION : 26.00 (AHD) ANGLE FROM HORIZONTAL : 90°  
RIG TYPE : GEO205 MOUNTING : Track CONTRACTOR : Terratest  
DATE STARTED : 2/7/2025 DATE COMPLETED : 2/7/2025 DATE LOGGED : 2/7/2025 LOGGED BY : HW CHECKED BY : BMS

| DRILLING          |       |                     | MATERIAL  |             | PIEZOMETER CONSTRUCTION DETAILS |                                                                                                                                                                        |            |                   |                                     |                                      |                               |                    |
|-------------------|-------|---------------------|-----------|-------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------|-------------------------------------|--------------------------------------|-------------------------------|--------------------|
| PROGRESS          |       | GROUND WATER LEVELS | DEPTH (m) | GRAPHIC LOG | GROUP SYMBOL                    | MATERIAL DESCRIPTION<br>Soil Type, Colour, Plasticity or Particle Characteristic<br>Secondary and Minor Components                                                     | ID<br>BH02 | Type<br>Standpipe | Stick Up & RL<br>5.00 m 21.00 m AHD | Tip Depth & RL<br>5.00 m 21.00 m AHD | Installation Date<br>2/7/2025 | Static Water Level |
| DRILLING & CASING | WATER |                     |           |             |                                 |                                                                                                                                                                        |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 0.0       |             | 0.13m                           | FILL: CONCRETE, pale grey                                                                                                                                              |            |                   |                                     |                                      |                               |                    |
|                   |       |                     |           |             | 0.30m                           | FILL SAND: fine to coarse grained, dark orange-brown, poorly graded, trace fine grained gravel                                                                         |            |                   |                                     |                                      |                               |                    |
|                   |       |                     |           |             |                                 | FILL Sandy Silty CLAY: low to medium plasticity, dark brown to pale grey, fine to coarse grained sand                                                                  |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 1.0       |             | 1.10m                           | CLAY: high plasticity, pale grey to brown-grey, mottled orange-red, with fine to medium grained sand, with coarse grained ironstone gravel, sub-angular to sub-rounded |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 2.0       |             |                                 |                                                                                                                                                                        |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 3.0       |             | 2.80m                           | SANDSTONE: fine grained, red-brown to grey-brown, inferred highly weathered, very low to low strength                                                                  |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 3.20m     |             |                                 | INTERBEDDED SANDSTONE (80%) AND SILTSTONE (20%): fine grained, red-brown to dark brown-grey, thinly to medium bedded at 0°-5°                                          |            |                   |                                     |                                      |                               |                    |
|                   |       |                     |           |             |                                 | 3.90m: becoming pale grey to pale red-brown                                                                                                                            |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 5.0       |             |                                 | 5.10m: becoming medium to coarse grained, pale grey to pale brown, stained orange-red, medium bedded at 10°-20°                                                        |            |                   |                                     |                                      |                               |                    |
|                   |       |                     | 6.0       |             | 6.00m                           | Hole Terminated at 6.00 m<br>Target depth<br>Groundwater monitoring well installed                                                                                     |            |                   |                                     |                                      |                               |                    |

See Explanatory Notes for details of abbreviations & basis of descriptions.



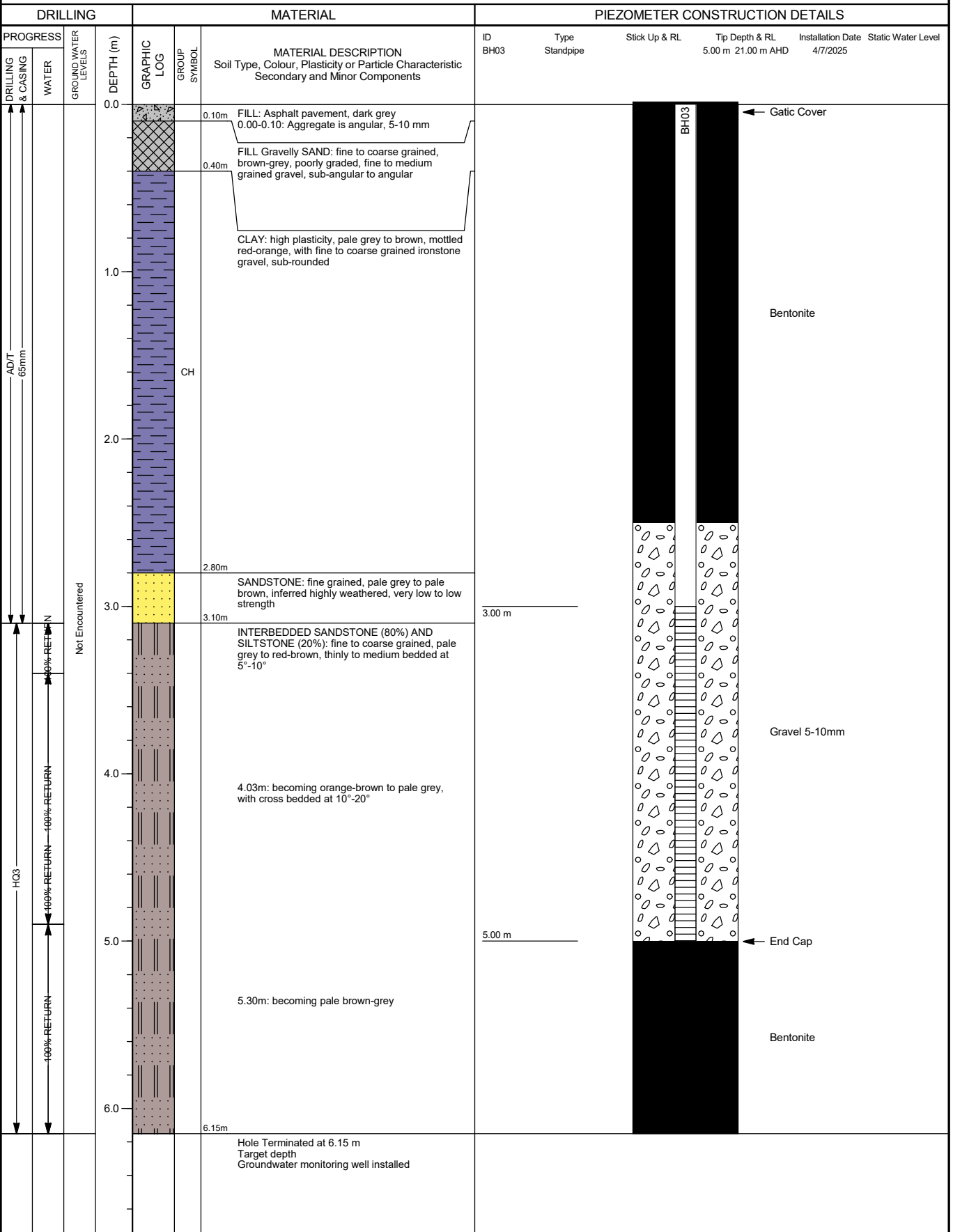
CLIENT : Bloompark  
LOCATION : Bayview 5 Main Drive

PROJECT : Opal Bayview SI

HOLE NO : BH03

FILE / JOB NO : PS223670  
SHEET : 1 OF 2

POSITION : E: 341910, N: 6273523 (MGA2020-56) SURFACE ELEVATION : 26.00 (AHD) ANGLE FROM HORIZONTAL : 90°  
RIG TYPE : GEO205 MOUNTING : Track CONTRACTOR : Terratest  
DATE STARTED : 3/7/2025 DATE COMPLETED : 4/7/2025 DATE LOGGED : 4/7/2025 LOGGED BY : HW CHECKED BY : BMS



See Explanatory Notes for  
details of abbreviations  
& basis of descriptions.

# Appendix B

Well development records



# MONITORING WELL DEVELOPMENT RECORD

|                                                 |          |             |              |
|-------------------------------------------------|----------|-------------|--------------|
| PROJECT NO.:                                    | PS223670 | PROJECT:    | Opal Bayview |
| MONITORING WELL ID:                             | BH01     | DATE:       | 3/07/2025    |
| WSP STAFF:                                      | DH       | CONTRACTOR: | N/A          |
| WEATHER (Temp/Cloud cover/Precipitation): Sunny |          |             |              |
| DEVELOPMENT METHOD: Pump type? Bailer           |          |             |              |

## CALCULATION OF MINIMUM DEVELOPMENT VOLUME

All depths measured below top of PVC casing (TOC)

| Time    | Casing Diameter (mm) | Depth to Water (m) | Measured Depth of Well (mbTOC) | Depth of Well from TOC from Well Report Sheet (m) | Metres of Standing Water (m)<br>D = B-A or C-A<br>whichever is greater | One Well Casing Volume (L)<br>E = D * 2 | Min. Total Volume to be Purged (L)<br>F = E x 3 |
|---------|----------------------|--------------------|--------------------------------|---------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------|
|         |                      | A                  | B                              | C                                                 |                                                                        |                                         |                                                 |
| 9:20 AM | 50                   | 4.75               | 4.80                           | 5.00                                              | 0.25                                                                   | 0.50                                    | 15.00                                           |

## DEVELOPMENT RECORDS

Field Measurements

| Time                                                                                               | Cumulative Volume Purged (L) | Cumulative No. of Surge Cycles | Temp (°C) | Conductivity (µS/cm) | pH | Redox (mV) | Appearance & Odour (colour/clarity/odour/sheen) | Notes    |
|----------------------------------------------------------------------------------------------------|------------------------------|--------------------------------|-----------|----------------------|----|------------|-------------------------------------------------|----------|
| 9:30 AM                                                                                            | 0                            | -                              | -         | -                    | -  | -          | -                                               | Well dry |
| Well slow to recharge so approximatley 10 l of clean water was poured down well until TOC reached. |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |          |

Final Measured Depth of Well from TOC(m) N/A

# MONITORING WELL DEVELOPMENT RECORD

|                                                 |          |             |              |
|-------------------------------------------------|----------|-------------|--------------|
| PROJECT NO.:                                    | PS223670 | PROJECT:    | Opal Bayview |
| MONITORING WELL ID:                             | BH02     | DATE:       | 3/07/2025    |
| WSP STAFF:                                      | DH       | CONTRACTOR: | N/A          |
| WEATHER (Temp/Cloud cover/Precipitation): Sunny |          |             |              |
| DEVELOPMENT METHOD: Pump type? Bailer           |          |             |              |

## CALCULATION OF MINIMUM DEVELOPMENT VOLUME

All depths measured below top of PVC casing (TOC)

| Time    | Casing Diameter (mm) | Depth to Water (m) | Measured Depth of Well (mbTOC) | Depth of Well from TOC from Well Report Sheet (m) | Metres of Standing Water (m)<br>D = B-A or C-A<br>whichever is greater | One Well Casing Volume (L)<br>E = D * 2 | Min. Total Volume to be Purged (L)<br>F = E x 3 |
|---------|----------------------|--------------------|--------------------------------|---------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------|
|         |                      | A                  | B                              | C                                                 |                                                                        |                                         |                                                 |
| 8:40 AM | 50                   | 0.865              | 4.790                          | 5.00                                              | 4.135                                                                  | 8.27                                    | 24.81                                           |

## DEVELOPMENT RECORDS

Field Measurements

| Time                                                                                               | Cumulative Volume Purged (L) | Cumulative No. of Surge Cycles | Temp (°C) | Conductivity (µS/cm) | pH | Redox (mV) | Appearance & Odour (colour/clarity/odour/sheen) | Notes                 |
|----------------------------------------------------------------------------------------------------|------------------------------|--------------------------------|-----------|----------------------|----|------------|-------------------------------------------------|-----------------------|
| 8:45 AM                                                                                            | 5                            | -                              | -         | -                    | -  | -          | Turbid 50%, brown                               |                       |
| 8:50 AM                                                                                            | 10                           | -                              | -         | -                    | -  | -          | Opaque, brown                                   |                       |
| 8:52 AM                                                                                            | 13.5                         | -                              | -         | -                    | -  | -          | Opaque, brown                                   | Bailed until well dry |
| Well slow to recharge so approximatley 10 l of clean water was poured down well until TOC reached. |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |

Final Measured Depth of Well from TOC(m) N/A

# MONITORING WELL DEVELOPMENT RECORD

|                                                        |          |             |              |
|--------------------------------------------------------|----------|-------------|--------------|
| PROJECT NO.:                                           | PS223670 | PROJECT:    | Opal Bayview |
| MONITORING WELL ID:                                    | BH03     | DATE:       | 10/07/2025   |
| WSP STAFF:                                             | DH       | CONTRACTOR: | N/A          |
| WEATHER (Temp/Cloud cover/Precipitation): Sunny, windy |          |             |              |
| DEVELOPMENT METHOD: Pump type? Bailer                  |          |             |              |

## CALCULATION OF MINIMUM DEVELOPMENT VOLUME

All depths measured below top of PVC casing (TOC)

| Time    | Casing Diameter (mm) | Depth to Water (m) | Measured Depth of Well (mbTOC) | Depth of Well from TOC from Well Report Sheet (m) | Metres of Standing Water (m)<br>D = B-A or C-A<br>whichever is greater | One Well Casing Volume (L)<br>E = D * 2 | Min. Total Volume to be Purged (L)<br>F = E x 3 |
|---------|----------------------|--------------------|--------------------------------|---------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------------|
|         |                      | A                  | B                              | C                                                 |                                                                        |                                         |                                                 |
| 9:45 AM | 50                   | 4.680              | 5.100                          | 5.00                                              | 0.420                                                                  | 0.84                                    | 2.52                                            |

## DEVELOPMENT RECORDS

Field Measurements

| Time                                                                                               | Cumulative Volume Purged (L) | Cumulative No. of Surge Cycles | Temp (°C) | Conductivity (µS/cm) | pH | Redox (mV) | Appearance & Odour (colour/clarity/odour/sheen) | Notes                 |
|----------------------------------------------------------------------------------------------------|------------------------------|--------------------------------|-----------|----------------------|----|------------|-------------------------------------------------|-----------------------|
| 9:46 AM                                                                                            | 1.5                          | -                              | -         | -                    | -  | -          | Brown                                           |                       |
| Well slow to recharge so approximatley 12 l of clean water was poured down well until TOC reached. |                              |                                |           |                      |    |            |                                                 |                       |
| 10:40 AM                                                                                           | 13.5                         | -                              | -         | -                    | -  | -          | Clear for 5 l then brown                        | Bailed until well dry |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |
|                                                                                                    |                              |                                |           |                      |    |            |                                                 |                       |

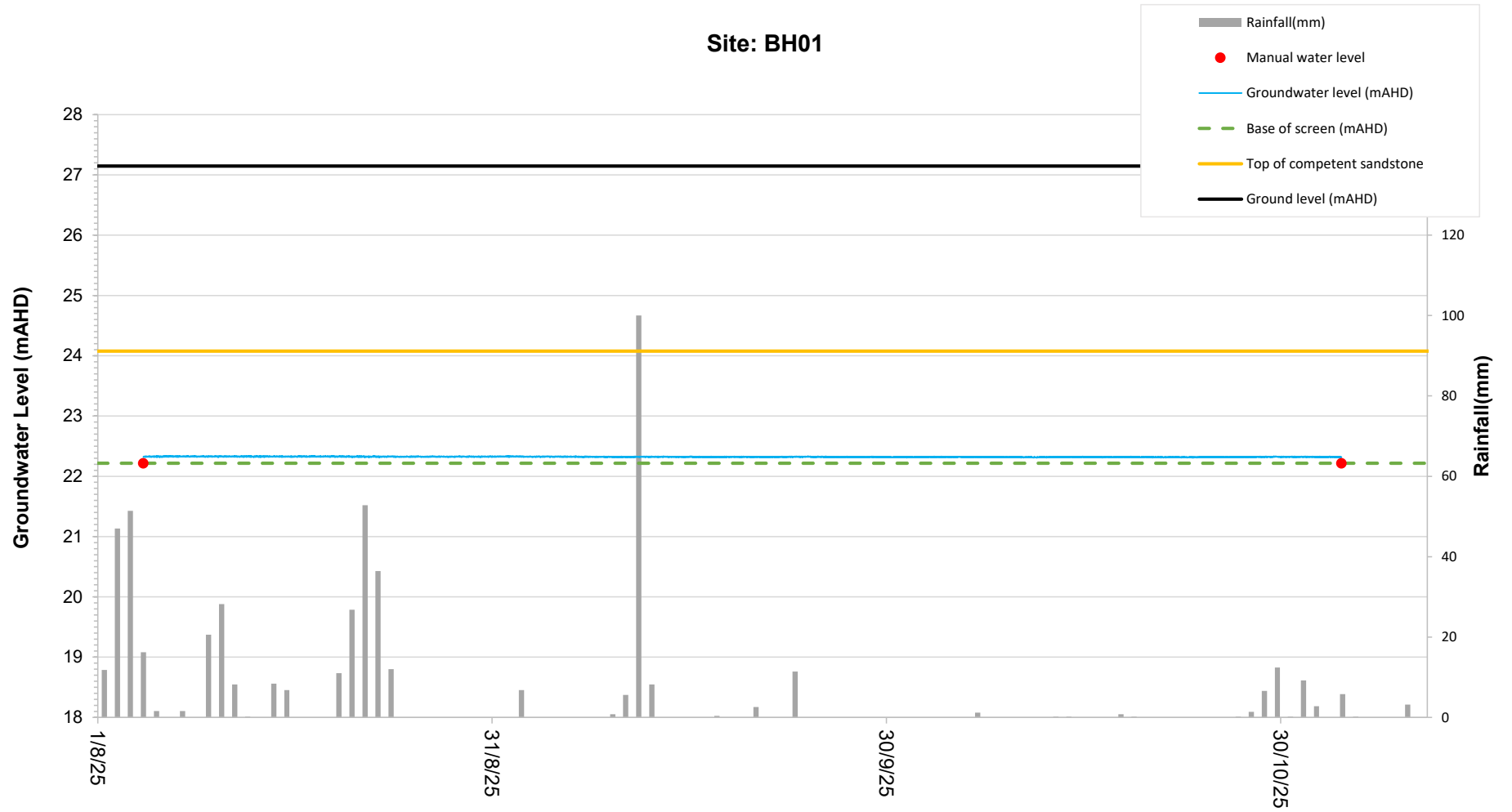
Final Measured Depth of Well from TOC(m) DRY

# Appendix C

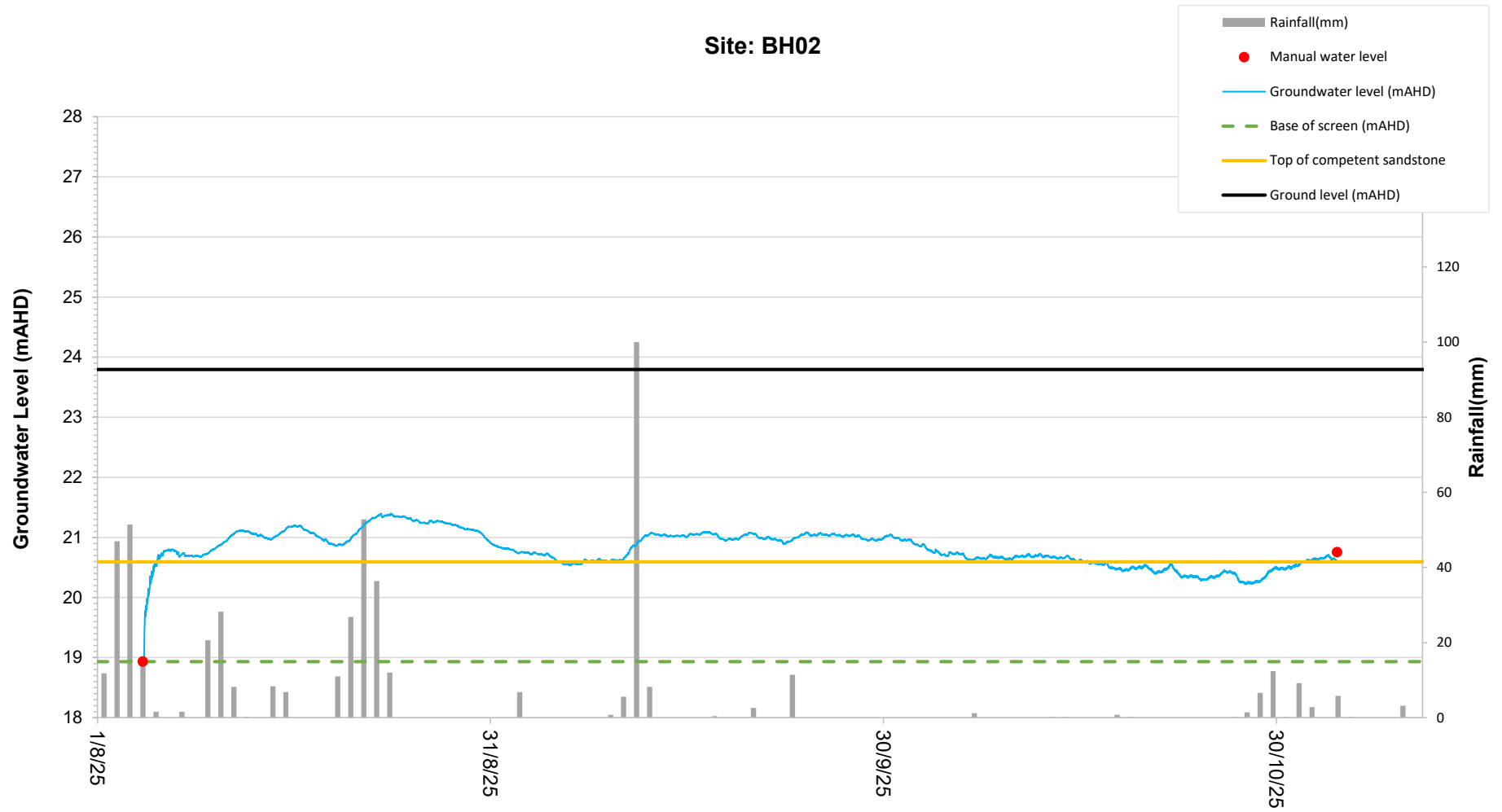
Groundwater level hydrographs



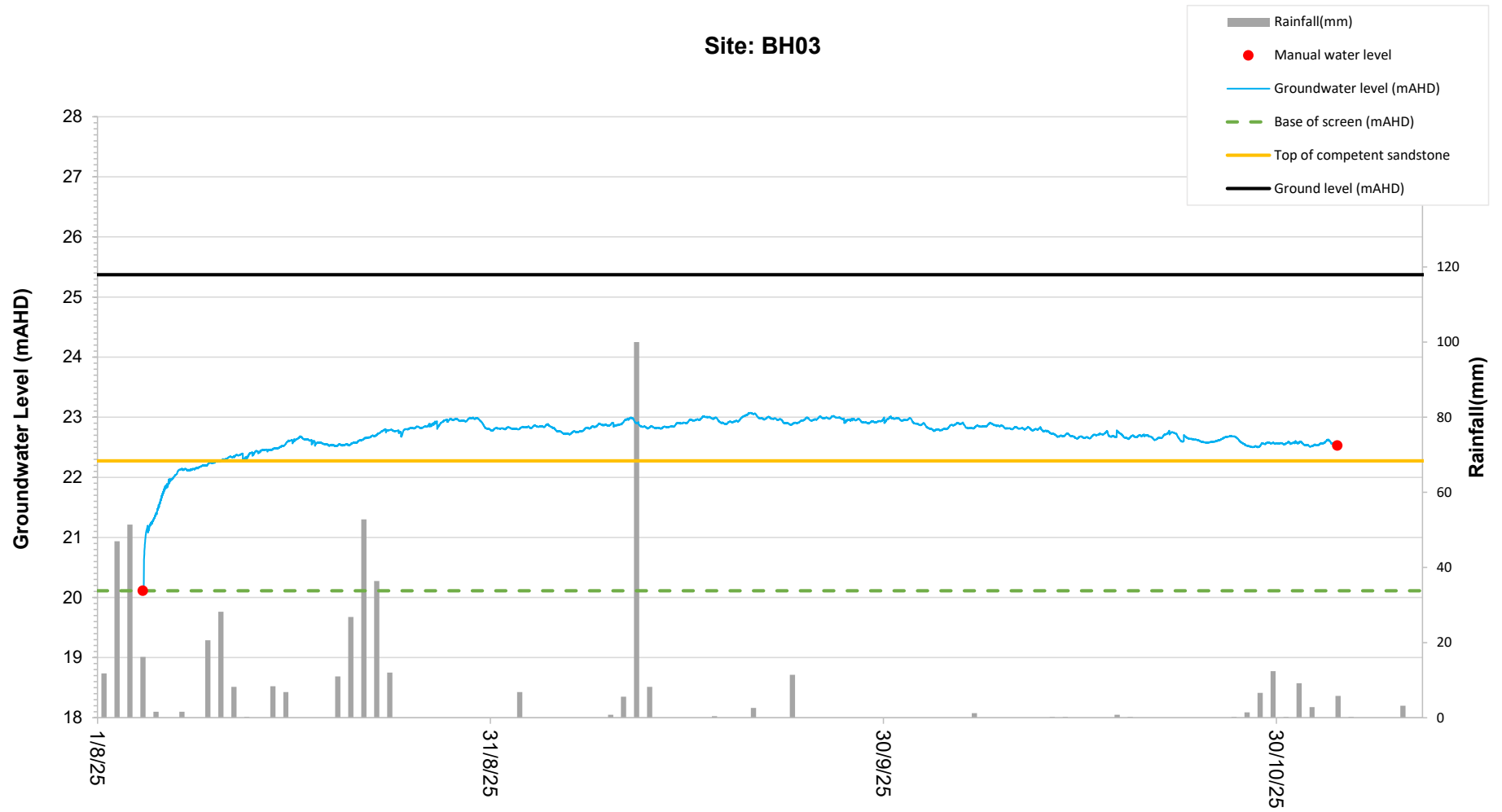
# Site: BH01



# Site: BH02



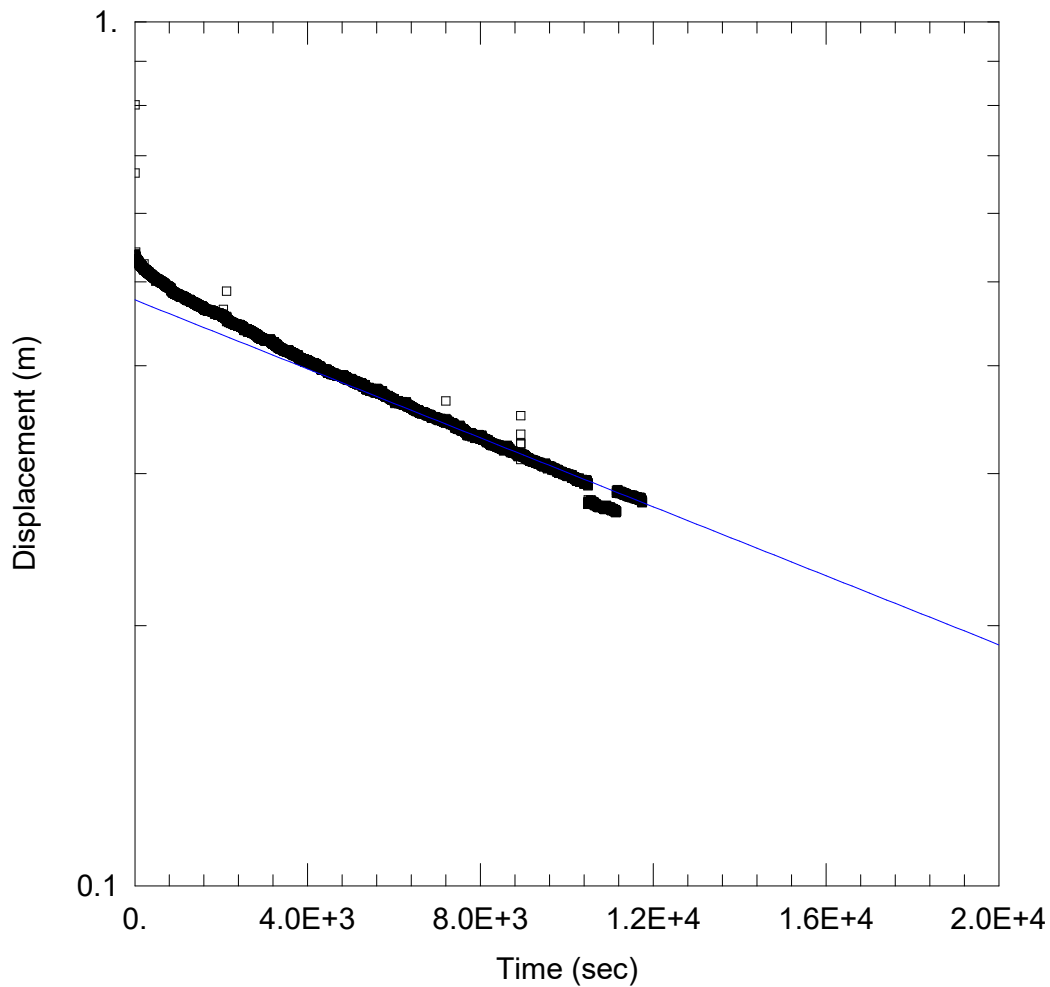
# Site: BH03



# Appendix D

Slug test analysis





### WELL TEST ANALYSIS

Data Set: \...\BH02\_FHT\_HS.aqt

Date: 11/14/25

Time: 15:12:25

### PROJECT INFORMATION

Company: WSP

Client: Opal Healthcare

Project: PS223670

Location: Opal Bayview

Test Well: BH02

Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH02)

Initial Displacement: 0.538 m

Total Well Penetration Depth: 2.11 m

Casing Radius: 0.025 m

Static Water Column Height: 2.11 m

Screen Length: 2.11 m

Well Radius: 0.048 m

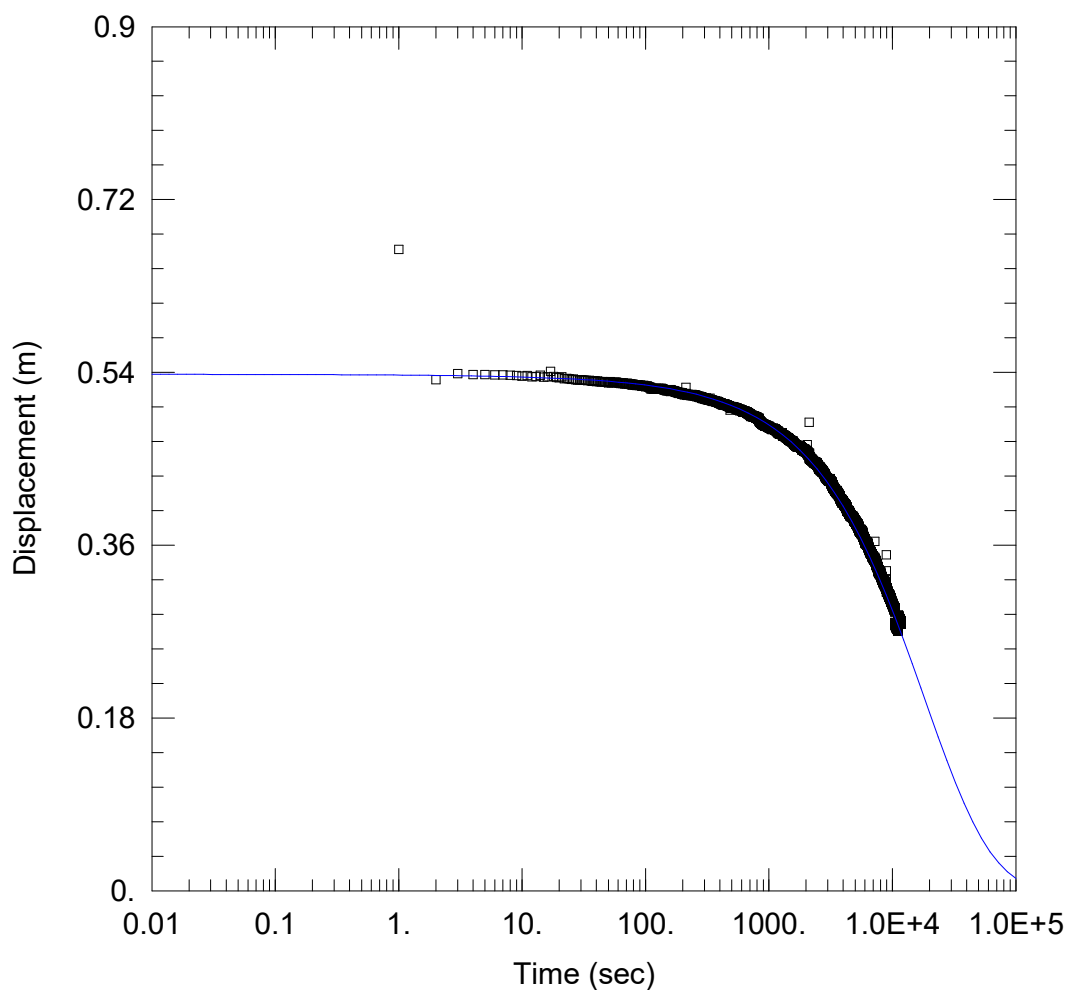
### SOLUTION

Aquifer Model: Unconfined

$K = 3.605E-8$  m/sec

Solution Method: Hvorslev

$y_0 = 0.4765$  m



### WELL TEST ANALYSIS

Data Set: \\...\BH02\_FHT\_KGS.aqt

Date: 11/14/25

Time: 15:12:47

### PROJECT INFORMATION

Company: WSP

Client: Opal Healthcare

Project: PS223670

Location: Opal Bayview

Test Well: BH02

Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

### WELL DATA (BH02)

Initial Displacement: 0.538 m

Total Well Penetration Depth: 2.11 m

Casing Radius: 0.025 m

Static Water Column Height: 2.11 m

Screen Length: 2.11 m

Well Radius: 0.048 m

### SOLUTION

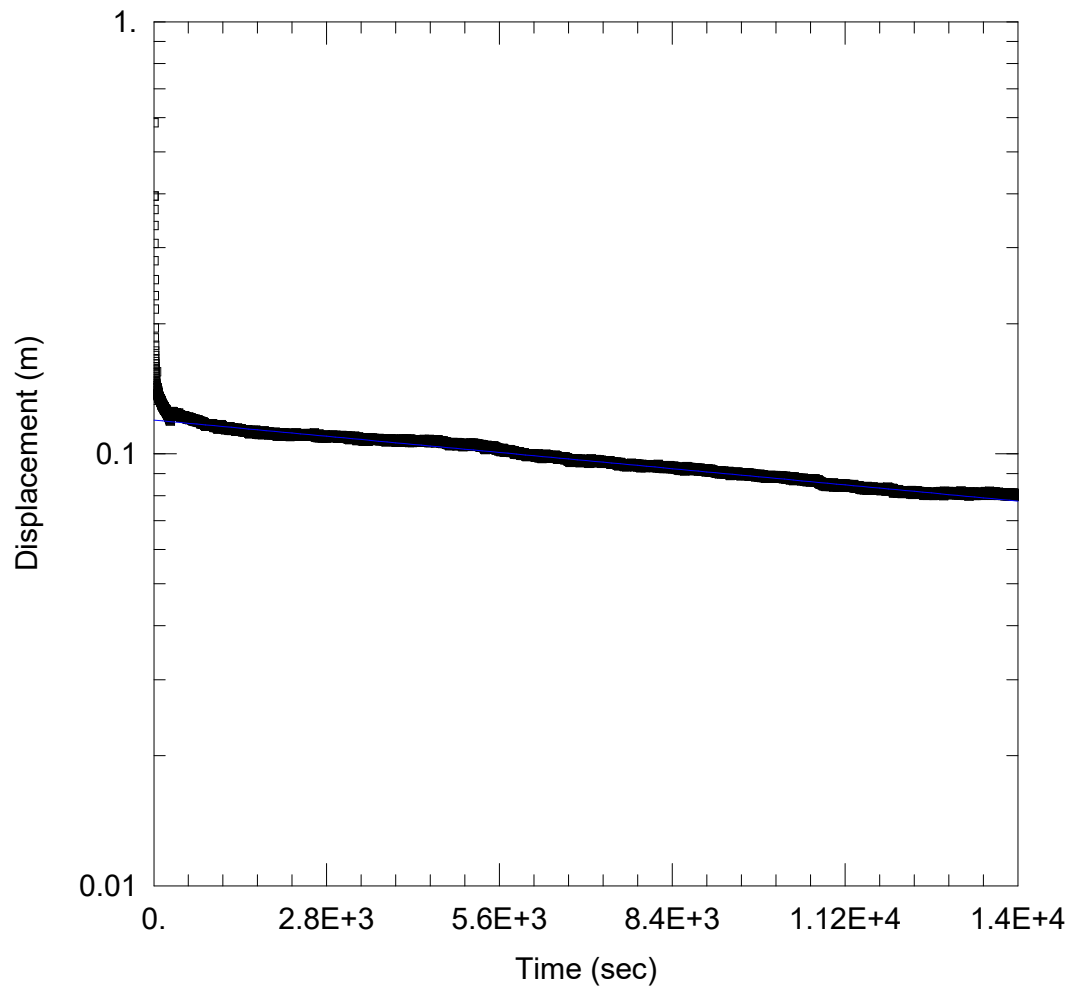
Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 2.197E-8 m/sec

Ss = 0.0007173 m<sup>-1</sup>

Kz/Kr = 1.



### WELL TEST ANALYSIS

Data Set: \...\BH02\_RHT\_HS.aqt  
Date: 11/14/25

Time: 15:13:18

### PROJECT INFORMATION

Company: WSP  
Client: Opal Healthcare  
Project: PS223670  
Location: Opal Bayview  
Test Well: BH02  
Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH02)

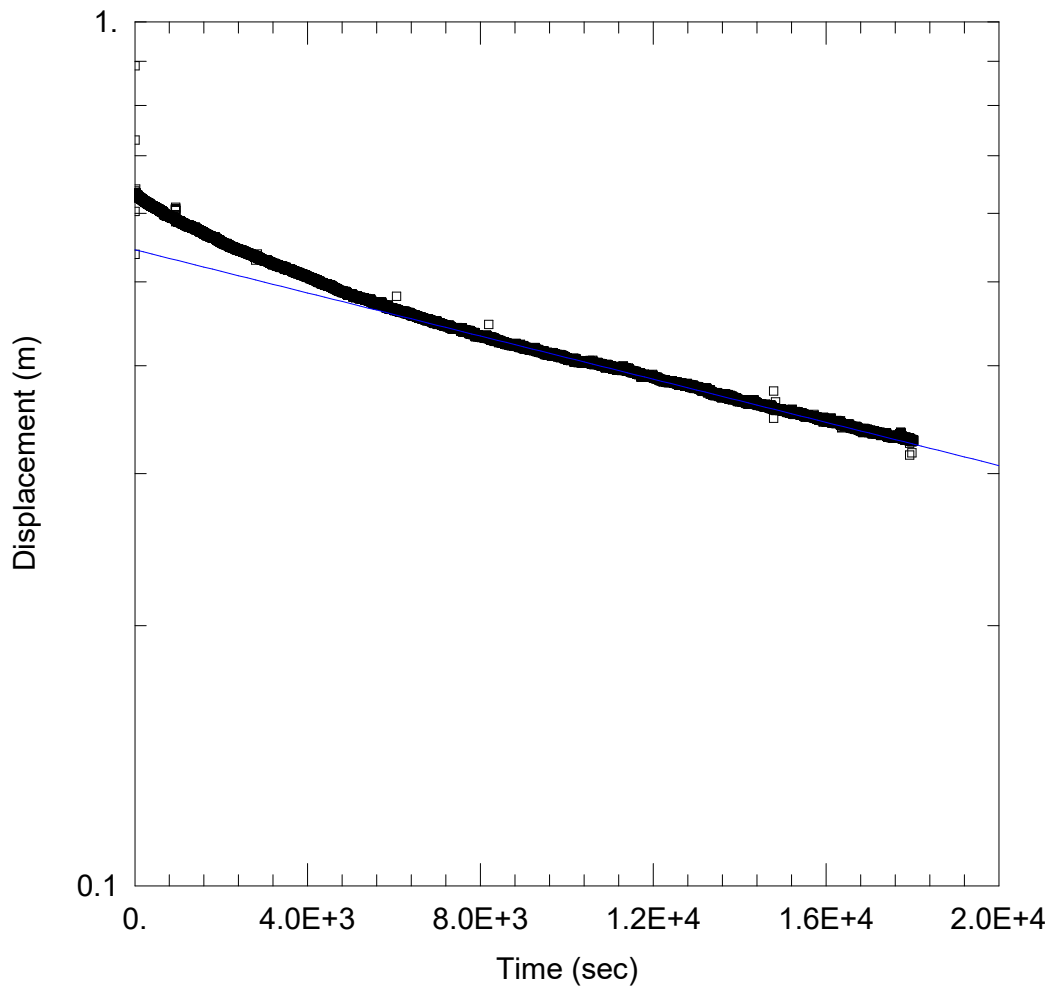
Initial Displacement: 0.3949 m  
Total Well Penetration Depth: 2.11 m  
Casing Radius: 0.025 m

Static Water Column Height: 2.11 m  
Screen Length: 2.11 m  
Well Radius: 0.048 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 2.42E-8$  m/sec

Solution Method: Hvorslev  
 $y_0 = 0.1197$  m



### WELL TEST ANALYSIS

Data Set: \...\BH03\_FHT\_HS.aqt  
Date: 11/14/25

Time: 15:11:43

### PROJECT INFORMATION

Company: WSP  
Client: Opal Healthcare  
Project: PS223670  
Location: Opal Bayview  
Test Well: BH02  
Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH02)

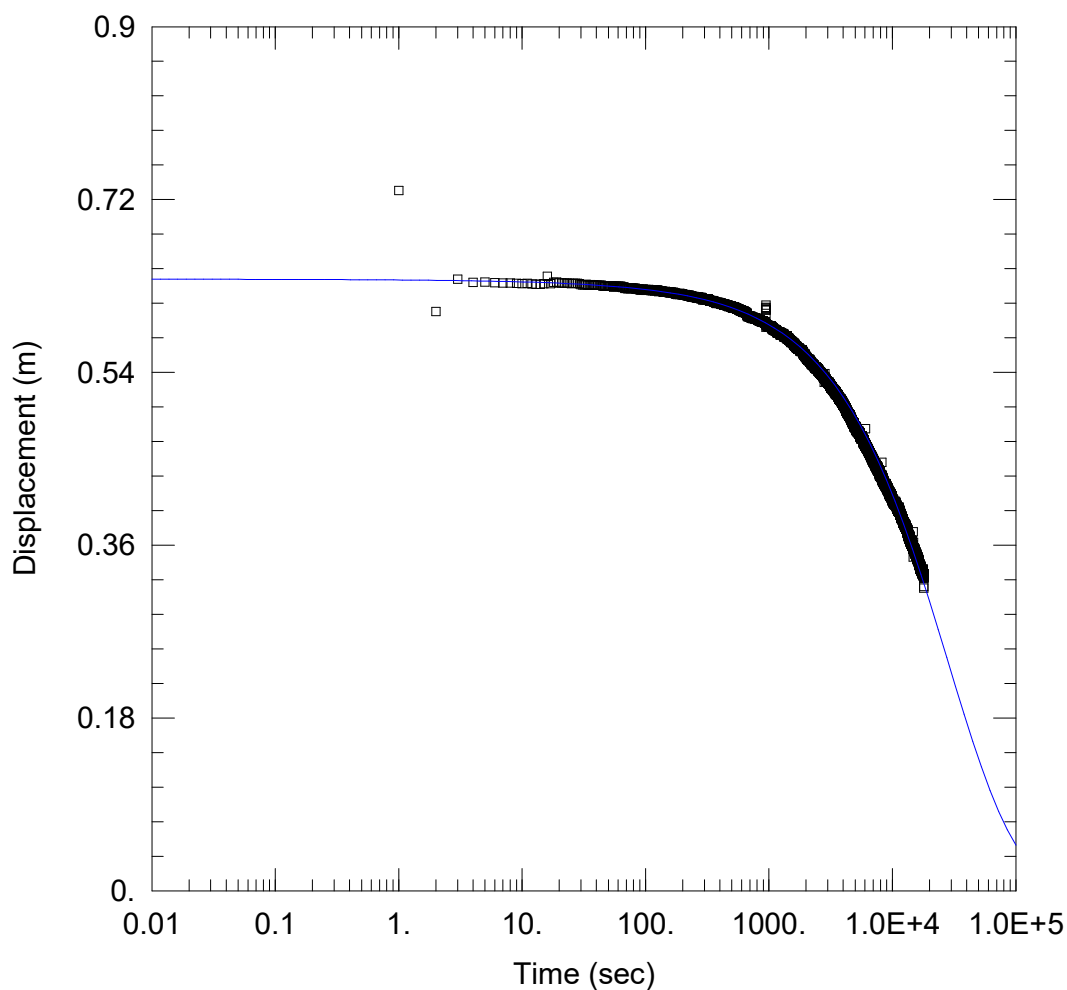
Initial Displacement: 0.538 m  
Total Well Penetration Depth: 2.11 m  
Casing Radius: 0.025 m

Static Water Column Height: 2.11 m  
Screen Length: 2.11 m  
Well Radius: 0.048 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 2.255E-8$  m/sec

Solution Method: Hvorslev  
 $y_0 = 0.5446$  m



### WELL TEST ANALYSIS

Data Set: \...\BH03\_FHT\_KGS.aqt

Date: 11/14/25

Time: 15:11:17

### PROJECT INFORMATION

Company: WSP

Client: Opal Healthcare

Project: PS223670

Location: Opal Bayview

Test Well: BH02

Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

### WELL DATA (BH02)

Initial Displacement: 0.6371 m

Total Well Penetration Depth: 2.11 m

Casing Radius: 0.025 m

Static Water Column Height: 2.11 m

Screen Length: 2.11 m

Well Radius: 0.048 m

### SOLUTION

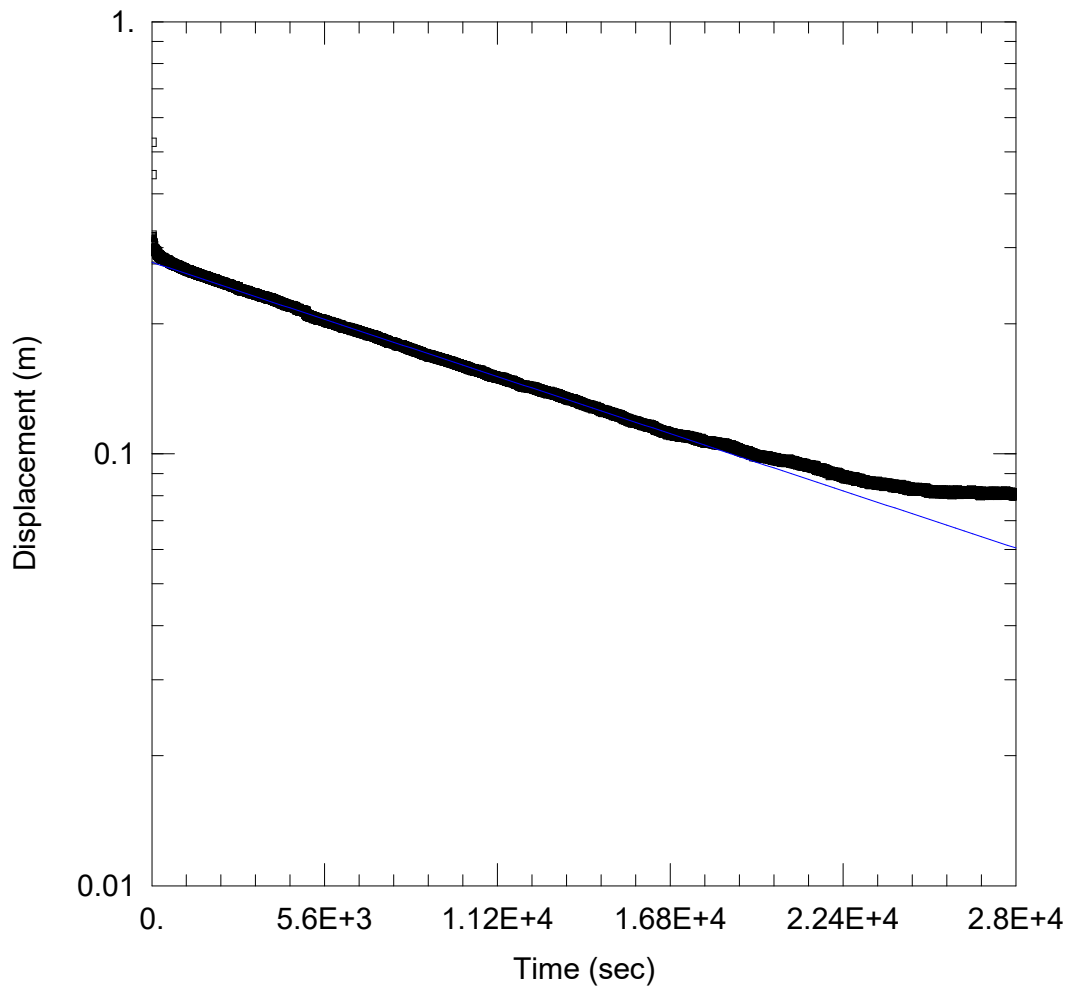
Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 1.371E-8 m/sec

Ss = 0.0008825 m<sup>-1</sup>

Kz/Kr = 1.



### WELL TEST ANALYSIS

Data Set: \...\BH03\_RHT\_HS.aqt  
Date: 11/14/25

Time: 15:10:07

### PROJECT INFORMATION

Company: WSP  
Client: Opal Healthcare  
Project: PS223670  
Location: Opal Bayview  
Test Well: BH02  
Test Date: 4/11/2025

### AQUIFER DATA

Saturated Thickness: 2.11 m

Anisotropy Ratio ( $K_z/K_r$ ): 1.

### WELL DATA (BH02)

Initial Displacement: 0.318 m  
Total Well Penetration Depth: 2.11 m  
Casing Radius: 0.025 m

Static Water Column Height: 2.11 m  
Screen Length: 2.11 m  
Well Radius: 0.048 m

### SOLUTION

Aquifer Model: Unconfined  
 $K = 4.269E-8$  m/sec

Solution Method: Hvorslev  
 $y_0 = 0.2776$  m

# Appendix E

Groundwater sampling laboratory certificates





| COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:                                                                                                                                                                                                                    | SAMPLE DETAILS<br>MATRIX: SOLID (S) WATER (W) | ALS<br>USE |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------|
| <p><b>ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)</b><br/>           Where <b>Metals</b> are required, specify <b>Total</b> (unfiltered bottle required) or <b>Dissolved</b> (field filtered bottle required).</p> |                                               |            |

[illegible]

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; h = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved G = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Sulfuric Preserved Plastic Bag for Acid Sulphate Solids; B = Unpreserved Bag.



## CERTIFICATE OF ANALYSIS

**Work Order** : **ES2523743**  
**Client** : **WSP Australia Pty Ltd**  
**Contact** : Callum Fisher  
**Address** : LEVEL 27 680 GEORGE STREET  
SYDNEY 2000  
**Telephone** : ----  
**Project** : PS223670  
**Order number** : PS223670  
**C-O-C number** : ----  
**Sampler** : DAVID HUGHES  
**Site** : ----  
**Quote number** : WSP MSA 2025  
**No. of samples received** : 4  
**No. of samples analysed** : 4

**Page** : 1 of 9  
**Laboratory** : Environmental Division Sydney  
**Contact** : Andrew Wotherspoon  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 04-Aug-2025 16:00  
**Date Analysis Commenced** : 04-Aug-2025  
**Issue Date** : 11-Aug-2025 15:50



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 Fadjjar | Organic Coordinator                | Sydney Organics, Smithfield, NSW     |
| Lauren Waters   | Microbiology Laboratory Technician | Sydney Microbiology, Smithfield, NSW |
| Sarah Griffiths | Microbiologist                     | Sydney Microbiology, 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.

- MF = membrane filtration
- CFU = colony forming unit
- 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), Dibenzo(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.
- MW006 is ALS's internal code and is equivalent to AS4276.5.
- Microbiological Comment: Membrane filtration result for ES2523743-02 MW006 E.coli is reported as estimate (~) due to the presence of many non-target organism colonies that may have inhibited the growth of the target organisms on the filter membrane. It may be informative to record this fact.
- EK061G: LOR raised for TKN due to sample matrix.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Microbiological Comment: In accordance with ALS work instruction QWI-MIC/04, membrane filtration result is reported an approximate (~) when the count of colonies on the filtered membrane is outside the range of 10 - 100cfu.
- MW013 is ALS's internal code and is equivalent to AS4276.9.
- 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.

| Sub-Matrix: WATER<br>(Matrix: WATER)              |             |       |         | Sample ID         | BH02              | BH03              | Trip spike        | Trip blank | ---- |
|---------------------------------------------------|-------------|-------|---------|-------------------|-------------------|-------------------|-------------------|------------|------|
| Sampling date / time                              |             |       |         | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----       |      |
| Compound                                          | CAS Number  | LOR   | Unit    | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | -----      |      |
|                                                   |             |       |         | Result            | Result            | Result            | Result            | ----       |      |
| EA005P: pH by PC Titrator                         |             |       |         |                   |                   |                   |                   |            |      |
| pH Value                                          | ----        | 0.01  | pH Unit | 6.35              | 6.40              | ----              | ----              | ----       |      |
| EA010P: Conductivity by PC Titrator               |             |       |         |                   |                   |                   |                   |            |      |
| Electrical Conductivity @ 25°C                    | ----        | 1     | µS/cm   | 396               | 700               | ----              | ----              | ----       |      |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C |             |       |         |                   |                   |                   |                   |            |      |
| Total Dissolved Solids @180°C                     | ----        | 10    | mg/L    | 368               | 522               | ----              | ----              | ----       |      |
| EA075: Redox Potential                            |             |       |         |                   |                   |                   |                   |            |      |
| Redox Potential                                   | ----        | 0.1   | mV      | 138               | 143               | ----              | ----              | ----       |      |
| pH Redox                                          | ----        | 0.01  | pH Unit | 6.16              | 6.25              | ----              | ----              | ----       |      |
| ED009: Anions                                     |             |       |         |                   |                   |                   |                   |            |      |
| Bromide                                           | 24959-67-9  | 0.010 | mg/L    | 0.185             | 1.02              | ----              | ----              | ----       |      |
| Iodide                                            | 20461-54-5  | 0.010 | mg/L    | 0.144             | <0.010            | ----              | ----              | ----       |      |
| 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    | 51                | 64                | ----              | ----              | ----       |      |
| Total Alkalinity as CaCO3                         | ----        | 1     | mg/L    | 51                | 64                | ----              | ----              | ----       |      |
| ED040F: Dissolved Major Anions                    |             |       |         |                   |                   |                   |                   |            |      |
| Silicon as SiO2                                   | 14464-46-1  | 0.1   | mg/L    | 45.9              | 47.4              | ----              | ----              | ----       |      |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA   |             |       |         |                   |                   |                   |                   |            |      |
| Sulfate as SO4 - Turbidimetric                    | 14808-79-8  | 1     | mg/L    | 92                | 204               | ----              | ----              | ----       |      |
| ED045G: Chloride by Discrete Analyser             |             |       |         |                   |                   |                   |                   |            |      |
| Chloride                                          | 16887-00-6  | 1     | mg/L    | 24                | 38                | ----              | ----              | ----       |      |
| ED093F: Dissolved Major Cations                   |             |       |         |                   |                   |                   |                   |            |      |
| Calcium                                           | 7440-70-2   | 1     | mg/L    | 10                | 9                 | ----              | ----              | ----       |      |
| Magnesium                                         | 7439-95-4   | 1     | mg/L    | 2                 | 2                 | ----              | ----              | ----       |      |
| Sodium                                            | 7440-23-5   | 1     | mg/L    | 67                | 128               | ----              | ----              | ----       |      |
| Potassium                                         | 7440-09-7   | 1     | mg/L    | 2                 | 5                 | ----              | ----              | ----       |      |
| ED093F: SAR and Hardness Calculations             |             |       |         |                   |                   |                   |                   |            |      |



## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

Sample ID

|                      |            |     |      | BH02              | BH03              | Trip spike        | Trip blank        | ----  |
|----------------------|------------|-----|------|-------------------|-------------------|-------------------|-------------------|-------|
| Sampling date / time |            |     |      | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----  |
| Compound             | CAS Number | LOR | Unit | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | ----- |
|                      |            |     |      | Result            | Result            | Result            | Result            | ----  |

### ED093F: SAR and Hardness Calculations - Continued

|                         |      |   |      |    |    |      |      |      |
|-------------------------|------|---|------|----|----|------|------|------|
| Total Hardness as CaCO3 | ---- | 1 | mg/L | 33 | 31 | ---- | ---- | ---- |
|-------------------------|------|---|------|----|----|------|------|------|

### EG020F: Dissolved Metals by ICP-MS

|            |           |        |      |         |         |      |      |      |
|------------|-----------|--------|------|---------|---------|------|------|------|
| Aluminium  | 7429-90-5 | 0.01   | mg/L | 0.04    | 0.08    | ---- | ---- | ---- |
| Antimony   | 7440-36-0 | 0.001  | mg/L | <0.001  | <0.001  | ---- | ---- | ---- |
| Arsenic    | 7440-38-2 | 0.001  | mg/L | <0.001  | 0.002   | ---- | ---- | ---- |
| Boron      | 7440-42-8 | 0.05   | mg/L | 0.14    | 0.35    | ---- | ---- | ---- |
| Barium     | 7440-39-3 | 0.001  | mg/L | 0.018   | 0.018   | ---- | ---- | ---- |
| 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 | 0.002   | 0.003   | ---- | ---- | ---- |
| Chromium   | 7440-47-3 | 0.001  | mg/L | 0.001   | 0.004   | ---- | ---- | ---- |
| Copper     | 7440-50-8 | 0.001  | mg/L | 0.006   | 0.007   | ---- | ---- | ---- |
| Manganese  | 7439-96-5 | 0.001  | mg/L | 0.048   | 0.050   | ---- | ---- | ---- |
| Nickel     | 7440-02-0 | 0.001  | mg/L | 0.002   | 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 | 0.013   | 0.023   | ---- | ---- | ---- |
| Lithium    | 7439-93-2 | 0.001  | mg/L | 0.003   | 0.004   | ---- | ---- | ---- |
| Molybdenum | 7439-98-7 | 0.001  | mg/L | <0.001  | <0.001  | ---- | ---- | ---- |
| Silver     | 7440-22-4 | 0.001  | mg/L | <0.001  | <0.001  | ---- | ---- | ---- |
| Strontium  | 7440-24-6 | 0.001  | mg/L | 0.034   | 0.054   | ---- | ---- | ---- |
| Uranium    | 7440-61-1 | 0.001  | mg/L | <0.001  | <0.001  | ---- | ---- | ---- |
| Iron       | 7439-89-6 | 0.05   | mg/L | <0.05   | 0.17    | ---- | ---- | ---- |

### EG035F: Dissolved Mercury by FIMS

|         |           |        |      |         |         |      |      |      |
|---------|-----------|--------|------|---------|---------|------|------|------|
| Mercury | 7439-97-6 | 0.0001 | mg/L | <0.0001 | <0.0001 | ---- | ---- | ---- |
|---------|-----------|--------|------|---------|---------|------|------|------|

### EK040P: Fluoride by PC Titrator



## Analytical Results

| Sub-Matrix: WATER<br>(Matrix: WATER)                                |            |      |       | Sample ID | BH02              | BH03              | Trip spike        | Trip blank        | ----  |
|---------------------------------------------------------------------|------------|------|-------|-----------|-------------------|-------------------|-------------------|-------------------|-------|
| Sampling date / time                                                |            |      |       |           | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----  |
| Compound                                                            | CAS Number | LOR  | Unit  |           | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | ----- |
|                                                                     |            |      |       |           | Result            | Result            | Result            | Result            | ----  |
| <b>EK040P: Fluoride by PC Titrator - Continued</b>                  |            |      |       |           |                   |                   |                   |                   |       |
| Fluoride                                                            | 16984-48-8 | 0.1  | mg/L  |           | <0.1              | <0.1              | ----              | ----              | ----  |
| <b>EK055G: Ammonia as N by Discrete Analyser</b>                    |            |      |       |           |                   |                   |                   |                   |       |
| Ammonia as N                                                        | 7664-41-7  | 0.01 | mg/L  |           | 0.04              | 0.09              | ----              | ----              | ----  |
| <b>EK057G: Nitrite as N by Discrete Analyser</b>                    |            |      |       |           |                   |                   |                   |                   |       |
| Nitrite as N                                                        | 14797-65-0 | 0.01 | mg/L  |           | <0.01             | <0.01             | ----              | ----              | ----  |
| <b>EK058G: Nitrate as N by Discrete Analyser</b>                    |            |      |       |           |                   |                   |                   |                   |       |
| Nitrate as N                                                        | 14797-55-8 | 0.01 | mg/L  |           | 0.11              | 0.03              | ----              | ----              | ----  |
| <b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b> |            |      |       |           |                   |                   |                   |                   |       |
| Nitrite + Nitrate as N                                              | ----       | 0.01 | mg/L  |           | 0.11              | 0.03              | ----              | ----              | ----  |
| <b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>         |            |      |       |           |                   |                   |                   |                   |       |
| Total Kjeldahl Nitrogen as N                                        | ----       | 0.1  | mg/L  |           | <0.5              | <3.0              | ----              | ----              | ----  |
| <b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b> |            |      |       |           |                   |                   |                   |                   |       |
| ^ Total Nitrogen as N                                               | ----       | 0.1  | mg/L  |           | <0.5              | <3.0              | ----              | ----              | ----  |
| <b>EK067G: Total Phosphorus as P by Discrete Analyser</b>           |            |      |       |           |                   |                   |                   |                   |       |
| Total Phosphorus as P                                               | ----       | 0.01 | mg/L  |           | 0.29              | 3.39              | ----              | ----              | ----  |
| <b>EK071G: Reactive Phosphorus as P by discrete analyser</b>        |            |      |       |           |                   |                   |                   |                   |       |
| Reactive Phosphorus as P                                            | 14265-44-2 | 0.01 | mg/L  |           | <0.01             | <0.01             | ----              | ----              | ----  |
| <b>EN055: Ionic Balance</b>                                         |            |      |       |           |                   |                   |                   |                   |       |
| ∅ Total Anions                                                      | ----       | 0.01 | meq/L |           | 3.61              | 6.60              | ----              | ----              | ----  |
| ∅ Total Cations                                                     | ----       | 0.01 | meq/L |           | 3.63              | 6.31              | ----              | ----              | ----  |
| ∅ Ionic Balance                                                     | ----       | 0.01 | %     |           | 0.24              | 2.24              | ----              | ----              | ----  |
| <b>EP025: Oxygen - Dissolved (DO)</b>                               |            |      |       |           |                   |                   |                   |                   |       |
| Dissolved Oxygen                                                    | ----       | 0.1  | mg/L  |           | 9.3               | 9.2               | ----              | ----              | ----  |
| <b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons</b>               |            |      |       |           |                   |                   |                   |                   |       |
| 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              | ----              | ----              | ----  |



## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

Sample ID

|                                                                        |                   |     |      | BH02              | BH03              | Trip spike        | Trip blank        | ----  |
|------------------------------------------------------------------------|-------------------|-----|------|-------------------|-------------------|-------------------|-------------------|-------|
| Sampling date / time                                                   |                   |     |      | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----  |
| Compound                                                               | CAS Number        | LOR | Unit | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | ----- |
|                                                                        |                   |     |      | Result            | Result            | Result            | Result            | ----  |
| <b>EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued</b>      |                   |     |      |                   |                   |                   |                   |       |
| 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              | ----              | ----              | ----  |
| ^ 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              | ----              | ----              | ----  |
| <b>EP080/071: Total Petroleum Hydrocarbons</b>                         |                   |     |      |                   |                   |                   |                   |       |
| 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               | ----              | ----              | ----  |
| <b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b> |                   |     |      |                   |                   |                   |                   |       |
| 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              | ----              | ----              | ----  |



## Analytical Results

Sub-Matrix: WATER  
 (Matrix: WATER)

Sample ID

|                                                                                    |                   |     |           | BH02              | BH03              | Trip spike        | Trip blank        | ----  |
|------------------------------------------------------------------------------------|-------------------|-----|-----------|-------------------|-------------------|-------------------|-------------------|-------|
| Sampling date / time                                                               |                   |     |           | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----  |
| Compound                                                                           | CAS Number        | LOR | Unit      | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | ----- |
|                                                                                    |                   |     |           | Result            | Result            | Result            | Result            | ----  |
| <b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b> |                   |     |           |                   |                   |                   |                   |       |
| ^ >C10 - C40 Fraction (sum)                                                        | ----              | 100 | µg/L      | <100              | <100              | ----              | ----              | ----  |
| ^ >C10 - C16 Fraction minus Naphthalene (F2)                                       | ----              | 100 | µg/L      | <100              | <100              | ----              | ----              | ----  |
| <b>EP080: BTEXN</b>                                                                |                   |     |           |                   |                   |                   |                   |       |
| Benzene                                                                            | 71-43-2           | 1   | µg/L      | <1                | <1                | 17                | <1                | ----  |
| Toluene                                                                            | 108-88-3          | 2   | µg/L      | <2                | <2                | 17                | <2                | ----  |
| Ethylbenzene                                                                       | 100-41-4          | 2   | µg/L      | <2                | <2                | 17                | <2                | ----  |
| meta- & para-Xylene                                                                | 108-38-3 106-42-3 | 2   | µg/L      | <2                | <2                | 17                | <2                | ----  |
| ortho-Xylene                                                                       | 95-47-6           | 2   | µg/L      | <2                | <2                | 23                | <2                | ----  |
| ^ Total Xylenes                                                                    | ----              | 2   | µg/L      | <2                | <2                | 40                | <2                | ----  |
| ^ Sum of BTEX                                                                      | ----              | 1   | µg/L      | <1                | <1                | 91                | <1                | ----  |
| Naphthalene                                                                        | 91-20-3           | 5   | µg/L      | <5                | <5                | 21                | <5                | ----  |
| <b>MW006: Thermotolerant Coliforms &amp; E.coli by MF</b>                          |                   |     |           |                   |                   |                   |                   |       |
| Thermotolerant Coliforms                                                           | ----              | 1   | CFU/100mL | 12000             | 8500              | ----              | ----              | ----  |
| Escherichia coli                                                                   | ----              | 1   | CFU/100mL | ~2                | ~160              | ----              | ----              | ----  |
| <b>MW013: Faecal Streptococci by MF</b>                                            |                   |     |           |                   |                   |                   |                   |       |
| Faecal Streptococci                                                                | ----              | 1   | CFU/100mL | 100               | 66                | ----              | ----              | ----  |
| <b>EP075(SIM)S: Phenolic Compound Surrogates</b>                                   |                   |     |           |                   |                   |                   |                   |       |
| Phenol-d6                                                                          | 13127-88-3        | 1.0 | %         | 23.2              | 24.6              | ----              | ----              | ----  |
| 2-Chlorophenol-D4                                                                  | 93951-73-6        | 1.0 | %         | 47.3              | 64.7              | ----              | ----              | ----  |
| 2,4,6-Tribromophenol                                                               | 118-79-6          | 1.0 | %         | 45.2              | 64.3              | ----              | ----              | ----  |
| <b>EP075(SIM)T: PAH Surrogates</b>                                                 |                   |     |           |                   |                   |                   |                   |       |
| 2-Fluorobiphenyl                                                                   | 321-60-8          | 1.0 | %         | 68.7              | 84.1              | ----              | ----              | ----  |
| Anthracene-d10                                                                     | 1719-06-8         | 1.0 | %         | 68.4              | 87.4              | ----              | ----              | ----  |
| 4-Terphenyl-d14                                                                    | 1718-51-0         | 1.0 | %         | 70.2              | 84.8              | ----              | ----              | ----  |
| <b>EP080S: TPH(V)/BTEX Surrogates</b>                                              |                   |     |           |                   |                   |                   |                   |       |
| 1,2-Dichloroethane-D4                                                              | 17060-07-0        | 2   | %         | 118               | 111               | 108               | 97.0              | ----  |
| Toluene-D8                                                                         | 2037-26-5         | 2   | %         | 123               | 117               | 112               | 103               | ----  |



Analytical Results

|                                            |            |     |      |           |                   |                   |                   |                   |       |
|--------------------------------------------|------------|-----|------|-----------|-------------------|-------------------|-------------------|-------------------|-------|
| Sub-Matrix: WATER<br>(Matrix: WATER)       |            |     |      | Sample ID | BH02              | BH03              | Trip spike        | Trip blank        | ----  |
| Sampling date / time                       |            |     |      |           | 04-Aug-2025 13:45 | 04-Aug-2025 12:50 | 28-Jul-2025 00:00 | 28-Jul-2025 00:00 | ----  |
| Compound                                   | CAS Number | LOR | Unit |           | ES2523743-001     | ES2523743-002     | ES2523743-003     | ES2523743-004     | ----- |
|                                            |            |     |      |           | Result            | Result            | Result            | Result            | ----  |
| EP080S: TPH(V)/BTEX Surrogates - Continued |            |     |      |           |                   |                   |                   |                   |       |
| 4-Bromofluorobenzene                       | 460-00-4   | 2   | %    |           | 133               | 129               | 118               | 110               | ----  |



## Surrogate Control Limits

Sub-Matrix: **WATER**

|                                                  |            | Recovery Limits (%) |      |
|--------------------------------------------------|------------|---------------------|------|
| Compound                                         | CAS Number | Low                 | High |
| <b>EP075(SIM)S: Phenolic Compound Surrogates</b> |            |                     |      |
| Phenol-d6                                        | 13127-88-3 | 10                  | 44   |
| 2-Chlorophenol-D4                                | 93951-73-6 | 14                  | 94   |
| 2,4,6-Tribromophenol                             | 118-79-6   | 17                  | 125  |
| <b>EP075(SIM)T: PAH Surrogates</b>               |            |                     |      |
| 2-Fluorobiphenyl                                 | 321-60-8   | 20                  | 104  |
| Anthracene-d10                                   | 1719-06-8  | 27                  | 113  |
| 4-Terphenyl-d14                                  | 1718-51-0  | 32                  | 112  |
| <b>EP080S: TPH(V)/BTEX Surrogates</b>            |            |                     |      |
| 1,2-Dichloroethane-D4                            | 17060-07-0 | 72                  | 143  |
| Toluene-D8                                       | 2037-26-5  | 75                  | 131  |
| 4-Bromofluorobenzene                             | 460-00-4   | 73                  | 137  |



## QUALITY CONTROL REPORT

|                         |                                             |                         |                                                       |
|-------------------------|---------------------------------------------|-------------------------|-------------------------------------------------------|
| Work Order              | : ES2523743                                 | Page                    | : 1 of 11                                             |
| Client                  | : WSP Australia Pty Ltd                     | Laboratory              | : Environmental Division Sydney                       |
| Contact                 | : Callum Fisher                             | Contact                 | : Andrew Wotherspoon                                  |
| Address                 | : LEVEL 27 680 GEORGE STREET<br>SYDNEY 2000 | Address                 | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| Telephone               | : ----                                      | Telephone               | : +61-2-8784 8555                                     |
| Project                 | : PS223670                                  | Date Samples Received   | : 04-Aug-2025                                         |
| Order number            | : PS223670                                  | Date Analysis Commenced | : 04-Aug-2025                                         |
| C-O-C number            | : ----                                      | Issue Date              | : 11-Aug-2025                                         |
| Sampler                 | : DAVID HUGHES                              |                         |                                                       |
| Site                    | : ----                                      |                         |                                                       |
| Quote number            | : WSP MSA 2025                              |                         |                                                       |
| No. of samples received | : 4                                         |                         |                                                       |
| No. of samples analysed | : 4                                         |                         |                                                       |



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 Quality Control Report contains the following information:

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

### 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     |
| Lauren Waters   | Microbiology Laboratory Technician | Sydney Microbiology, Smithfield, NSW |
| Sarah Griffiths | Microbiologist                     | Sydney Microbiology, 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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

RPD = Relative Percentage Difference

# = Indicates failed QC

\* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

## Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                   |           |                                          |             | Laboratory Duplicate (DUP) Report |         |                 |                  |         |                    |
|---------------------------------------------------------------------|-----------|------------------------------------------|-------------|-----------------------------------|---------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                                | Sample ID | Method: Compound                         | CAS Number  | LOR                               | Unit    | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| ED009: Anions (QC Lot: 6766382)                                     |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523743-001                                                       | BH02      | ED009-X: Bromide                         | 24959-67-9  | 0.01                              | mg/L    | 0.185           | 0.187            | 1.1     | 0% - 50%           |
|                                                                     |           | ED009-X: Iodide                          | 20461-54-5  | 0.01                              | mg/L    | 0.144           | 0.117            | 20.7    | 0% - 50%           |
| EA005P: pH by PC Titrator (QC Lot: 6764629)                         |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523714-001                                                       | Anonymous | EA005-P: pH Value                        | ----        | 0.01                              | pH Unit | 7.98            | 7.99             | 0.1     | 0% - 20%           |
| ES2523737-001                                                       | Anonymous | EA005-P: pH Value                        | ----        | 0.01                              | pH Unit | 7.80            | 7.71             | 1.2     | 0% - 20%           |
| EA010P: Conductivity by PC Titrator (QC Lot: 6764631)               |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523737-001                                                       | Anonymous | EA010-P: Electrical Conductivity @ 25°C  | ----        | 1                                 | µS/cm   | 632             | 632              | 0.0     | 0% - 20%           |
| ES2523743-001                                                       | BH02      | EA010-P: Electrical Conductivity @ 25°C  | ----        | 1                                 | µS/cm   | 396             | 402              | 1.6     | 0% - 20%           |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 6772203) |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523087-006                                                       | Anonymous | EA015H: Total Dissolved Solids @180°C    | ----        | 10                                | mg/L    | 738             | 728              | 1.4     | 0% - 20%           |
| EA075: Redox Potential (QC Lot: 6764540)                            |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523743-001                                                       | BH02      | EA075: Redox Potential                   | ----        | 0.1                               | mV      | 138             | 141              | 2.6     | 0% - 20%           |
|                                                                     |           | EA075: pH Redox                          | ----        | 0.01                              | pH Unit | 6.16            | 6.16             | 0.0     | 0% - 20%           |
| ED037P: Alkalinity by PC Titrator (QC Lot: 6764630)                 |           |                                          |             |                                   |         |                 |                  |         |                    |
| ES2523714-001                                                       | Anonymous | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1                                 | mg/L    | <1              | <1               | 0.0     | No Limit           |
|                                                                     |           | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1                                 | mg/L    | <1              | <1               | 0.0     | No Limit           |
|                                                                     |           | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3     | 1                                 | mg/L    | 812             | 812              | 0.0     | 0% - 20%           |
|                                                                     |           | ED037-P: Total Alkalinity as CaCO3       | ----        | 1                                 | mg/L    | 812             | 812              | 0.0     | 0% - 20%           |
| ES2523743-001                                                       | BH02      | ED037-P: Hydroxide Alkalinity as CaCO3   | DMO-210-001 | 1                                 | mg/L    | <1              | <1               | 0.0     | No Limit           |
|                                                                     |           | ED037-P: Carbonate Alkalinity as CaCO3   | 3812-32-6   | 1                                 | mg/L    | <1              | <1               | 0.0     | No Limit           |



| Sub-Matrix: WATER                                                 |           |                                          |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                    |
|-------------------------------------------------------------------|-----------|------------------------------------------|------------|-----------------------------------|------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                              | Sample ID | Method: Compound                         | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| ED037P: Alkalinity by PC Titrator (QC Lot: 6764630) - continued   |           |                                          |            |                                   |      |                 |                  |         |                    |
| ES2523743-001                                                     | BH02      | ED037-P: Bicarbonate Alkalinity as CaCO3 | 71-52-3    | 1                                 | mg/L | 51              | 52               | 2.5     | 0% - 20%           |
|                                                                   |           | ED037-P: Total Alkalinity as CaCO3       | ----       | 1                                 | mg/L | 51              | 52               | 2.5     | 0% - 20%           |
| ED040F: Dissolved Major Anions (QC Lot: 6767871)                  |           |                                          |            |                                   |      |                 |                  |         |                    |
| EN2512999-001                                                     | Anonymous | ED040F: Silicon as SiO2                  | 14464-46-1 | 0.1                               | mg/L | 1.5             | 1.4              | 0.0     | 0% - 50%           |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 6767868) |           |                                          |            |                                   |      |                 |                  |         |                    |
| EN2512975-003                                                     | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8 | 1                                 | mg/L | 60              | 57               | 4.6     | 0% - 20%           |
| ES2523768-003                                                     | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric   | 14808-79-8 | 1                                 | mg/L | 45              | 44               | 0.0     | 0% - 20%           |
| ED045G: Chloride by Discrete Analyser (QC Lot: 6767867)           |           |                                          |            |                                   |      |                 |                  |         |                    |
| EN2512975-003                                                     | Anonymous | ED045G: Chloride                         | 16887-00-6 | 1                                 | mg/L | 16              | 16               | 0.0     | 0% - 50%           |
| ES2523768-003                                                     | Anonymous | ED045G: Chloride                         | 16887-00-6 | 1                                 | mg/L | 54              | 53               | 2.2     | 0% - 20%           |
| ED093F: Dissolved Major Cations (QC Lot: 6767401)                 |           |                                          |            |                                   |      |                 |                  |         |                    |
| ES2523525-001                                                     | Anonymous | ED093F: Calcium                          | 7440-70-2  | 1                                 | mg/L | 8               | 8                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Magnesium                        | 7439-95-4  | 1                                 | mg/L | 1               | 1                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Sodium                           | 7440-23-5  | 1                                 | mg/L | 3               | 3                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Potassium                        | 7440-09-7  | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
| ES2523525-011                                                     | Anonymous | ED093F: Calcium                          | 7440-70-2  | 1                                 | mg/L | 2               | 2                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Magnesium                        | 7439-95-4  | 1                                 | mg/L | 1               | 1                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Sodium                           | 7440-23-5  | 1                                 | mg/L | 2               | 2                | 0.0     | No Limit           |
|                                                                   |           | ED093F: Potassium                        | 7440-09-7  | 1                                 | mg/L | <1              | <1               | 0.0     | No Limit           |
| EG020F: Dissolved Metals by ICP-MS (QC Lot: 6767399)              |           |                                          |            |                                   |      |                 |                  |         |                    |
| ES2523525-001                                                     | Anonymous | EG020A-F: Cadmium                        | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Antimony                       | 7440-36-0  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Arsenic                        | 7440-38-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Beryllium                      | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Barium                         | 7440-39-3  | 0.001                             | mg/L | 0.014           | 0.015            | 0.0     | 0% - 50%           |
|                                                                   |           | EG020A-F: Chromium                       | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Cobalt                         | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Copper                         | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Lead                           | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Lithium                        | 7439-93-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Manganese                      | 7439-96-5  | 0.001                             | mg/L | 0.001           | 0.002            | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Molybdenum                     | 7439-98-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Nickel                         | 7440-02-0  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Zinc                           | 7440-66-6  | 0.005                             | mg/L | <0.005          | <0.005           | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Aluminium                      | 7429-90-5  | 0.01                              | mg/L | 0.12            | 0.13             | 0.0     | 0% - 50%           |
|                                                                   |           | EG020A-F: Selenium                       | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |
|                                                                   |           | EG020A-F: Vanadium                       | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |

| Sub-Matrix: WATER                                                |           |                                                      |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                    |
|------------------------------------------------------------------|-----------|------------------------------------------------------|------------|-----------------------------------|------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                             | Sample ID | Method: Compound                                     | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| EG020F: Dissolved Metals by ICP-MS (QC Lot: 6767399) - continued |           |                                                      |            |                                   |      |                 |                  |         |                    |
| ES2523525-001                                                    | Anonymous | EG020A-F: Boron                                      | 7440-42-8  | 0.05                              | mg/L | <0.05           | <0.05            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Iron                                       | 7439-89-6  | 0.05                              | mg/L | 0.06            | 0.07             | 0.0     | No Limit           |
| ES2523525-011                                                    | Anonymous | EG020A-F: Cadmium                                    | 7440-43-9  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Antimony                                   | 7440-36-0  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Arsenic                                    | 7440-38-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Beryllium                                  | 7440-41-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Barium                                     | 7440-39-3  | 0.001                             | mg/L | 0.003           | 0.003            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Chromium                                   | 7440-47-3  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Cobalt                                     | 7440-48-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Copper                                     | 7440-50-8  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Lead                                       | 7439-92-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Lithium                                    | 7439-93-2  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Manganese                                  | 7439-96-5  | 0.001                             | mg/L | 0.002           | 0.003            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Molybdenum                                 | 7439-98-7  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Nickel                                     | 7440-02-0  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Zinc                                       | 7440-66-6  | 0.005                             | mg/L | <0.005          | <0.005           | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Aluminium                                  | 7429-90-5  | 0.01                              | mg/L | 0.10            | 0.10             | 0.0     | 0% - 50%           |
|                                                                  |           | EG020A-F: Selenium                                   | 7782-49-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Vanadium                                   | 7440-62-2  | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Boron                                      | 7440-42-8  | 0.05                              | mg/L | <0.05           | <0.05            | 0.0     | No Limit           |
|                                                                  |           | EG020A-F: Iron                                       | 7439-89-6  | 0.05                              | mg/L | 0.06            | 0.06             | 0.0     | No Limit           |
|                                                                  |           | EG020F: Dissolved Metals by ICP-MS (QC Lot: 6767400) |            |                                   |      |                 |                  |         |                    |
| ES2523525-001                                                    | Anonymous | EG020B-F: Silver                                     | 7440-22-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020B-F: Strontium                                  | 7440-24-6  | 0.001                             | mg/L | 0.020           | 0.020            | 0.0     | 0% - 20%           |
|                                                                  |           | EG020B-F: Uranium                                    | 7440-61-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
| ES2523525-011                                                    | Anonymous | EG020B-F: Silver                                     | 7440-22-4  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
|                                                                  |           | EG020B-F: Strontium                                  | 7440-24-6  | 0.001                             | mg/L | 0.011           | 0.011            | 0.0     | 0% - 50%           |
|                                                                  |           | EG020B-F: Uranium                                    | 7440-61-1  | 0.001                             | mg/L | <0.001          | <0.001           | 0.0     | No Limit           |
| EG035F: Dissolved Mercury by FIMS (QC Lot: 6767402)              |           |                                                      |            |                                   |      |                 |                  |         |                    |
| ES2523525-004                                                    | Anonymous | EG035F: Mercury                                      | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.0     | No Limit           |
| ES2523525-010                                                    | Anonymous | EG035F: Mercury                                      | 7439-97-6  | 0.0001                            | mg/L | <0.0001         | <0.0001          | 0.0     | No Limit           |
| EK040P: Fluoride by PC Titrator (QC Lot: 6764633)                |           |                                                      |            |                                   |      |                 |                  |         |                    |
| ES2523743-001                                                    | BH02      | EK040P: Fluoride                                     | 16984-48-8 | 0.1                               | mg/L | <0.1            | <0.1             | 0.0     | No Limit           |
| EK055G: Ammonia as N by Discrete Analyser (QC Lot: 6767901)      |           |                                                      |            |                                   |      |                 |                  |         |                    |
| ES2523356-001                                                    | Anonymous | EK055G: Ammonia as N                                 | 7664-41-7  | 0.01                              | mg/L | 12.3            | 11.8             | 3.5     | 0% - 20%           |
| ES2523525-009                                                    | Anonymous | EK055G: Ammonia as N                                 | 7664-41-7  | 0.01                              | mg/L | 0.02            | 0.01             | 0.0     | No Limit           |
| EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6767866)      |           |                                                      |            |                                   |      |                 |                  |         |                    |



| Sub-Matrix: <b>WATER</b>                                                                 |           |                                      |            | Laboratory Duplicate (DUP) Report |      |                 |                  |         |                    |
|------------------------------------------------------------------------------------------|-----------|--------------------------------------|------------|-----------------------------------|------|-----------------|------------------|---------|--------------------|
| Laboratory sample ID                                                                     | Sample ID | Method: Compound                     | CAS Number | LOR                               | Unit | Original Result | Duplicate Result | RPD (%) | Acceptable RPD (%) |
| <b>EK057G: Nitrite as N by Discrete Analyser (QC Lot: 6767866) - continued</b>           |           |                                      |            |                                   |      |                 |                  |         |                    |
| ES2523750-004                                                                            | Anonymous | EK057G: Nitrite as N                 | 14797-65-0 | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |
| EN2512975-003                                                                            | Anonymous | EK057G: Nitrite as N                 | 14797-65-0 | 0.01                              | mg/L | 0.02            | 0.02             | 0.0     | No Limit           |
| <b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 6767900)</b>    |           |                                      |            |                                   |      |                 |                  |         |                    |
| ES2523356-001                                                                            | Anonymous | EK059G: Nitrite + Nitrate as N       | ----       | 0.01                              | mg/L | 0.01            | 0.01             | 0.0     | No Limit           |
| ES2523525-009                                                                            | Anonymous | EK059G: Nitrite + Nitrate as N       | ----       | 0.01                              | mg/L | 0.01            | <0.01            | 0.0     | No Limit           |
| <b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 6767893)</b>            |           |                                      |            |                                   |      |                 |                  |         |                    |
| ES2523356-001                                                                            | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ----       | 0.1 (0.5)*                        | mg/L | 24.8            | 23.2             | 6.6     | 0% - 20%           |
| ES2523525-010                                                                            | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ----       | 0.1                               | mg/L | 0.2             | 0.3              | 0.0     | No Limit           |
| <b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 6767894)</b>              |           |                                      |            |                                   |      |                 |                  |         |                    |
| ES2523356-001                                                                            | Anonymous | EK067G: Total Phosphorus as P        | ----       | 0.01 (0.05)*                      | mg/L | 6.69            | 6.39             | 4.6     | 0% - 20%           |
| ES2523525-010                                                                            | Anonymous | EK067G: Total Phosphorus as P        | ----       | 0.01                              | mg/L | 0.04            | 0.04             | 0.0     | No Limit           |
| <b>EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 6767869)</b>           |           |                                      |            |                                   |      |                 |                  |         |                    |
| ES2523750-004                                                                            | Anonymous | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.01                              | mg/L | <0.01           | <0.01            | 0.0     | No Limit           |
| EN2512975-003                                                                            | Anonymous | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.01                              | mg/L | 0.09            | 0.09             | 0.0     | No Limit           |
| <b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 6765986)</b>                         |           |                                      |            |                                   |      |                 |                  |         |                    |
| CA2504551-001                                                                            | Anonymous | EP080: C6 - C9 Fraction              | ----       | 20                                | µg/L | <20             | <20              | 0.0     | No Limit           |
| CA2504551-006                                                                            | Anonymous | EP080: C6 - C9 Fraction              | ----       | 20                                | µg/L | 70              | 70               | 0.0     | No Limit           |
| <b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 6765986)</b> |           |                                      |            |                                   |      |                 |                  |         |                    |
| CA2504551-001                                                                            | Anonymous | EP080: C6 - C10 Fraction             | C6_C10     | 20                                | µg/L | <20             | <20              | 0.0     | No Limit           |
| CA2504551-006                                                                            | Anonymous | EP080: C6 - C10 Fraction             | C6_C10     | 20                                | µg/L | 70              | 70               | 0.0     | No Limit           |
| <b>EP080: BTEXN (QC Lot: 6765986)</b>                                                    |           |                                      |            |                                   |      |                 |                  |         |                    |
| CA2504551-001                                                                            | Anonymous | EP080: Benzene                       | 71-43-2    | 1                                 | µg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                                          |           | EP080: Toluene                       | 108-88-3   | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           | EP080: Ethylbenzene                  | 100-41-4   | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           | EP080: meta- & para-Xylene           | 108-38-3   | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           |                                      | 106-42-3   |                                   |      |                 |                  |         |                    |
|                                                                                          |           | EP080: ortho-Xylene                  | 95-47-6    | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
| CA2504551-006                                                                            | Anonymous | EP080: Naphthalene                   | 91-20-3    | 5                                 | µg/L | <5              | <5               | 0.0     | No Limit           |
|                                                                                          |           | EP080: Benzene                       | 71-43-2    | 1                                 | µg/L | <1              | <1               | 0.0     | No Limit           |
|                                                                                          |           | EP080: Toluene                       | 108-88-3   | 2                                 | µg/L | 24              | 24               | 0.0     | 0% - 50%           |
|                                                                                          |           | EP080: Ethylbenzene                  | 100-41-4   | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           | EP080: meta- & para-Xylene           | 108-38-3   | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           |                                      | 106-42-3   |                                   |      |                 |                  |         |                    |
|                                                                                          |           | EP080: ortho-Xylene                  | 95-47-6    | 2                                 | µg/L | <2              | <2               | 0.0     | No Limit           |
|                                                                                          |           | EP080: Naphthalene                   | 91-20-3    | 5                                 | µg/L | <5              | <5               | 0.0     | No Limit           |



## Method Blank (MB) and Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                  |            |      |         | Method Blank (MB)<br>Report | Laboratory Control Spike (LCS) Report |                           |                                   |      |
|--------------------------------------------------------------------|------------|------|---------|-----------------------------|---------------------------------------|---------------------------|-----------------------------------|------|
|                                                                    |            |      |         |                             | Spike<br>Concentration                | Spike Recovery (%)<br>LCS | Acceptable Limits (%)<br>Low High |      |
| Method: Compound                                                   | CAS Number | LOR  | Unit    | Result                      |                                       |                           |                                   |      |
| ED009: Anions (QCLot: 6766382)                                     |            |      |         |                             |                                       |                           |                                   |      |
| ED009-X: Bromide                                                   | 24959-67-9 | 0.01 | mg/L    | <0.010                      | 2 mg/L                                | 103                       | 93.0                              | 109  |
| ED009-X: Iodide                                                    | 20461-54-5 | 0.01 | mg/L    | <0.010                      | 0.5 mg/L                              | 79.8                      | 79.0                              | 123  |
| EA005P: pH by PC Titrator (QCLot: 6764629)                         |            |      |         |                             |                                       |                           |                                   |      |
| EA005-P: pH Value                                                  | ----       | ---- | pH Unit | ----                        | 4 pH Unit                             | 99.8                      | 98.8                              | 101  |
|                                                                    |            |      |         | ----                        | 7 pH Unit                             | 100                       | 99.2                              | 101  |
| EA010P: Conductivity by PC Titrator (QCLot: 6764631)               |            |      |         |                             |                                       |                           |                                   |      |
| EA010-P: Electrical Conductivity @ 25°C                            | ----       | 1    | µS/cm   | <1                          | 220 µS/cm                             | 102                       | 89.9                              | 110  |
|                                                                    |            |      |         | <1                          | 2100 µS/cm                            | 96.4                      | 90.2                              | 111  |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 6772203) |            |      |         |                             |                                       |                           |                                   |      |
| EA015H: Total Dissolved Solids @180°C                              | ----       | 10   | mg/L    | <10                         | 2000 mg/L                             | 97.1                      | 87.0                              | 109  |
|                                                                    |            |      |         | <10                         | 293 mg/L                              | 116                       | 75.2                              | 126  |
|                                                                    |            |      |         | <10                         | 2420 mg/L                             | 101                       | 83.0                              | 124  |
| EA075: Redox Potential (QCLot: 6764540)                            |            |      |         |                             |                                       |                           |                                   |      |
| EA075: Redox Potential                                             | ----       | ---- | mV      | ----                        | 234 mV                                | 99.4                      | 96.0                              | 106  |
|                                                                    |            |      |         | ----                        | 300 mV                                | 102                       | 97.0                              | 105  |
|                                                                    |            |      |         | ----                        | 86 mV                                 | 107                       | 89.0                              | 111  |
| ED037P: Alkalinity by PC Titrator (QCLot: 6764630)                 |            |      |         |                             |                                       |                           |                                   |      |
| ED037-P: Total Alkalinity as CaCO3                                 | ----       | ---- | mg/L    | ----                        | 200 mg/L                              | 100                       | 81.0                              | 115  |
|                                                                    |            |      |         | ----                        | 50 mg/L                               | 105                       | 80.0                              | 128  |
| ED040F: Dissolved Major Anions (QCLot: 6767871)                    |            |      |         |                             |                                       |                           |                                   |      |
| ED040F: Silicon as SiO2                                            | 14464-46-1 | 0.1  | mg/L    | <0.1                        | ----                                  | ----                      | ----                              | ---- |
| ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6767868)   |            |      |         |                             |                                       |                           |                                   |      |
| ED041G: Sulfate as SO4 - Turbidimetric                             | 14808-79-8 | 1    | mg/L    | <1                          | 25 mg/L                               | 100                       | 82.0                              | 122  |
|                                                                    |            |      |         | <1                          | 500 mg/L                              | 98.0                      | 82.0                              | 122  |
| ED045G: Chloride by Discrete Analyser (QCLot: 6767867)             |            |      |         |                             |                                       |                           |                                   |      |
| ED045G: Chloride                                                   | 16887-00-6 | 1    | mg/L    | <1                          | 50 mg/L                               | 107                       | 80.9                              | 127  |
|                                                                    |            |      |         | <1                          | 1000 mg/L                             | 105                       | 80.9                              | 127  |
| ED093F: Dissolved Major Cations (QCLot: 6767401)                   |            |      |         |                             |                                       |                           |                                   |      |
| ED093F: Calcium                                                    | 7440-70-2  | 1    | mg/L    | <1                          | 50 mg/L                               | 103                       | 80.0                              | 114  |
| ED093F: Magnesium                                                  | 7439-95-4  | 1    | mg/L    | <1                          | 50 mg/L                               | 103                       | 90.0                              | 116  |
| ED093F: Sodium                                                     | 7440-23-5  | 1    | mg/L    | <1                          | 50 mg/L                               | 103                       | 82.0                              | 120  |

| Sub-Matrix: WATER                                                             |            |        |      | Method Blank (MB) Report | Laboratory Control Spike (LCS) Report |                    |                       |      |
|-------------------------------------------------------------------------------|------------|--------|------|--------------------------|---------------------------------------|--------------------|-----------------------|------|
|                                                                               |            |        |      |                          | Spike Concentration                   | Spike Recovery (%) | Acceptable Limits (%) |      |
| Method: Compound                                                              | CAS Number | LOR    | Unit | Result                   |                                       | LCS                | Low                   | High |
| ED093F: Dissolved Major Cations (QCLot: 6767401) - continued                  |            |        |      |                          |                                       |                    |                       |      |
| ED093F: Potassium                                                             | 7440-09-7  | 1      | mg/L | <1                       | 50 mg/L                               | 99.8               | 85.0                  | 113  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 6767399)                           |            |        |      |                          |                                       |                    |                       |      |
| EG020A-F: Aluminium                                                           | 7429-90-5  | 0.01   | mg/L | <0.01                    | 0.5 mg/L                              | 106                | 80.0                  | 116  |
| EG020A-F: Antimony                                                            | 7440-36-0  | 0.001  | mg/L | <0.001                   | 0.02 mg/L                             | 105                | 70.0                  | 130  |
| EG020A-F: Arsenic                                                             | 7440-38-2  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 94.2               | 85.0                  | 114  |
| EG020A-F: Beryllium                                                           | 7440-41-7  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 90.6               | 85.0                  | 115  |
| EG020A-F: Barium                                                              | 7440-39-3  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 94.1               | 82.0                  | 110  |
| EG020A-F: Cadmium                                                             | 7440-43-9  | 0.0001 | mg/L | <0.0001                  | 0.1 mg/L                              | 94.0               | 84.0                  | 110  |
| EG020A-F: Chromium                                                            | 7440-47-3  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 98.7               | 85.0                  | 111  |
| EG020A-F: Cobalt                                                              | 7440-48-4  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 92.5               | 82.0                  | 112  |
| EG020A-F: Copper                                                              | 7440-50-8  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 93.6               | 81.0                  | 111  |
| EG020A-F: Lead                                                                | 7439-92-1  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 91.5               | 83.0                  | 111  |
| EG020A-F: Lithium                                                             | 7439-93-2  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 93.2               | 79.0                  | 117  |
| EG020A-F: Manganese                                                           | 7439-96-5  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 99.3               | 82.0                  | 110  |
| EG020A-F: Molybdenum                                                          | 7439-98-7  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 98.6               | 79.0                  | 113  |
| EG020A-F: Nickel                                                              | 7440-02-0  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 94.4               | 82.0                  | 112  |
| EG020A-F: Selenium                                                            | 7782-49-2  | 0.01   | mg/L | <0.01                    | 0.1 mg/L                              | 97.1               | 85.0                  | 115  |
| EG020A-F: Vanadium                                                            | 7440-62-2  | 0.01   | mg/L | <0.01                    | 0.1 mg/L                              | 97.6               | 83.0                  | 109  |
| EG020A-F: Zinc                                                                | 7440-66-6  | 0.005  | mg/L | <0.005                   | 0.1 mg/L                              | 98.0               | 81.0                  | 117  |
| EG020A-F: Boron                                                               | 7440-42-8  | 0.05   | mg/L | <0.05                    | 0.5 mg/L                              | 102                | 85.0                  | 115  |
| EG020A-F: Iron                                                                | 7439-89-6  | 0.05   | mg/L | <0.05                    | 0.5 mg/L                              | 95.9               | 82.0                  | 112  |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 6767400)                           |            |        |      |                          |                                       |                    |                       |      |
| EG020B-F: Silver                                                              | 7440-22-4  | 0.001  | mg/L | <0.001                   | 0.02 mg/L                             | 79.8               | 70.0                  | 130  |
| EG020B-F: Strontium                                                           | 7440-24-6  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 92.1               | 81.0                  | 113  |
| EG020B-F: Uranium                                                             | 7440-61-1  | 0.001  | mg/L | <0.001                   | 0.1 mg/L                              | 94.9               | 85.0                  | 115  |
| EG035F: Dissolved Mercury by FIMS (QCLot: 6767402)                            |            |        |      |                          |                                       |                    |                       |      |
| EG035F: Mercury                                                               | 7439-97-6  | 0.0001 | mg/L | <0.0001                  | 0.01 mg/L                             | 98.0               | 83.0                  | 105  |
| EK040P: Fluoride by PC Titrator (QCLot: 6764633)                              |            |        |      |                          |                                       |                    |                       |      |
| EK040P: Fluoride                                                              | 16984-48-8 | 0.1    | mg/L | <0.1                     | 5 mg/L                                | 93.4               | 82.0                  | 116  |
| EK055G: Ammonia as N by Discrete Analyser (QCLot: 6767901)                    |            |        |      |                          |                                       |                    |                       |      |
| EK055G: Ammonia as N                                                          | 7664-41-7  | 0.01   | mg/L | <0.01                    | 0.5 mg/L                              | 100                | 90.0                  | 114  |
| EK057G: Nitrite as N by Discrete Analyser (QCLot: 6767866)                    |            |        |      |                          |                                       |                    |                       |      |
| EK057G: Nitrite as N                                                          | 14797-65-0 | 0.01   | mg/L | <0.01                    | 0.5 mg/L                              | 103                | 82.0                  | 114  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6767900) |            |        |      |                          |                                       |                    |                       |      |

| Sub-Matrix: WATER                                                                         |            |      |      | Method Blank (MB)<br>Report | Laboratory Control Spike (LCS) Report |                           |                                   |      |
|-------------------------------------------------------------------------------------------|------------|------|------|-----------------------------|---------------------------------------|---------------------------|-----------------------------------|------|
| Method: Compound                                                                          | CAS Number | LOR  | Unit | Result                      | Spike<br>Concentration                | Spike Recovery (%)<br>LCS | Acceptable Limits (%)<br>Low High |      |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6767900) - continued |            |      |      |                             |                                       |                           |                                   |      |
| EK059G: Nitrite + Nitrate as N                                                            | ----       | 0.01 | mg/L | <0.01                       | 0.5 mg/L                              | 98.3                      | 91.0                              | 113  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6767893)                     |            |      |      |                             |                                       |                           |                                   |      |
| EK061G: Total Kjeldahl Nitrogen as N                                                      | ----       | 0.1  | mg/L | <0.1                        | 5 mg/L                                | 87.3                      | 69.0                              | 123  |
|                                                                                           |            |      |      | <0.1                        | 2.5 mg/L                              | 87.6                      | 70.0                              | 123  |
| EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6767894)                       |            |      |      |                             |                                       |                           |                                   |      |
| EK067G: Total Phosphorus as P                                                             | ----       | 0.01 | mg/L | <0.01                       | 2.21 mg/L                             | 93.8                      | 71.3                              | 126  |
|                                                                                           |            |      |      | <0.01                       | 0.5 mg/L                              | 75.0                      | 71.3                              | 126  |
| EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 6767869)                    |            |      |      |                             |                                       |                           |                                   |      |
| EK071G: Reactive Phosphorus as P                                                          | 14265-44-2 | 0.01 | mg/L | <0.01                       | 0.5 mg/L                              | 107                       | 85.0                              | 117  |
| EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 6764868)                           |            |      |      |                             |                                       |                           |                                   |      |
| EP075(SIM): Naphthalene                                                                   | 91-20-3    | 1    | µg/L | <1.0                        | 5 µg/L                                | 74.3                      | 50.0                              | 94.0 |
| EP075(SIM): Acenaphthylene                                                                | 208-96-8   | 1    | µg/L | <1.0                        | 5 µg/L                                | 78.7                      | 63.6                              | 114  |
| EP075(SIM): Acenaphthene                                                                  | 83-32-9    | 1    | µg/L | <1.0                        | 5 µg/L                                | 81.5                      | 62.2                              | 113  |
| EP075(SIM): Fluorene                                                                      | 86-73-7    | 1    | µg/L | <1.0                        | 5 µg/L                                | 80.7                      | 63.9                              | 115  |
| EP075(SIM): Phenanthrene                                                                  | 85-01-8    | 1    | µg/L | <1.0                        | 5 µg/L                                | 114                       | 62.6                              | 116  |
| EP075(SIM): Anthracene                                                                    | 120-12-7   | 1    | µg/L | <1.0                        | 5 µg/L                                | 93.2                      | 64.3                              | 116  |
| EP075(SIM): Fluoranthene                                                                  | 206-44-0   | 1    | µg/L | <1.0                        | 5 µg/L                                | 95.4                      | 63.6                              | 118  |
| EP075(SIM): Pyrene                                                                        | 129-00-0   | 1    | µg/L | <1.0                        | 5 µg/L                                | 97.1                      | 63.1                              | 118  |
| EP075(SIM): Benz(a)anthracene                                                             | 56-55-3    | 1    | µg/L | <1.0                        | 5 µg/L                                | 84.8                      | 64.1                              | 117  |
| EP075(SIM): Chrysene                                                                      | 218-01-9   | 1    | µg/L | <1.0                        | 5 µg/L                                | 91.8                      | 62.5                              | 116  |
| EP075(SIM): Benzo(b+j)fluoranthene                                                        | 205-99-2   | 1    | µg/L | <1.0                        | 5 µg/L                                | 64.7                      | 61.7                              | 119  |
|                                                                                           | 205-82-3   |      |      |                             |                                       |                           |                                   |      |
| EP075(SIM): Benzo(k)fluoranthene                                                          | 207-08-9   | 1    | µg/L | <1.0                        | 5 µg/L                                | 73.8                      | 63.0                              | 115  |
| EP075(SIM): Benzo(a)pyrene                                                                | 50-32-8    | 0.5  | µg/L | <0.5                        | 5 µg/L                                | 92.7                      | 63.3                              | 117  |
| EP075(SIM): Indeno(1,2,3.cd)pyrene                                                        | 193-39-5   | 1    | µg/L | <1.0                        | 5 µg/L                                | 79.9                      | 59.9                              | 118  |
| EP075(SIM): Dibenz(a,h)anthracene                                                         | 53-70-3    | 1    | µg/L | <1.0                        | 5 µg/L                                | 81.0                      | 61.2                              | 117  |
| EP075(SIM): Benzo(g,h,i)perylene                                                          | 191-24-2   | 1    | µg/L | <1.0                        | 5 µg/L                                | 78.0                      | 59.1                              | 118  |
| EP080/071: Total Petroleum Hydrocarbons (QCLot: 6764869)                                  |            |      |      |                             |                                       |                           |                                   |      |
| EP071: C10 - C14 Fraction                                                                 | ----       | 50   | µg/L | <50                         | 400 µg/L                              | 76.8                      | 53.7                              | 97.0 |
| EP071: C15 - C28 Fraction                                                                 | ----       | 100  | µg/L | <100                        | 600 µg/L                              | 95.4                      | 63.3                              | 107  |
| EP071: C29 - C36 Fraction                                                                 | ----       | 50   | µg/L | <50                         | 400 µg/L                              | 101                       | 58.3                              | 120  |
| EP080/071: Total Petroleum Hydrocarbons (QCLot: 6765986)                                  |            |      |      |                             |                                       |                           |                                   |      |
| EP080: C6 - C9 Fraction                                                                   | ----       | 20   | µg/L | <20                         | 260 µg/L                              | 95.6                      | 75.0                              | 127  |
| EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6764869)          |            |      |      |                             |                                       |                           |                                   |      |



Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                                            |                      |     |      | Method Blank (MB)<br>Report | Laboratory Control Spike (LCS) Report |                           |                                        |      |
|----------------------------------------------------------------------------------------------|----------------------|-----|------|-----------------------------|---------------------------------------|---------------------------|----------------------------------------|------|
|                                                                                              |                      |     |      |                             | Spike<br>Concentration                | Spike Recovery (%)<br>LCS | Acceptable Limits (%)<br>Low      High |      |
| Method: Compound                                                                             | CAS Number           | LOR | Unit | Result                      |                                       |                           |                                        |      |
| EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6764869) - continued |                      |     |      |                             |                                       |                           |                                        |      |
| EP071: >C10 - C16 Fraction                                                                   | ----                 | 100 | µg/L | <100                        | 500 µg/L                              | 75.6                      | 53.9                                   | 95.5 |
| EP071: >C16 - C34 Fraction                                                                   | ----                 | 100 | µg/L | <100                        | 700 µg/L                              | 102                       | 57.8                                   | 110  |
| EP071: >C34 - C40 Fraction                                                                   | ----                 | 100 | µg/L | <100                        | 300 µg/L                              | 95.9                      | 50.5                                   | 115  |
| EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6765986)             |                      |     |      |                             |                                       |                           |                                        |      |
| EP080: C6 - C10 Fraction                                                                     | C6_C10               | 20  | µg/L | <20                         | 310 µg/L                              | 92.2                      | 75.0                                   | 127  |
| EP080: BTEXN (QCLot: 6765986)                                                                |                      |     |      |                             |                                       |                           |                                        |      |
| EP080: Benzene                                                                               | 71-43-2              | 1   | µg/L | <1                          | 10 µg/L                               | 96.4                      | 68.3                                   | 119  |
| EP080: Toluene                                                                               | 108-88-3             | 2   | µg/L | <2                          | 10 µg/L                               | 99.8                      | 73.5                                   | 120  |
| EP080: Ethylbenzene                                                                          | 100-41-4             | 2   | µg/L | <2                          | 10 µg/L                               | 103                       | 73.8                                   | 122  |
| EP080: meta- & para-Xylene                                                                   | 108-38-3<br>106-42-3 | 2   | µg/L | <2                          | 10 µg/L                               | 104                       | 73.0                                   | 122  |
| EP080: ortho-Xylene                                                                          | 95-47-6              | 2   | µg/L | <2                          | 10 µg/L                               | 108                       | 76.4                                   | 123  |
| EP080: Naphthalene                                                                           | 91-20-3              | 5   | µg/L | <5                          | 10 µg/L                               | 96.4                      | 75.5                                   | 124  |

## Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

|                                                                         |           |                                        |            | Matrix Spike (MS) Report |                         |                       |      |
|-------------------------------------------------------------------------|-----------|----------------------------------------|------------|--------------------------|-------------------------|-----------------------|------|
|                                                                         |           |                                        |            | Spike<br>Concentration   | Spike Recovery(%)<br>MS | Acceptable Limits (%) |      |
| Laboratory sample ID                                                    | Sample ID | Method: Compound                       | CAS Number |                          |                         | Low                   | High |
| <b>ED009: Anions (QCLot: 6766382)</b>                                   |           |                                        |            |                          |                         |                       |      |
| ES2523743-001                                                           | BH02      | ED009-X: Bromide                       | 24959-67-9 | 0.2 mg/L                 | 71.5                    | 70.0                  | 130  |
|                                                                         |           | ED009-X: Iodide                        | 20461-54-5 | 0.2 mg/L                 | 124                     | 70.0                  | 130  |
| <b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 6767868)</b> |           |                                        |            |                          |                         |                       |      |
| EN2512975-003                                                           | Anonymous | ED041G: Sulfate as SO4 - Turbidimetric | 14808-79-8 | 10 mg/L                  | # Not Determined        | 70.0                  | 130  |
| <b>ED045G: Chloride by Discrete Analyser (QCLot: 6767867)</b>           |           |                                        |            |                          |                         |                       |      |
| EN2512975-003                                                           | Anonymous | ED045G: Chloride                       | 16887-00-6 | 300 mg/L                 | 112                     | 70.0                  | 130  |
| <b>EG020F: Dissolved Metals by ICP-MS (QCLot: 6767399)</b>              |           |                                        |            |                          |                         |                       |      |
| ES2523525-002                                                           | Anonymous | EG020A-F: Arsenic                      | 7440-38-2  | 1 mg/L                   | 93.2                    | 70.0                  | 130  |
|                                                                         |           | EG020A-F: Beryllium                    | 7440-41-7  | 1 mg/L                   | 93.8                    | 70.0                  | 130  |
|                                                                         |           | EG020A-F: Barium                       | 7440-39-3  | 1 mg/L                   | 92.3                    | 70.0                  | 130  |
|                                                                         |           | EG020A-F: Cadmium                      | 7440-43-9  | 0.25 mg/L                | 96.6                    | 70.0                  | 130  |
|                                                                         |           | EG020A-F: Chromium                     | 7440-47-3  | 1 mg/L                   | 98.4                    | 70.0                  | 130  |
|                                                                         |           | EG020A-F: Cobalt                       | 7440-48-4  | 1 mg/L                   | 93.3                    | 70.0                  | 130  |

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 Client : WSP Australia Pty Ltd  
 Project : PS223670



Sub-Matrix: **WATER**

| Sub-Matrix: WATER                                                                |           |                                      |            | Matrix Spike (MS) Report |                  |                       |      |
|----------------------------------------------------------------------------------|-----------|--------------------------------------|------------|--------------------------|------------------|-----------------------|------|
|                                                                                  |           |                                      |            | Spike                    | SpikeRecovery(%) | Acceptable Limits (%) |      |
| Laboratory sample ID                                                             | Sample ID | Method: Compound                     | CAS Number | Concentration            | MS               | Low                   | High |
| EG020F: Dissolved Metals by ICP-MS (QCLot: 6767399) - continued                  |           |                                      |            |                          |                  |                       |      |
| ES2523525-002                                                                    | Anonymous | EG020A-F: Copper                     | 7440-50-8  | 1 mg/L                   | 94.1             | 70.0                  | 130  |
|                                                                                  |           | EG020A-F: Lead                       | 7439-92-1  | 1 mg/L                   | 102              | 70.0                  | 130  |
|                                                                                  |           | EG020A-F: Manganese                  | 7439-96-5  | 1 mg/L                   | 101              | 70.0                  | 130  |
|                                                                                  |           | EG020A-F: Nickel                     | 7440-02-0  | 1 mg/L                   | 94.4             | 70.0                  | 130  |
|                                                                                  |           | EG020A-F: Vanadium                   | 7440-62-2  | 1 mg/L                   | 98.5             | 70.0                  | 130  |
|                                                                                  |           | EG020A-F: Zinc                       | 7440-66-6  | 1 mg/L                   | 96.0             | 70.0                  | 130  |
| EG035F: Dissolved Mercury by FIMS (QCLot: 6767402)                               |           |                                      |            |                          |                  |                       |      |
| ES2523525-003                                                                    | Anonymous | EG035F: Mercury                      | 7439-97-6  | 0.01 mg/L                | 104              | 70.0                  | 130  |
| EK040P: Fluoride by PC Titrator (QCLot: 6764633)                                 |           |                                      |            |                          |                  |                       |      |
| ES2523743-002                                                                    | BH03      | EK040P: Fluoride                     | 16984-48-8 | 5 mg/L                   | 74.8             | 70.0                  | 130  |
| EK055G: Ammonia as N by Discrete Analyser (QCLot: 6767901)                       |           |                                      |            |                          |                  |                       |      |
| ES2523356-001                                                                    | Anonymous | EK055G: Ammonia as N                 | 7664-41-7  | 0.5 mg/L                 | # Not Determined | 70.0                  | 130  |
| EK057G: Nitrite as N by Discrete Analyser (QCLot: 6767866)                       |           |                                      |            |                          |                  |                       |      |
| EN2512975-003                                                                    | Anonymous | EK057G: Nitrite as N                 | 14797-65-0 | 0.5 mg/L                 | 129              | 70.0                  | 130  |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 6767900)    |           |                                      |            |                          |                  |                       |      |
| ES2523356-001                                                                    | Anonymous | EK059G: Nitrite + Nitrate as N       | ----       | 0.5 mg/L                 | 111              | 70.0                  | 130  |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 6767893)            |           |                                      |            |                          |                  |                       |      |
| ES2523525-001                                                                    | Anonymous | EK061G: Total Kjeldahl Nitrogen as N | ----       | 5 mg/L                   | 81.0             | 70.0                  | 130  |
| EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 6767894)              |           |                                      |            |                          |                  |                       |      |
| ES2523525-001                                                                    | Anonymous | EK067G: Total Phosphorus as P        | ----       | 1 mg/L                   | 72.6             | 70.0                  | 130  |
| EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 6767869)           |           |                                      |            |                          |                  |                       |      |
| EN2512975-003                                                                    | Anonymous | EK071G: Reactive Phosphorus as P     | 14265-44-2 | 0.5 mg/L                 | 119              | 70.0                  | 130  |
| EP080/071: Total Petroleum Hydrocarbons (QCLot: 6765986)                         |           |                                      |            |                          |                  |                       |      |
| CA2504551-001                                                                    | Anonymous | EP080: C6 - C9 Fraction              | ----       | 325 µg/L                 | 118              | 70.0                  | 130  |
| EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 6765986) |           |                                      |            |                          |                  |                       |      |
| CA2504551-001                                                                    | Anonymous | EP080: C6 - C10 Fraction             | C6_C10     | 375 µg/L                 | 110              | 70.0                  | 130  |
| EP080: BTEXN (QCLot: 6765986)                                                    |           |                                      |            |                          |                  |                       |      |
| CA2504551-001                                                                    | Anonymous | EP080: Benzene                       | 71-43-2    | 25 µg/L                  | 99.5             | 70.0                  | 130  |
|                                                                                  |           | EP080: Toluene                       | 108-88-3   | 25 µg/L                  | 102              | 70.0                  | 130  |
|                                                                                  |           | EP080: Ethylbenzene                  | 100-41-4   | 25 µg/L                  | 107              | 70.0                  | 130  |
|                                                                                  |           | EP080: meta- & para-Xylene           | 108-38-3   | 25 µg/L                  | 106              | 70.0                  | 130  |
|                                                                                  |           |                                      | 106-42-3   |                          |                  |                       |      |
|                                                                                  |           | EP080: ortho-Xylene                  | 95-47-6    | 25 µg/L                  | 113              | 70.0                  | 130  |
|                                                                                  |           | EP080: Naphthalene                   | 91-20-3    | 25 µg/L                  | 108              | 70.0                  | 130  |





## QA/QC Compliance Assessment to assist with Quality Review

|              |                         |                         |                                 |
|--------------|-------------------------|-------------------------|---------------------------------|
| Work Order   | : ES2523743             | Page                    | : 1 of 11                       |
| Client       | : WSP Australia Pty Ltd | Laboratory              | : Environmental Division Sydney |
| Contact      | : Callum Fisher         | Telephone               | : +61-2-8784 8555               |
| Project      | : PS223670              | Date Samples Received   | : 04-Aug-2025                   |
| Site         | : ----                  | Issue Date              | : 11-Aug-2025                   |
| Sampler      | : DAVID HUGHES          | No. of samples received | : 4                             |
| Order number | : PS223670              | No. of samples analysed | : 4                             |

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, where applicable to the methodology, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

#### Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



### Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

| Compound Group Name                                         | Laboratory Sample ID | Client Sample ID | Analyte                                    | CAS Number | Data           | Limits | Comment                                                                               |
|-------------------------------------------------------------|----------------------|------------------|--------------------------------------------|------------|----------------|--------|---------------------------------------------------------------------------------------|
| <b>Matrix Spike (MS) Recoveries</b>                         |                      |                  |                                            |            |                |        |                                                                                       |
| ED041G: Sulfate (Turbidimetric) as SO <sub>4</sub> 2- by DA | EN2512975--003       | Anonymous        | Sulfate as SO <sub>4</sub> - Turbidimetric | 14808-79-8 | Not Determined | ----   | MS recovery not determined, background level greater than or equal to 4x spike level. |
| EK055G: Ammonia as N by Discrete Analyser                   | ES2523356--001       | Anonymous        | Ammonia as N                               | 7664-41-7  | Not Determined | ----   | MS recovery not determined, background level greater than or equal to 4x spike level. |

### Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

| Method                                                      |  | Extraction / Preparation |                    |              | Analysis      |                  |              |
|-------------------------------------------------------------|--|--------------------------|--------------------|--------------|---------------|------------------|--------------|
| Container / Client Sample ID(s)                             |  | Date extracted           | Due for extraction | Days overdue | Date analysed | Due for analysis | Days overdue |
| <b>EK055G: Ammonia as N by Discrete Analyser</b>            |  |                          |                    |              |               |                  |              |
| Clear Plastic Bottle - Natural<br>BH02, BH03                |  | ----                     | ----               | ----         | 06-Aug-2025   | 05-Aug-2025      | 1            |
| <b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b> |  |                          |                    |              |               |                  |              |
| Clear Plastic Bottle - Natural<br>BH02, BH03                |  | 06-Aug-2025              | 05-Aug-2025        | 1            | ----          | ----             | ----         |
| <b>EP025: Oxygen - Dissolved (DO)</b>                       |  |                          |                    |              |               |                  |              |
| Clear Plastic Bottle - Natural<br>BH02, BH03                |  | ----                     | ----               | ----         | 05-Aug-2025   | 04-Aug-2025      | 1            |

### Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

| Quality Control Sample Type      |            | Count |         | Rate (%) |          | Quality Control Specification  |
|----------------------------------|------------|-------|---------|----------|----------|--------------------------------|
| Analytical Methods               | Method     | QC    | Regular | Actual   | Expected |                                |
| Laboratory Duplicates (DUP)      |            |       |         |          |          |                                |
| PAH/Phenols (GC/MS - SIM)        | EP075(SIM) | 0     | 17      | 0.00     | 10.00    | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction      | EP071      | 0     | 17      | 0.00     | 10.00    | NEPM 2013 B3 & ALS QC Standard |
| Laboratory Control Samples (LCS) |            |       |         |          |          |                                |
| Major Anions - Dissolved         | ED040F     | 0     | 4       | 0.00     | 5.00     | NEPM 2013 B3 & ALS QC Standard |
| Matrix Spikes (MS)               |            |       |         |          |          |                                |
| PAH/Phenols (GC/MS - SIM)        | EP075(SIM) | 0     | 17      | 0.00     | 5.00     | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction      | EP071      | 0     | 17      | 0.00     | 5.00     | NEPM 2013 B3 & ALS QC Standard |



## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

| Method                                                                 | Sample Date | Extraction / Preparation |                    |            | Analysis      |                  |            |
|------------------------------------------------------------------------|-------------|--------------------------|--------------------|------------|---------------|------------------|------------|
| Container / Client Sample ID(s)                                        |             | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| EA005P: pH by PC Titrator                                              |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EA005-P)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 04-Aug-2025   | 04-Aug-2025      | ✓          |
| EA010P: Conductivity by PC Titrator                                    |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EA010-P)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 04-Aug-2025   | 01-Sep-2025      | ✓          |
| EA015: Total Dissolved Solids dried at 180 ± 5 °C                      |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EA015H)<br>BH02, BH03                  | 04-Aug-2025 | ----                     | ----               | ----       | 07-Aug-2025   | 11-Aug-2025      | ✓          |
| EA075: Redox Potential                                                 |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EA075)<br>BH02, BH03                   | 04-Aug-2025 | ----                     | ----               | ----       | 04-Aug-2025   | 04-Aug-2025      | ✓          |
| ED009: Anions                                                          |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (ED009-X)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 05-Aug-2025   | 01-Sep-2025      | ✓          |
| ED037P: Alkalinity by PC Titrator                                      |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (ED037-P)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 04-Aug-2025   | 18-Aug-2025      | ✓          |
| ED040F: Dissolved Major Anions                                         |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (ED040F)<br>BH02, BH03                  | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 01-Sep-2025      | ✓          |
| ED041G: Sulfate (Turbidimetric) as SO <sub>4</sub> <sup>2-</sup> by DA |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (ED041G)<br>BH02, BH03                  | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 01-Sep-2025      | ✓          |
| ED045G: Chloride by Discrete Analyser                                  |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (ED045G)<br>BH02, BH03                  | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 01-Sep-2025      | ✓          |
| ED093F: Dissolved Major Cations                                        |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>BH02, BH03    | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 01-Sep-2025      | ✓          |
| ED093F: SAR and Hardness Calculations                                  |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)<br>BH02, BH03    | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 01-Sep-2025      | ✓          |

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 Client : WSP Australia Pty Ltd  
 Project : PS223670



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

| Method                                                                | Sample Date | Extraction / Preparation |                    |            | Analysis      |                  |            |
|-----------------------------------------------------------------------|-------------|--------------------------|--------------------|------------|---------------|------------------|------------|
| Container / Client Sample ID(s)                                       |             | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| EG020F: Dissolved Metals by ICP-MS                                    |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)<br>BH02, BH03 | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 31-Jan-2026      | ✓          |
| EG035F: Dissolved Mercury by FIMS                                     |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)<br>BH02, BH03   | 04-Aug-2025 | ----                     | ----               | ----       | 07-Aug-2025   | 01-Sep-2025      | ✓          |
| EK040P: Fluoride by PC Titrator                                       |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK040P)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 04-Aug-2025   | 01-Sep-2025      | ✓          |
| EK055G: Ammonia as N by Discrete Analyser                             |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK055G)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 05-Aug-2025      | ✗          |
| EK057G: Nitrite as N by Discrete Analyser                             |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK057G)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 06-Aug-2025      | ✓          |
| EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser          |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK059G)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 06-Aug-2025      | ✓          |
| EK061G: Total Kjeldahl Nitrogen By Discrete Analyser                  |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK061G)<br>BH02, BH03                 | 04-Aug-2025 | 06-Aug-2025              | 05-Aug-2025        | ✗          | 06-Aug-2025   | 03-Sep-2025      | ✓          |
| EK067G: Total Phosphorus as P by Discrete Analyser                    |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK067G)<br>BH02, BH03                 | 04-Aug-2025 | 06-Aug-2025              | 06-Aug-2025        | ✓          | 06-Aug-2025   | 03-Sep-2025      | ✓          |
| EK071G: Reactive Phosphorus as P by discrete analyser                 |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EK071G)<br>BH02, BH03                 | 04-Aug-2025 | ----                     | ----               | ----       | 06-Aug-2025   | 06-Aug-2025      | ✓          |
| EP025: Oxygen - Dissolved (DO)                                        |             |                          |                    |            |               |                  |            |
| Clear Plastic Bottle - Natural (EP025)<br>BH02, BH03                  | 04-Aug-2025 | ----                     | ----               | ----       | 05-Aug-2025   | 04-Aug-2025      | ✗          |
| EP075(SIM)B: Polynuclear Aromatic Hydrocarbons                        |             |                          |                    |            |               |                  |            |
| Amber Glass Bottle - Unpreserved (EP075(SIM))<br>BH02, BH03           | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 06-Aug-2025   | 14-Sep-2025      | ✓          |
| EP080/071: Total Petroleum Hydrocarbons                               |             |                          |                    |            |               |                  |            |
| Amber Glass Bottle - Unpreserved (EP080)<br>BH02, BH03                | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |
| Amber Glass Bottle - Unpreserved (EP071)<br>BH02, BH03                | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 06-Aug-2025   | 14-Sep-2025      | ✓          |
| Amber VOC Vial - Sulfuric Acid (EP080)<br>Trip blank                  | 28-Jul-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |



Matrix: **WATER** Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

| Method                                                            | Sample Date | Extraction / Preparation |                    |            | Analysis      |                  |            |  |
|-------------------------------------------------------------------|-------------|--------------------------|--------------------|------------|---------------|------------------|------------|--|
| Container / Client Sample ID(s)                                   |             | Date extracted           | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |  |
| EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions   |             |                          |                    |            |               |                  |            |  |
| Amber Glass Bottle - Unpreserved (EP080)<br>BH02, BH03            | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |  |
| Amber Glass Bottle - Unpreserved (EP071)<br>BH02, BH03            | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 06-Aug-2025   | 14-Sep-2025      | ✓          |  |
| Amber VOC Vial - Sulfuric Acid (EP080)<br>Trip blank              | 28-Jul-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |  |
| EP080: BTEXN                                                      |             |                          |                    |            |               |                  |            |  |
| Amber Glass Bottle - Unpreserved (EP080)<br>BH02, BH03            | 04-Aug-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |  |
| Amber VOC Vial - Sulfuric Acid (EP080)<br>Trip spike, Trip blank  | 28-Jul-2025 | 05-Aug-2025              | 11-Aug-2025        | ✓          | 05-Aug-2025   | 11-Aug-2025      | ✓          |  |
| MW006: Thermotolerant Coliforms & E.coli by MF                    |             |                          |                    |            |               |                  |            |  |
| Sterile Plastic Bottle - Sodium Thiosulfate (MW006)<br>BH02, BH03 | 04-Aug-2025 | ----                     | ----               | ----       | 05-Aug-2025   | 05-Aug-2025      | ✓          |  |
| MW013: Faecal Streptococci by MF                                  |             |                          |                    |            |               |                  |            |  |
| Sterile Plastic Bottle - Sodium Thiosulfate (MW013)<br>BH02, BH03 | 04-Aug-2025 | ----                     | ----               | ----       | 05-Aug-2025   | 05-Aug-2025      | ✓          |  |



## Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

| Quality Control Sample Type                            |            | Count |         | Rate (%) |          |            | Quality Control Specification  |
|--------------------------------------------------------|------------|-------|---------|----------|----------|------------|--------------------------------|
| Analytical Methods                                     | Method     | QC    | Regular | Actual   | Expected | Evaluation |                                |
| Laboratory Duplicates (DUP)                            |            |       |         |          |          |            |                                |
| Alkalinity by Auto Titrator                            | ED037-P    | 2     | 12      | 16.67    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Ammonia as N by Discrete analyser                      | EK055G     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G     | 2     | 16      | 12.50    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Conductivity by Auto Titrator                          | EA010-P    | 2     | 16      | 12.50    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS                              | EG035F     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F   | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B                   | EG020B-F   | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by Auto Titrator                              | EK040P     | 1     | 2       | 50.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Anions - Dissolved                               | ED040F     | 1     | 4       | 25.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser                      | EK057G     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM)                              | EP075(SIM) | 0     | 17      | 0.00     | 10.00    | ✗          | NEPM 2013 B3 & ALS QC Standard |
| pH by Auto Titrator                                    | EA005-P    | 2     | 19      | 10.53    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Redox Potential                                        | EA075      | 1     | 2       | 50.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Standard Anions -by IC (Extended Method)               | ED009-X    | 1     | 2       | 50.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G     | 2     | 16      | 12.50    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Dissolved Solids (High Level)                    | EA015H     | 1     | 7       | 14.29    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G     | 2     | 20      | 10.00    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser             | EK067G     | 2     | 18      | 11.11    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction                            | EP071      | 0     | 17      | 0.00     | 10.00    | ✗          | NEPM 2013 B3 & ALS QC Standard |
| TRH Volatiles/BTEX                                     | EP080      | 2     | 13      | 15.38    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Laboratory Control Samples (LCS)                       |            |       |         |          |          |            |                                |
| Alkalinity by Auto Titrator                            | ED037-P    | 2     | 12      | 16.67    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Ammonia as N by Discrete analyser                      | EK055G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G     | 2     | 16      | 12.50    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Conductivity by Auto Titrator                          | EA010-P    | 2     | 16      | 12.50    | 8.33     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS                              | EG035F     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B                   | EG020B-F   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by Auto Titrator                              | EK040P     | 1     | 2       | 50.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Anions - Dissolved                               | ED040F     | 0     | 4       | 0.00     | 5.00     | ✗          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser                      | EK057G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |



Matrix: **WATER**

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

| Quality Control Sample Type                            |            | Count |         | Rate (%) |          |            | Quality Control Specification  |
|--------------------------------------------------------|------------|-------|---------|----------|----------|------------|--------------------------------|
| Analytical Methods                                     | Method     | QC    | Regular | Actual   | Expected | Evaluation |                                |
| Laboratory Control Samples (LCS) - Continued           |            |       |         |          |          |            |                                |
| PAH/Phenols (GC/MS - SIM)                              | EP075(SIM) | 1     | 17      | 5.88     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| pH by Auto Titrator                                    | EA005-P    | 2     | 19      | 10.53    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Redox Potential                                        | EA075      | 3     | 2       | 150.00   | 15.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Standard Anions -by IC (Extended Method)               | ED009-X    | 1     | 2       | 50.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G     | 2     | 16      | 12.50    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Dissolved Solids (High Level)                    | EA015H     | 3     | 7       | 42.86    | 12.50    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G     | 3     | 20      | 15.00    | 15.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser             | EK067G     | 2     | 18      | 11.11    | 10.00    | ✓          | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction                            | EP071      | 1     | 17      | 5.88     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| TRH Volatiles/BTEX                                     | EP080      | 1     | 13      | 7.69     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Method Blanks (MB)                                     |            |       |         |          |          |            |                                |
| Ammonia as N by Discrete analyser                      | EK055G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G     | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Conductivity by Auto Titrator                          | EA010-P    | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS                              | EG035F     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B                   | EG020B-F   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by Auto Titrator                              | EK040P     | 1     | 2       | 50.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Anions - Dissolved                               | ED040F     | 1     | 4       | 25.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved                              | ED093F     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser                      | EK057G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM)                              | EP075(SIM) | 1     | 17      | 5.88     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Standard Anions -by IC (Extended Method)               | ED009-X    | 1     | 2       | 50.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G     | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Dissolved Solids (High Level)                    | EA015H     | 1     | 7       | 14.29    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser             | EK067G     | 1     | 18      | 5.56     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction                            | EP071      | 1     | 17      | 5.88     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| TRH Volatiles/BTEX                                     | EP080      | 1     | 13      | 7.69     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Matrix Spikes (MS)                                     |            |       |         |          |          |            |                                |
| Ammonia as N by Discrete analyser                      | EK055G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser                          | ED045G     | 1     | 16      | 6.25     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS                              | EG035F     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F   | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Fluoride by Auto Titrator                              | EK040P     | 1     | 2       | 50.00    | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser    | EK059G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser                      | EK057G     | 1     | 20      | 5.00     | 5.00     | ✓          | NEPM 2013 B3 & ALS QC Standard |



Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification .

| Quality Control Sample Type                            |            | Count |         | Rate (%) |          |            | Quality Control Specification  |
|--------------------------------------------------------|------------|-------|---------|----------|----------|------------|--------------------------------|
| Analytical Methods                                     | Method     | QC    | Regular | Actual   | Expected | Evaluation |                                |
| Matrix Spikes (MS) - Continued                         |            |       |         |          |          |            |                                |
| PAH/Phenols (GC/MS - SIM)                              | EP075(SIM) | 0     | 17      | 0.00     | 5.00     | ✖          | NEPM 2013 B3 & ALS QC Standard |
| Reactive Phosphorus as P-By Discrete Analyser          | EK071G     | 1     | 20      | 5.00     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Standard Anions -by IC (Extended Method)               | ED009-X    | 1     | 2       | 50.00    | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G     | 1     | 16      | 6.25     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser      | EK061G     | 1     | 20      | 5.00     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser             | EK067G     | 1     | 18      | 5.56     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |
| TRH - Semivolatile Fraction                            | EP071      | 0     | 17      | 0.00     | 5.00     | ✖          | NEPM 2013 B3 & ALS QC Standard |
| TRH Volatiles/BTEX                                     | EP080      | 1     | 13      | 7.69     | 5.00     | ✔          | NEPM 2013 B3 & ALS QC Standard |



## Brief Method Summaries

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

| Analytical Methods                                     | Method   | Matrix | Method Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------|----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pH by Auto Titrator                                    | EA005-P  | WATER  | In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                             |
| Conductivity by Auto Titrator                          | EA010-P  | WATER  | In house: Referenced to APHA 2510 B. This procedure determines conductivity by automated ISE. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                       |
| Total Dissolved Solids (High Level)                    | EA015H   | WATER  | In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM Schedule B(3)                                                                                                                          |
| Redox Potential                                        | EA075    | WATER  | In house: Ion selective electrode                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Standard Anions -by IC (Extended Method)               | ED009-X  | WATER  | In house: Referenced to APHA 4110B. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                 |
| Alkalinity by Auto Titrator                            | ED037-P  | WATER  | In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. Auto Titrator) on a settled supernatant aliquot of the sample using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                   |
| Major Anions - Dissolved                               | ED040F   | WATER  | In house: Referenced to APHA 3120. The 0.45µm filtered samples are determined by ICP/AES for Sulfur and/or Silicon content and reported as Sulfate and/or Silica after conversion by gravimetric factor.                                                                                                                                                                                                                                                             |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G   | WATER  | In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)                                     |
| Chloride by Discrete Analyser                          | ED045G   | WATER  | In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm.                                                                                                                                      |
| Major Cations - Dissolved                              | ED093F   | WATER  | In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3) |
| Dissolved Metals by ICP-MS - Suite A                   | EG020A-F | WATER  | In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.                                                |
| Dissolved Metals by ICP-MS - Suite B                   | EG020B-F | WATER  | In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.                                                |



| Analytical Methods                                               | Method       | Matrix | Method Descriptions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------|--------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dissolved Mercury by FIMS                                        | EG035F       | WATER  | In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl <sub>2</sub> )(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl <sub>2</sub> which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3). |
| Fluoride by Auto Titrator                                        | EK040P       | WATER  | In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                             |
| Ammonia as N by Discrete analyser                                | EK055G       | WATER  | In house: Referenced to APHA 4500-NH <sub>3</sub> G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Nitrite as N by Discrete Analyser                                | EK057G       | WATER  | In house: Referenced to APHA 4500-NO <sub>2</sub> - B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                                             |
| Nitrate as N by Discrete Analyser                                | EK058G       | WATER  | In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                             |
| Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser | EK059G       | WATER  | In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Combined oxidised Nitrogen (NO <sub>2</sub> +NO <sub>3</sub> ) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                               |
| Total Kjeldahl Nitrogen as N By Discrete Analyser                | EK061G       | WATER  | In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                           |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser             | EK062G       | WATER  | In house: Referenced to APHA 4500-Norg / 4500-NO <sub>3</sub> -. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Total Phosphorus as P By Discrete Analyser                       | EK067G       | WATER  | In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                          |
| Reactive Phosphorus as P-By Discrete Analyser                    | EK071G       | WATER  | In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with orthophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                |
| Ionic Balance by PCT DA and Turbi SO4 DA                         | * EN055 - PG | WATER  | In house: Referenced to APHA 1030E. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Oxygen - Dissolved                                               | EP025        | WATER  | In house: Referenced to APHA 4500-O G. Dissolved Oxygen Probe. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TRH - Semivolatile Fraction                                      | EP071        | WATER  | In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)                                                                                                                                                                                                                                                                                                     |

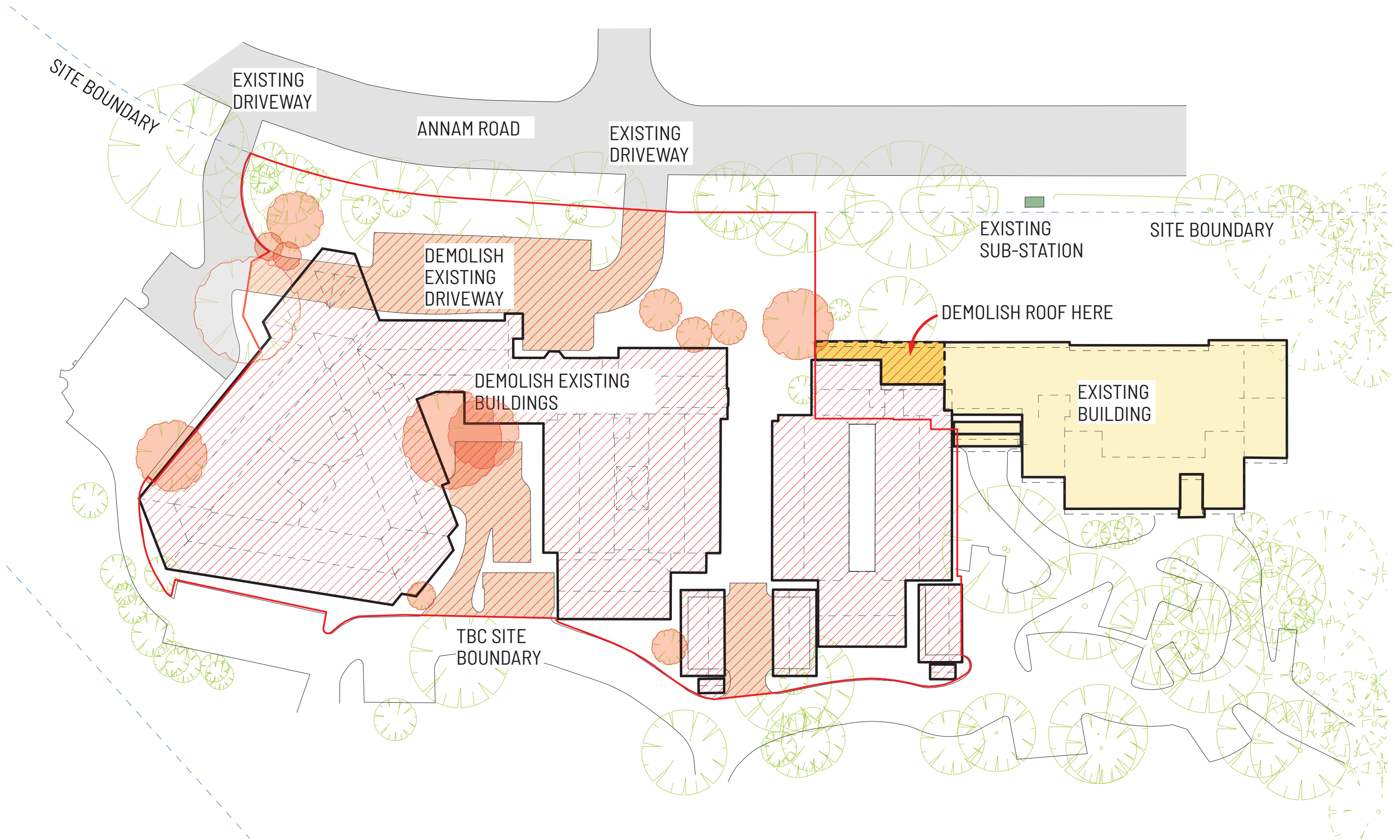


| <i>Analytical Methods</i>                                | <i>Method</i> | <i>Matrix</i> | <i>Method Descriptions</i>                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------|---------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PAH/Phenols (GC/MS - SIM)                                | EP075(SIM)    | WATER         | In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)                                                                                                                                                           |
| TRH Volatiles/BTEX                                       | EP080         | WATER         | In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3) |
| Thermotolerant Coliforms & E.coli by Membrane Filtration | MW006         | WATER         | AS 4276.5                                                                                                                                                                                                                                                                                                                                                                                                |
| Faecal Streptococci by Membrane Filtration               | MW013         | WATER         | APHA 9230A                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>Preparation Methods</i>                               | <i>Method</i> | <i>Matrix</i> | <i>Method Descriptions</i>                                                                                                                                                                                                                                                                                                                                                                               |
| TKN/TP Digestion                                         | EK061/EK067   | WATER         | In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)                                                                                                                                                                                                                                                                                            |
| Separatory Funnel Extraction of Liquids                  | ORG14         | WATER         | In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.                          |
| Volatiles Water Preparation                              | ORG16-W       | WATER         | A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.                                                                                                                                                                                                                                                                                                                     |

# Appendix F

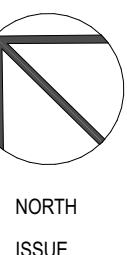
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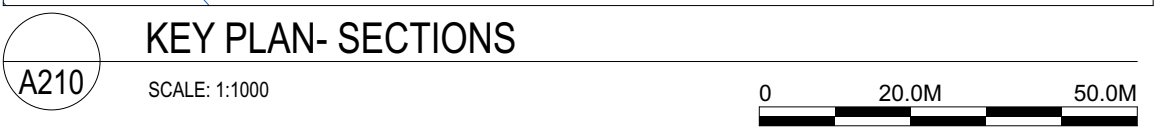
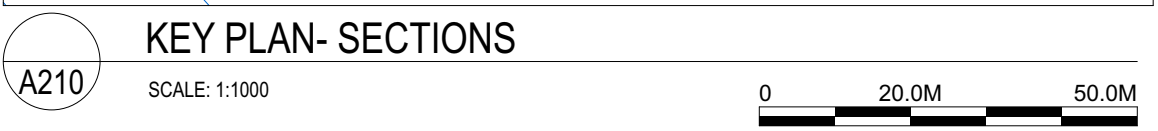
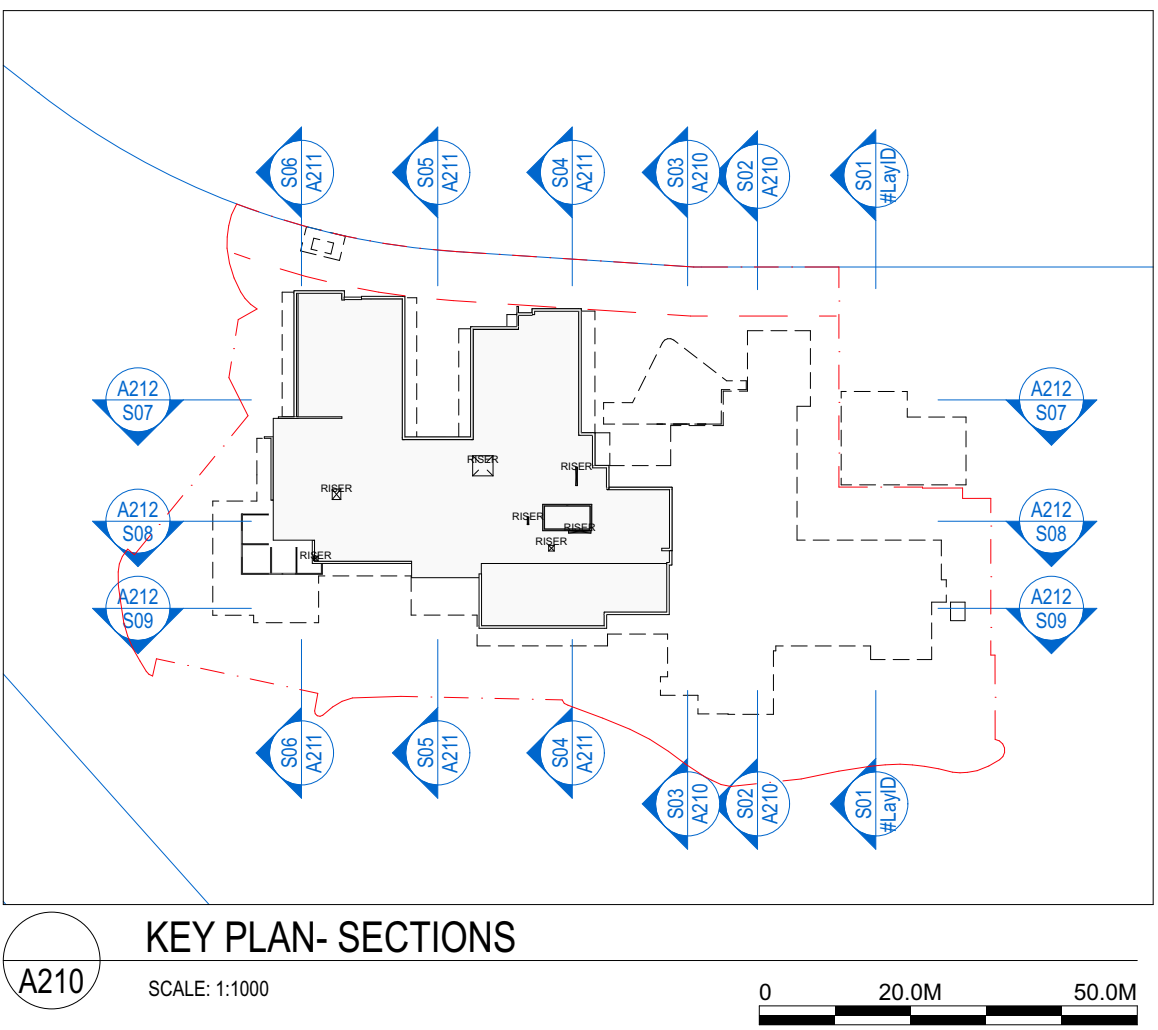








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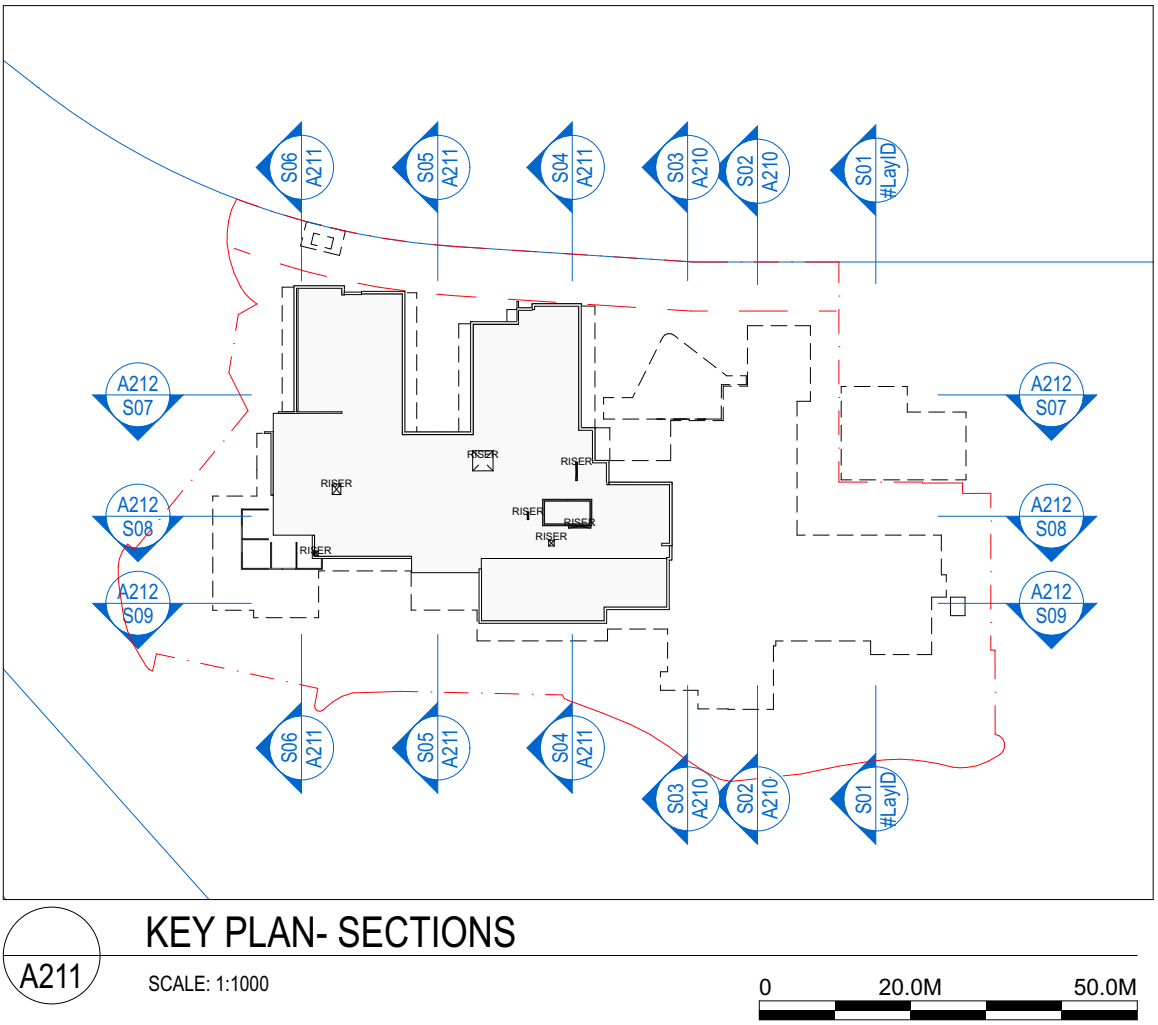
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