Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on Groundwater Investigation and Dewatering Management Plan

Proposed Northside Private Hospital
22 Faunce Street West, West Gosford

Prepared for
Erilyan Pty Ltd

Project 83574.04
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature		Date
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Report on Groundwater Investigation and Dewatering Management Plan
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1. Introduction

This report presents the results of a groundwater investigation and dewatering management plan undertaken for the proposed northside private hospital at 22 Faunce Street West, West Gosford. The investigation was commissioned by Mike Ryan of Erilyan Pty Ltd and was undertaken in accordance with Douglas Partners' proposal 83574.04 dated 13 January 2021.

It is understood that the revised proposed development will include the construction of a ten storey hospital building, with three additional lower ground and basement car parking levels. The finished floor level of the lower basement (B2) is proposed to be at RL 3.19 m AHD.

The objectives of this assessment were to:

- estimate the permeability of any aquifers at the site;
- assess groundwater quality at the site;
- characterise the groundwater system with the compilation of a Conceptual Hydrogeological Model (CHM);
- undertake numerical modelling to assess the potential for groundwater inflows to the basement during construction, and the resultant drawdown (or cone of depression) likely to be induced by the basement construction; and
- develop a Dewatering Management Plan (DMP).

The investigation included the drilling of three boreholes. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

This report should be read in conjunction with DP's "Notes about this Report", a copy of which is provided in Appendix A. Borehole logs of the three bores completed as monitoring bores (Bores 201, 202 and 203) are provided in Appendix B.

An outline of the site is shown in Drawing 1 (Appendix E).

2. Site Description

The site is located within the south-western area of Lot 2 in DP 1226923, on the corner of Faunce Street West and Racecourse Road, West Gosford. The proposed Northside Private Hospital development (the 'site') covers an irregular shaped area of approximately 1 ha.

The site is bounded by Faunce Street West to the south, Racecourse Road to the west, an existing Ausgrid substation to the east and structures associated with a former Ausgrid depot to the north and north-east.

Figure 1 below, shows an aerial view of the site.

Figure 1 – Aerial view of site (sourced from Google Earth with Nearmap Overlay dated 27 December 2018)

At the time of the investigation, the site was occupied by buildings associated with a former Ausgrid depot, and was being used for storage of motor vehicles, caravans and boast. Areas surrounding the existing buildings were generally covered with asphalt or concrete pavements.

Along the southern boundary, in the eastern area of the site, a cut batter was also observed, and sandstone bedrock was exposed.

Figure 2 to Figure 5 below show photographs of the site, taken at the time of the investigation.

Figure 2 – Panoramic view of the site, looking northeast

Figure 3 – Panoramic view of the site, looking southwest

Figure 4 – Panoramic view of the site, looking northwest

Figure 5 – View of the cut batter along the southern boundary, looking west

Review of the local topographical mapping indicates that surface levels at the site generally fall to the north, from about RL 14 m (toe of cut batter) to about RL 10 m AHD. The crest of the cut batter in the south-western area of the site is at approximately RL 18 m AHD.

Review of the interim 1:25 000 scale geology map for Gosford indicates that the site is underlain by the Terrigal Formation of the Narrabeen Group which typically comprises sandstone, siltstone, claystone and conglomerate.

The conditions encountered during the investigation are consistent with the geological mapping.

2.1 Ground Conditions

A current investigation shows that the subsurface is generally comprised of fill, then residual clays, and sandstone to the limit of the investigation.

Free groundwater was encountered in Bores 201, 202 and 203 during auger drilling at 12m, 6.5m and 7m respectively.

The proposed basement excavation sidewalls and base will mostly comprise residual clay and sandstone.

2.2 Proximity to Sensitive Environments

The site is located west of nearby Narara Creek. If groundwater extracted from the site during dewatering activities was to be disposed to stormwater, then this will likely result in the water discharging into Narara Creek.

3. Field Work Methods

3.1 Monitoring Bore Installation & Specification

DP installed Monitoring Bores 201, 202 and 203 in January 2021. Construction details for the monitoring bores are summarised in Table 1.

Table 1: Monitoring Bore Construction Details

Bore ID	Easting (GDA94)	Northing (GDA94)	Ground Level (mAHD)	Total Depth Bore (mbGL)	Screen Interval (mbGL)
201	344770	6300801	13.67	13.0	10.0 – 13.0
202	344751	6300872	11.02	10.0	7.0 – 10.0
203	344679	6300821	13.43	12.0	9.0 – 12.0

Notes
mbGL metres below ground level;
mAHD metres above Australian Height Datum

The ground level and location of the bores were interpolated from the 2020 1-meter digital elevation model (DEM) obtained from the NSW Government.

3.2 Groundwater Level Monitoring

The manual Standing Water Level (SWL) measurements from Bores 201, 202 and 203 are summarised in Table 2.

Table 2: Manual Standing Water Level (SWL) Measurements

Bore ID	Surface Elevation (mAHD)	21/01/2021	
		mbGL	mAHD
201	13.67	7.2	6.47
202	11.02	6.2	4.82
203	13.43	8.41	5.02

Notes
SWL Standing water level;
mbGL metres below ground level;
mAHD metres above Australian Height Datum

3.3 Hydraulic Testing

Field permeability tests (slug tests) were undertaken in Monitoring Bores 201, 202 and 203 to obtain estimates of the hydraulic conductivity or permeability of the aquifer material. The analysis results (Appendix C) are summarised in Table 3.

Table 3: Rising Head Permeability Test Result

Bore	Test Section (mbGL)	Geology	SWL (mbGL)	Permeability (m/day)
201	10.0 – 13.0	Sandstone	7.2	0.17
202	7.0 – 10.0	Sandstone and Clay	6.2	0.0035
203	9.0 – 12.0	Sandstone	8.41	0.0045

SWL Standing water level;
mbGL metres below ground level;

The permeability analyses indicate that the material intersected in Bores 201, 202 and 203 has a low hydraulic conductivity (permeability) ranging from 0.0045 m/day to 0.17 m/day with an average value of 0.06 m/day.

The permeability surrounding the excavation will however vary depending on variations in the silt or clay content, and grain size of the sediments and variations in the orientation and interconnection of secondary porosity features (joints / fractures or defects) which may be present in the sandstone.

4. Groundwater Quality Assessment

4.1 Groundwater Sampling Methodology

Groundwater was sampled from Bores 201, 202 and 203 and water quality parameters were measured in the field with a field water quality meter (Table 4). Three groundwater samples were collected on 21 January 2021 and sent to Envirolab Services Pty Ltd for analysis. Sampling complied with the Standard Operating Procedures described in DP's Field Procedures Manual, and Geoscience Australia (2009). Laboratory reports are attached (Appendix D).

Table 4: Field Water Quality Parameters

Sample ID	Date Sampled	Temp. (°C)	pH	EC (µS/cm)	Observations
201	21/01/2021	27.5	5.1	796	Clear, no odour detected, slow recovery
202	21/01/2021	26.9	5.6	178	Clear, no odour detected, slow recovery
203	21/01/2021	26.6	4.8	1,050	Clear, no odour detected, slow recovery
Site Assessment Criteria					
ANZECC (1)			7.0 – 8.5	-	

Notes for Table
(1) ANZECC (2000: Table 3.3.2) Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed estuary ecosystems.
~ No guideline available at time of investigation; and
Yellow Concentrations exceeding the ANZECC (2000) default trigger values
This table has been produced in colour to indicate exceedances of relevant criteria. Reproduction should be carried out in colour.

4.2 Regulatory Criteria for Water Quality

It is generally accepted that where groundwater may be disposed of to surface waters, groundwater quality should meet the water quality objectives (WQOs) set for the receiving surface water environment; in this case Narara Creek. These WQOs have been used to assess various physical and chemical indicators of groundwater for this project.

Physical and chemical indicators of groundwater quality at the site were assessed against the sub-regional guideline applicable to the south-east Australia slightly disturbed ecosystems. The available ANZECC (2000) guideline identifies WQOs at the point of use/discharge for various physical and chemical indicators. In the context of this project, ANZECC (2000) has been applied to assess the suitability of water for release to estuary (marine) environment.

The ANZECC & ARMCANZ (2000) guidelines were revised and replaced in 2018 with the Australian and New Zealand Governments (ANZG), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018* (ANZG, 2018). The criteria adopted are consistent with the default guideline values presented in ANZG (2018).

4.3 Groundwater Quality

Indicative groundwater quality has been assessed based on the samples of groundwater collected from Monitoring Bores 201, 202 and 203. Laboratory results have been compared to the adopted WQOs and are summarised in Table 5.

Groundwater is fresh to slightly brackish (EC between 178 µS/cm and 1,050 µS/cm) and has acidic pH with values ranging between 4.8 and 5.6 (Table 4). Therefore, groundwater would require treatment to increase the pH prior to off-site discharge into the stormwater collection system and/or local waterways.

The ionic composition indicates that groundwater is predominantly a sodium-chloride type (Table 5).

Concentrations of dissolved metals and metalloids are generally not within acceptable discharge limits, particularly in Bores 201 and 203 for aluminium, cadmium, copper, nickel and zinc (Table 5). Based on the available results, treatment would be required to reduce the concentration of these dissolved metals prior to off-site discharge. It is recommended that monitoring of dissolved aluminium, cadmium, copper, nickel and zinc be carried out during the dewatering operation.

High concentrations of iron (concentration above 500 µg/L), as recorded for Monitoring Bores 201 and 203 (6,100 µg/L and 12,000 µg/L), can cause precipitation, staining and clogging problems in dewatering and drainage systems. Daily monitoring of sediment levels in the tanks would assist in minimising potential clogging problems.

Concentrations of TRH (total recoverable hydrocarbons) and BTEXN are lower than the laboratory's limit of reporting in the three monitoring bores. A potential source of TRH and BTEXN was, however, identified in the locality of the site (i.e. former underground petroleum storage system - UPSS). On this basis it is recommended that monitoring of TRH and BTEXN be carried out during the dewatering operation.
In summary, groundwater will require treatment to increase the pH and reduce the concentrations of dissolved aluminium, cadmium, copper, nickel and zinc prior to any off-site discharge into local

stormwater infrastructure and/or local waterways. Ongoing monitoring of groundwater quality will be required during the dewatering operation.

Table 5: Analytical Results (TSS, Ionic Composition, Metals, Nutrients)

Analyte	201	202	203	Adopted Water Quality Objectives
				ANZECC(1)
Ionic Composition (mg/L)				
Calcium	10	4.4	7.6	~
Magnesium	10	1.6	11	~
Sodium	110	20	150	~
Potassium	11	5.4	22	~
Chloride	220	28	300	~
Sulfate	18	9	34	~
Chloride/Sulfate Ratio	12.2	3.1	8.8	~
Dissolved Metals (µg/L)				
Aluminium	70	<10	310	~
Arsenic	<1	<1	<1	~*
Cadmium	0.3	<0.1	0.4	0.7**
Chromium	<1	<1	1	4.4***
Copper	5	<1	5	1.3
Iron	6,100	310	12,000	~
Lead	<1	<1	<1	4.4
Nickel	32	10	96	7
Zinc	73	13	80	15
Hydrocarbon Compounds (µg/L)				
Total TRH	<LOR	<LOR	<LOR	~
Total BTEXN	<LOR	<LOR	<LOR	~

Notes:

(1)	ANZECC (2000: Table 3.4.1) Groundwater trigger values for marine (level of protection of 95% species)
*	Value relates to Arsenic III
**	For bioaccumulating toxicants, the 99% species level default guideline values has been adopted
***	Value relates to Chromium VI
~	Indicates no trigger value or guideline available.
<LOR	Less than the laboratory's detection limit.
Green	Concentrations that exceed the adopted WQOs

5. Numerical Groundwater Flow Modelling

DP developed a three-dimensional groundwater flow model to assess the potential inflow to the basement excavation during construction, and the resultant drawdown (or cone of depression) around the property likely to be induced by dewatering.

5.1 Key Model Assumptions

Boundaries of the model were extended far enough such that the boundary conditions did not affect model outcomes. Boundaries were set as no-flow boundaries with the exception of the western boundary which was set as constant head boundary coinciding with the alignment of the Narara Creek.

The average groundwater level measured on site was approximately RL 6.0 mAHD and was uniformly applied to the model as the initial hydraulic head.

Natural variations in the permeability in sub-surface materials are likely to occur due to the variations in silt or clay content, and grain size of the sediments and variations in the orientation and interconnection of secondary porosity features (joints / fractures or defects) which may be present in the sandstone. For this reason, and to assess the potential range of inflow rates to the proposed excavation, the model was run using both estimated and higher permeability estimates. Vertical hydraulic conductivity was generally assumed to be 20 percent of the horizontal hydraulic conductivity, except for the bedrock sandstone, where it was assumed to be the same as the horizontal hydraulic conductivity.

Table 6: Model Layer Summary (Horizontal Permeability)

Model Layer	Layer[A] Represents	Base of Layer (m AHD)	Permeability (m/day)	
			Site Tested and Estimate	High Estimate
1	Clay	10	0.06	0.5
2	Sandstone	2.7	0.06	0.5
3	Sandstone	-20	0.06	0.5

Notes:

A Layer type and base of model layer dependent upon predictive scenario

The site tested estimate chosen for the model (6.0E-02 m/day) is the average of values obtained from permeability tests conducted in the Monitoring Bores 201, 202 and 203 constructed on site.

DP considers it prudent to consider the likelihood that some part of the excavation may intersect highly conductive fractures, which will provide for a higher degree of hydraulic connection with the groundwater system. To simulate this uncertainty, DP has run the model applying a higher hydraulic conductivity estimate of 0.5 m/day.

5.2 Wall

A soldier pile wall with staged excavation and shotcreting was simulated (as a groundwater inflow control) during some of the model simulations by applying a horizontal flow barrier (HFB) to the cells around the proposed basement excavation. Scenarios which were modelled include:

- No wall; and
- Soldier pile wall with shotcreting extending to bulk excavation level (BEL) (i.e. RL 2.8 m AHD).

5.3 Groundwater Modelling Simulations

The model simulations comprised:

- Run 1 simulating inflows to the basement with no wall and using site tested permeability values;
- Run 2 simulating inflows to the basement with no wall and assuming higher permeability values;
- Run 3 simulating inflows to the basement with a soldier pile wall with shotcreting extending to BEL (i.e. RL 2.8 m AHD) and using site-tested permeability values; and
- Run 4 simulating inflows to the basement with a soldier pile wall with shotcreting extending to BEL (i.e. RL 2.8 m AHD) and assuming higher permeability values;

5.4 Predictive Groundwater Modelling Results

5.4.1 Simulated Inflows

The simulated groundwater inflows were monitored throughout Model Runs 1 to 4. Results are reported in Table 7.

Table 7: Predictive Model Simulated Inflow Results

Model Run	Feature	Inflow Rate / Dewatering Flow Rate	
		Start of Construction (L/s)	End of Construction & Long-term (L/s)
No Wall			
1	Site-tested Permeability	0.6	0.3 (7.9 ML/year)
2	Upper Range Permeability	3.9	1.6 (49.6 ML/year)
Soldier Pile Wall with Shotcreting to RL 2.8 m AHD			
3	Site-tested Permeability	0.5	0.3 (7.7 ML/year)
4	Upper Range Permeability	3.2	1.6 (46.4 ML/year)

The modelling results show that without a wall around the excavation, the estimated initial inflow rates to the excavation during construction would likely be between approximately 0.6 and 3.9 L/s.

With the installation of a soldier pile wall with shotcreting extending to BEL (i.e. RL 2.8 m AHD), the estimated initial inflow rates to the excavation during construction may be between 0.5 and 3.2 L/s.

It should be noted that the actual dewatering rates (and observed drawdown) will depend on the dewatering scheme adopted for the site during construction. If for instance deeper sumps and pumps are used as part of the dewatering strategy or the walls are installed to shallower depths (than those modelled), then the actual dewatering rates experienced on-site may be different than those simulated by the numerical modelling.

5.5 Water Balance

A water balance is a calculation to balance the water inputs and the water outputs of a system.

In the case of the site and over the construction period, the inputs are the rainfall infiltration and the groundwater flowing towards the aquifer underneath the site from other parts of the catchment. The outputs are the evapotranspiration and the groundwater flowing out (i.e. pumped groundwater).

5.5.1 Inputs:

The site and its surroundings are mostly covered by concrete and asphalt therefore infiltration and evapotranspiration are minor in the area. Most of the recharge to the aquifer present underneath the site (sandstone) is expected to occur at the Waterview Park located to the southeast of the site.

5.5.2 Outputs:

The simulated volumes of groundwater pumped over a 6-month construction period are reported in Table 8.

Table 8: Predictive Groundwater Take Volumes over a 6-month Construction Period

Model Run	Feature	Groundwater Take Volumes (ML)
No Wall		
1	Site-tested Permeability	8.0
2	Upper Range Permeability	31.9
Soldier Pile Wall with Shotcreting to RL 2.8 m AHD		
3	Site-tested Permeability	7.5
4	Upper Range Permeability	31.4

The water balance for the site over the construction period will be negative and essentially controlled by the outputs (i.e. pumped groundwater).

6. Dewatering Impact on Surroundings

6.1 Aquifer interference

The groundwater table drawdowns simulated for the end of the construction work (Drawing 3 and 4) are not expected to be impacting areas with endangered ecological communities (Figure 6), with the 0.5 m contour located at approximately 10 m from the nearest area of concern.

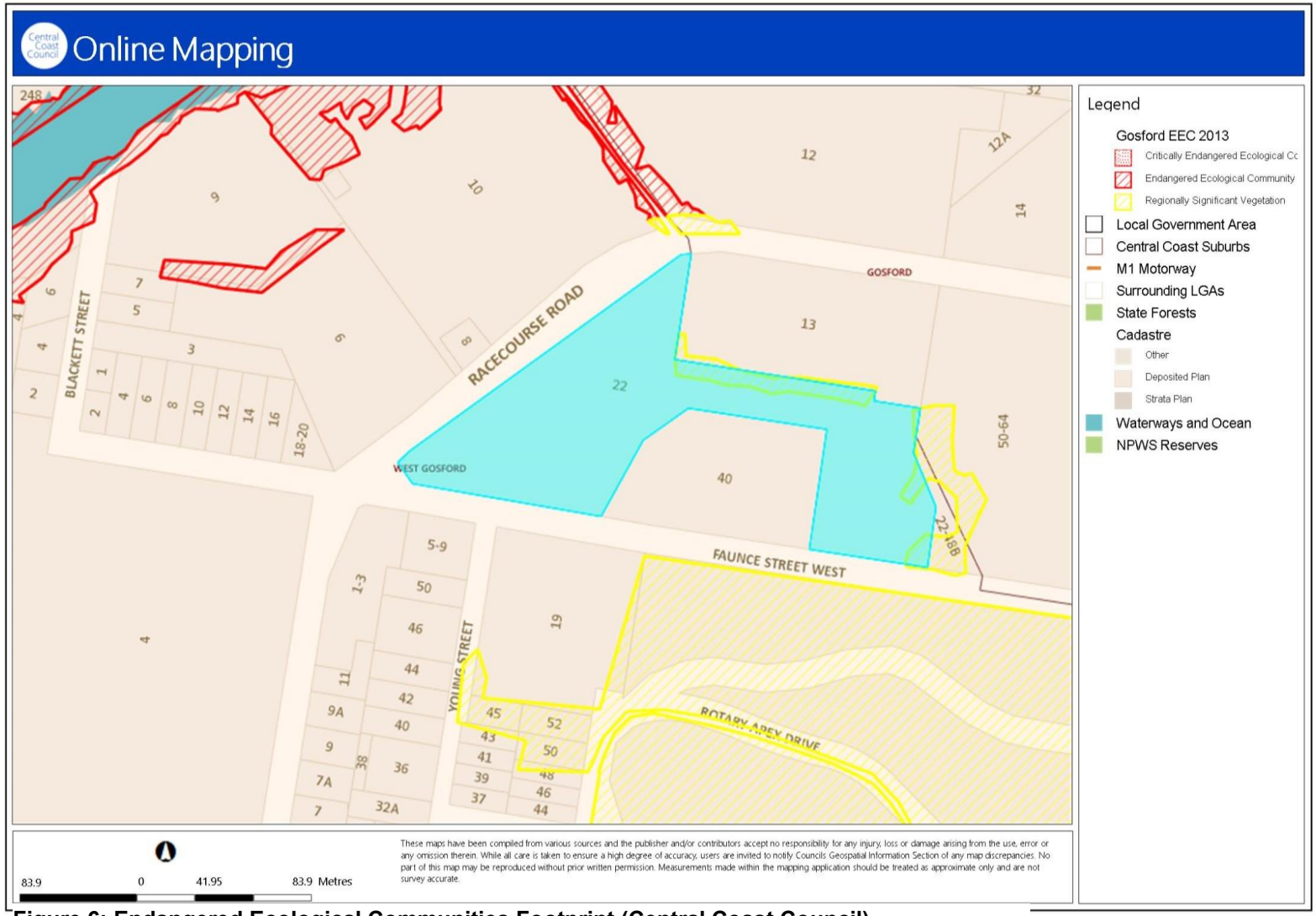


Figure 6: Endangered Ecological Communities Footprint (Central Coast Council)

6.2 Acid Sulfate Soils

The groundwater table drawdowns simulated for the end of the construction work (Drawing 3 and 4) are not expected to be impacting areas with potential acid sulfate soils, with the 0.5 m contour located at approximately 60 m from the nearest area with anticipated high occurrence.

6.3 Settlement Estimate

Based on the simulated end of excavation drawdown modelling, the groundwater drawdown at nearby structures is estimated to be less than 1.0 m. Therefore, based on this assessment and the encountered ground conditions (which are anticipated to comprise at least stiff clay over sandstone within approximately 100 m of the site), induced settlements are expected to be within the tolerable limits of the serviceability of the structures and may be consistent with expected seasonal variation in groundwater levels.

7. Dewatering Management Plan

This DMP describes the management practices to be adopted to mitigate the potential environmental impacts of dewatering on the local environment. The preferred management strategy is to temporarily store the extracted groundwater (dewatering effluent) on-site to allow water quality monitoring and water treatment (as required) prior to off-site discharge into the local stormwater drainage system.

It is further noted that any site-specific development consent conditions relating to off-site discharge of collected groundwater into the local stormwater drainage system must also be complied with prior to discharge.

7.1 Potential Dewatering Impacts

Potential on-site and off-site dewatering impacts may include drawdown of the water table or impacts to the receiving environment (Narara Creek) from the release of water containing elevated levels of dissolved heavy metals or total suspended solids (or turbidity).

7.2 Environmental Objective and Performance Targets

The environmental objective is to minimise the risk of on-site and off-site water quality impacts due to dewatering activities. Monitoring will be required as a key performance indicator throughout civil works and basement construction to demonstrate that this objective is being met.

The performance targets for dewatering effluent which meet the water quality criteria (prior to off-site discharge) are listed in Table 9. Monitoring data and planning (development) approval will be required prior to discharging excess groundwater (i.e. dewatering effluent) into the stormwater system.

Table 9: Groundwater Release Criteria

Analyte	Discharge Criteria(1)
pH (2)	7.0 – 8.5
Electrical Conductivity (EC) (µS/cm)	~
Dissolved Oxygen (DO) (% Sat) (2)	80-110
Turbidity (NTU) (2)	0.5-10
Aluminium (3)	~
Arsenic (3)	~*
Cadmium (3)	0.7**
Chromium (3)	4.4***
Copper (3)	1.3
Iron (3)	~
Lead (3)	4.4
Nickel (3)	7
Zinc (3)	15
Total Petroleum Hydrocarbon (TPH)	~****
Benzene	500
Toluene	180
Ethylbenzene	80
m-Xylene	75
Naphthalene	50

Notes:

(1) Concentrations in µg/L unless otherwise noted.

(2) ANZECC (2000: Table 3.3.2) Default trigger values for physical and chemical stressors for south-east Australia for slightly disturbed estuarine ecosystems.

(3) ANZECC (2000: Table 3.4.1) Groundwater trigger values for marine water (level of protection of 95% species)

* Value relates to Arsenic III

** For bioaccumulating toxicants, the 99% species level default guideline values have been adopted

*** Value relates to Chromium VI

~ Indicates no trigger value or guideline available.

**** No signs of potential impact (e.g. odour, oil sheen/scum and <PQL concentrations)

7.3 Management Strategies and Monitoring

Management and monitoring actions required to achieve the performance targets for dewatering effluent and groundwater are the responsibility of the Construction Contractor.

7.3.1 Management of Dewatering Effluent

Only effluent that meets the discharge criteria (Table 9) may be discharged into the local stormwater drains and/or waterways. All dewatering effluent is to be pumped into holding tanks where sampling can occur and treatment can be carried out, as necessary. Once the discharge criteria have been met, the effluent can then be discharged into the stormwater collection system via pumping to adjacent stormwater drains (subject to planning/development approval).

Based on the results from the predictive modelling, groundwater inflows to the basement excavation are expected to be manageable.

7.3.2 Monitoring During Dewatering

Monitoring of groundwater levels, dewatering effluent volume and dewatering effluent quality is to be conducted during all dewatering activities. Procedures for field measurements, sampling, and record keeping shall be established by a suitably qualified environmental consultant. Samples should be collected by the environmental consultant and analysed at a NATA accredited laboratory.

7.4 Pre-Dewatering Baseline Data and Ongoing Monitoring

Baseline groundwater data has been established for the site and can be used for comparison of future monitoring results. The monitoring bores, groundwater sumps excavated on-site, or on-site holding tanks could be used for water quality monitoring purposes. Baseline data requirements and suggested monitoring frequencies while dewatering during construction are presented in Table 10.

Table 10: Baseline Data Requirements (from Groundwater Sumps and/or Monitoring Bores)

Parameter/ Analyte	Method of Measurement	Unit of Measure	Monitoring Frequency
Groundwater level	Field measurement (dip meter)	Metres Australian Height Datum (mAHD)	Fortnightly prior to dewatering, daily for the first week of dewatering, then weekly during ongoing dewatering
Dewatering effluent volume	Flowmeter	m^3/day	Daily during ongoing dewatering and until construction of the basement has been completed; then weekly if the basement is drained until completion.
pH, Turbidity and DO	Field measurement (water quality meter)	pH units, and Nephelometric Turbidity Units (NTU)	Fortnightly prior to dewatering, daily for the first week of dewatering, then weekly during ongoing dewatering
TSS; Dissolved heavy metals (aluminium, copper, nickel and zinc), TRH, BTEXN	Laboratory analysis	Micrograms per litre (µg/L)	Prior to start of dewatering, then monthly during ongoing dewatering.

7.5 Dewatering Strategy

The dewatering strategy should be finalised by the Construction Contractor. As ground conditions comprise low permeability sandstone, it is anticipated that the dewatering strategy for the basement excavation may comprise a series of sumps and pumps to remove the groundwater seepage.

Any perched groundwater at the interface between residual clays and sandstone bedrock may lead to additional seepage to the excavation. Groundwater at the interface between residual clays and the sandstone bedrock (if any) would vary considerably over time depending the rainfall. Attention should be given to this matter in order to limit potential additional groundwater seepage into the excavation during construction.

Groundwater (dewatering effluent) should be temporarily stored on site in holding tanks to allow monitoring of groundwater quality and treatment (as required) to occur prior to discharge into the local stormwater drainage system with planning/development approval. Treatment is initially expected to include flocculation to remove turbidity and reduce metal concentrations, followed by pH adjustment to increase the pH to within the adopted discharge criteria. Additional treatment, such as filtration, may be required if the metal concentrations are still considered too high. Testing will be as outlined in Table 10.

The onsite permeability will vary in accordance with variations in the orientation and interconnection of the secondary porosity features (joints / fractures or defects) which may be present in the sandstone.

For these reasons it is recommended that the dewatering system provide for greater capacity than the modelled groundwater inflows. Nominally the dewatering system should be capable of pumping up to (say) 5 L/s.

8. Basement Design Considerations

Through completing this groundwater assessment, DP has found that site groundwater levels have been estimated to be as high as approximately 6.5 mAHD, with shallower perched seepage. Future groundwater level fluctuations due to variations in climate and groundwater recharge may cause groundwater levels to rise to levels higher than 6.5 mAHD.

DP understands that the lowest basement level will be completed at approximately 3.19 mAHD. Erilyan Pty Ltd will therefore need to design the basement to adequately cope with positive groundwater pressure on the sidewalls and the on ground basement floor slab. Alternatively, if a drained basement structure is being considered, then drainage will need to be installed below the lowest basement floor slab to dissipate upward groundwater pressures.

9. References

AUSTRALIAN AND NEW ZEALAND ENVIRONMENT AND CONSERVATION COUNCIL (ANZECC), 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (Chapters 1-7). October 2000.

CANBERRA, ACT: AUSTRALIAN AND NEW ZEALAND GOVERNMENTS AND AUSTRALIAN STATE AND TERRITORY GOVERNMENTS, 2018: *Australia and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018).

DOUGLAS PARTNERS, 2020: Report on Preliminary Geotechnical Investigation, Proposed Northside Private Hospital, Part Lot 2 in DP 1226923, Faunce Street West, West Gosford. Report 83574.02. July 2020.

DOUGLAS PARTNERS, 2020: Report on Detailed Site Investigation (Contamination), Proposed Northside Private Hospital, 22 Faunce Street West, West Gosford. Report 83574.03. October 2020.

GEOSCIENCE AUSTRALIA, 2009: Groundwater Sampling and Analysis – A Field Guide, Record 2009/27. Canberra.

10. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 22 Faunce Street West, West Gosford in accordance with DP's proposal 83574.04 dated 13 January 2021 and acceptance received from Mike Ryan from Erilyan Pty Ltd. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Erilyan Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Borehole Logs

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 13.67 AHD
EASTING: 344769.8
NORTHING: 6300801.1
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
13	0.05	ASPHALTIC CONCRETE							Monitoring Well completed with a flush-mounted Gatic Cover From 0.0m to 0.3m, concrete
	0.25	FILL/Sandy GRAVEL: poorly graded, subangular, grey brown, moist, fill (roadbase)		D	0.2				
	0.7	FILL/Sandy CLAY: medium grained, yellow brown and red brown, trace sandstone fragments, dry, fill							
	1	SANDSTONE: medium grained, orange brown and red brown, very low strength, extremely weathered, with soil like properties							
12	2								
11		From 2.5m: moist, possible seepage							
		From 2.7m: possible low strength and grey brown		D	2.7				
	3								
10	4			D	4.0				
9									From 0.3m to 9.0m, bore cuttings
	5								From 0.0m to 10.0m, 50mm dia PVC casing
8	6								
		From 6.2m: grey brown		D	6.2				
7	7								
6									

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly at 12m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 13.67 AHD
EASTING: 344769.8
NORTHING: 6300801.1
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	9	SANDSTONE: medium grained, orange brown and red brown, very low strength, extremely weathered, with soil like properties *(continued)*							From 9.0m to 9.5m, bentonite
	10	From 9.5m: interbedded sandstone and siltstone		D	10.0				
	11	From 10.5m: inferred low strength, high moisture content							From 9.5m to 13.0m, sand
	12							▼	From 10.0m to 13.0m, 50mm diameter machine slotted PVC
	13 13.0	Bore discontinued at 13.0m- limit of investigation							At 13.0m, end cap
	14								
	15								

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly at 12m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 11.02 AHD
EASTING: 344751.3
NORTHING: 6300872.4
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	ASPHALTIC CONCRETE		D	0.15				Monitoring Well completed with a flush-mounted Gatic Cover From 0.0m to 0.3m, concrete
	0.25	FILL/Sandy GRAVEL: poorly graded, grey brown, trace clay, moist, fill (roadbase)							
		FILL/Clayey SAND: fine to medium grained, grey, trace organics, very slight/possible hydrocarbon odour, moist, fill		D	0.5				
	0.9	FILL/Sandy CLAY: fine to medium grained, yellow brown, very slight hydrocarbon odour, moist, fill		D	1.0				
	3.0	CLAY CL: low to medium plasticity, red brown, w<PL, residual		D	3.2				From 0.3m to 6.0m, bore cuttings; From 0.0m to 7.0m, 50mm dia PVC casing
		From 6.7m: interbedded sandstone and claystone		D	6.9				From 6.0m to 6.5m, bentonite

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly between 6.5m to 7.0m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 11.02 AHD
EASTING: 344751.3
NORTHING: 6300872.4
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CLAY CL: low to medium plasticity, red brown, w<PL, residual *(continued)*							From 6.5m to 10.0m, sand
	8.5	SANDSTONE: red brown and grey, very low strength, extremely weathered		D	9.0				From 7.0m to 10.0m, 50mm diameter machine slotted PVC
	10.0	Bore discontinued at 10.0m- limit of investigation							At 10.0m, end cap

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly between 6.5m to 7.0m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 13.43 AHD
EASTING: 344679.4
NORTHING: 6300820.5
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE		D	0.1				Mounting Well completed with a flush-mounted Gatic Cover From 0.0m to 0.3m, concrete
	0.2	FILL/Sandy GRAVEL: poorly graded, grey brown, trace clay, moist, fill (roadbase)							
13		FILL/Sandy CLAY: red brown and mottled grey, low plasticity, w<PL, fill							
	1.0	Sandy CLAY/Clayey SAND SC: red brown, low plasticity, dry to moist, residual		D	1.1				
12									
		From 2.5m: sandy clay: red brown and grey brown		D	2.5				
11	3.0	SANDSTONE: medium grained, orange brown and red brown, very low strength, extremely weathered, with soil like properties							
10				D	4.0				From 0.3m to 8.0m, bore cuttings
9									From 0.0m to 9m, 50mm dia PCV casing
8									
7		At 7.0m: material is softer most likely from groundwater, interbedded sandstone and siltstone		D	7.0			▼	
6		From 7.5m: w>PL							

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly between 7.0m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Erilyan Pty Ltd
PROJECT: Proposed Northside Private Hospital
LOCATION: 22 Faunce St West, West Gosford

SURFACE LEVEL: 13.43 AHD
EASTING: 344679.4
NORTHING: 6300820.5
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 83574.04
DATE: 18/1/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		SANDSTONE: medium grained, orange brown and red brown, very low strength, extremely weathered, with soil like properties *(continued)*		D	9.5				From 8.0m to 8.5m, bentonite From 8.5m to 12.0m, sand From 9.0m to 12.0m, 50mm diameter machine slotted PVC
	12.0	Bore discontinued at 12.0m- limit of investigation							At 12.0m, end cap

RIG: Geo Probe **DRILLER:** STRATACORE **LOGGED:** MJH **CASING:**

TYPE OF BORING: 100mm Ø Spiral Flight Auger

WATER OBSERVATIONS: Free groundwater observed possibly between 7.0m depth

REMARKS: Location coordinates are in MGA94 Zone 56 H.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix C

Permeability Test Results

Douglas Partners
Geotechnics | Environment | Groundwater

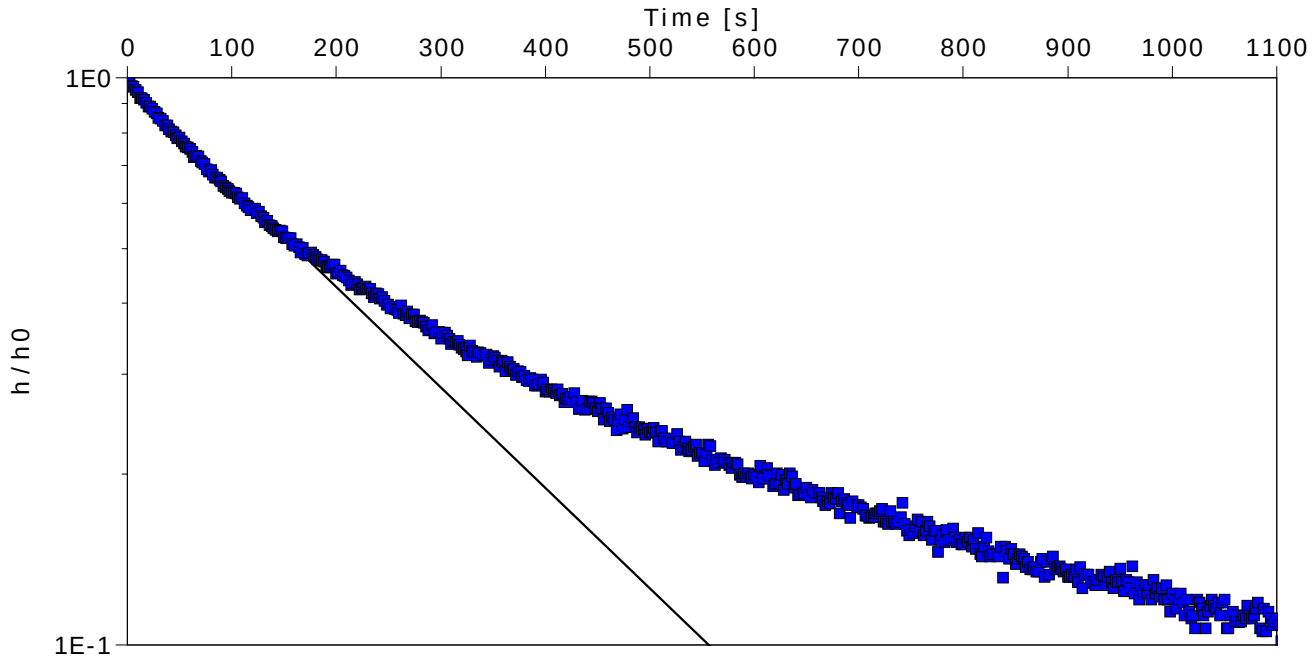
Slug Test Analysis Report

Project: Proposed Northside Private Hospital

Number: 83574.04

Client: Erilyan Pty Ltd

Location: 22 Faunce St. West, Gosford	Slug Test: Bore 201_RHT	Test Well: 201
Test Conducted by: DP		Test Date: 21/01/2021
Analysis Performed by: JJT		Analysis Date: 10/02/2021
Aquifer Thickness: 6.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
201	1.70×10^{-1}	

Douglas Partners
Geotechnics | Environment | Groundwater

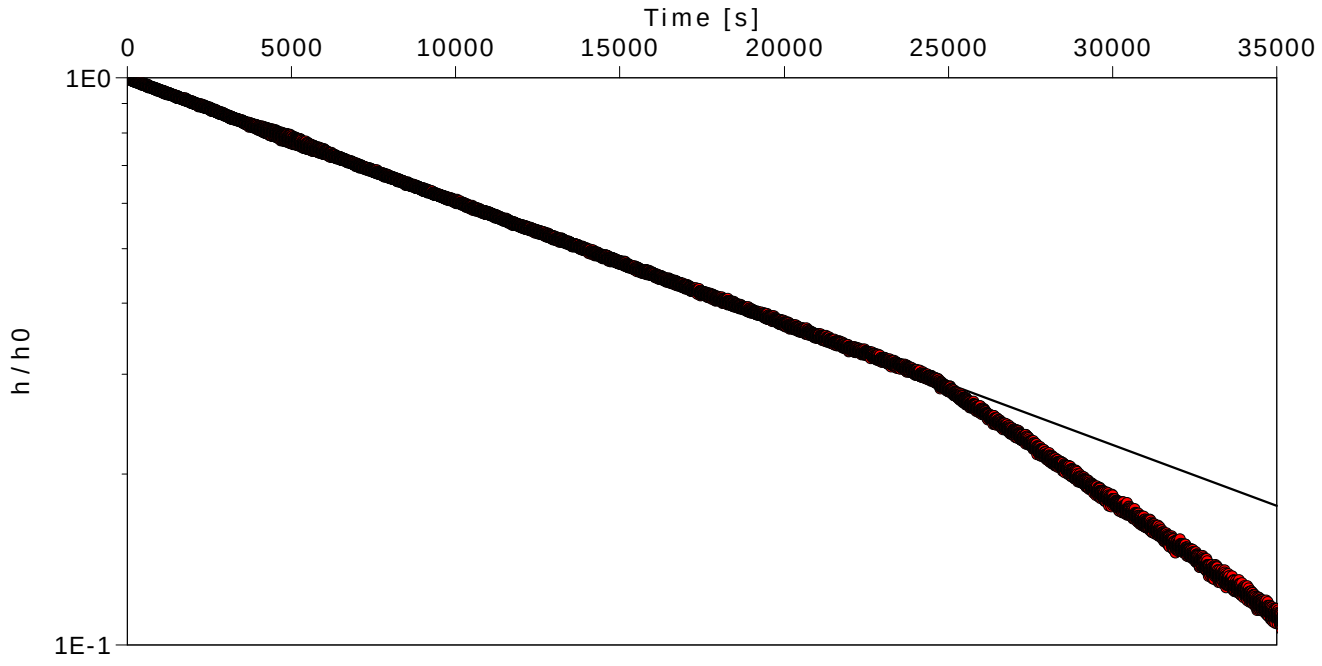
Slug Test Analysis Report

Project: Proposed Northside Private Hospital

Number: 83574.04

Client: Erilyan Pty Ltd

Location: 22 Faunce St. West, Gosford	Slug Test: Bore 202_RHT	Test Well: 202
Test Conducted by: DP		Test Date: 21/01/2021
Analysis Performed by: JJT		Analysis Date: 10/02/2021
Aquifer Thickness: 4.00 m		

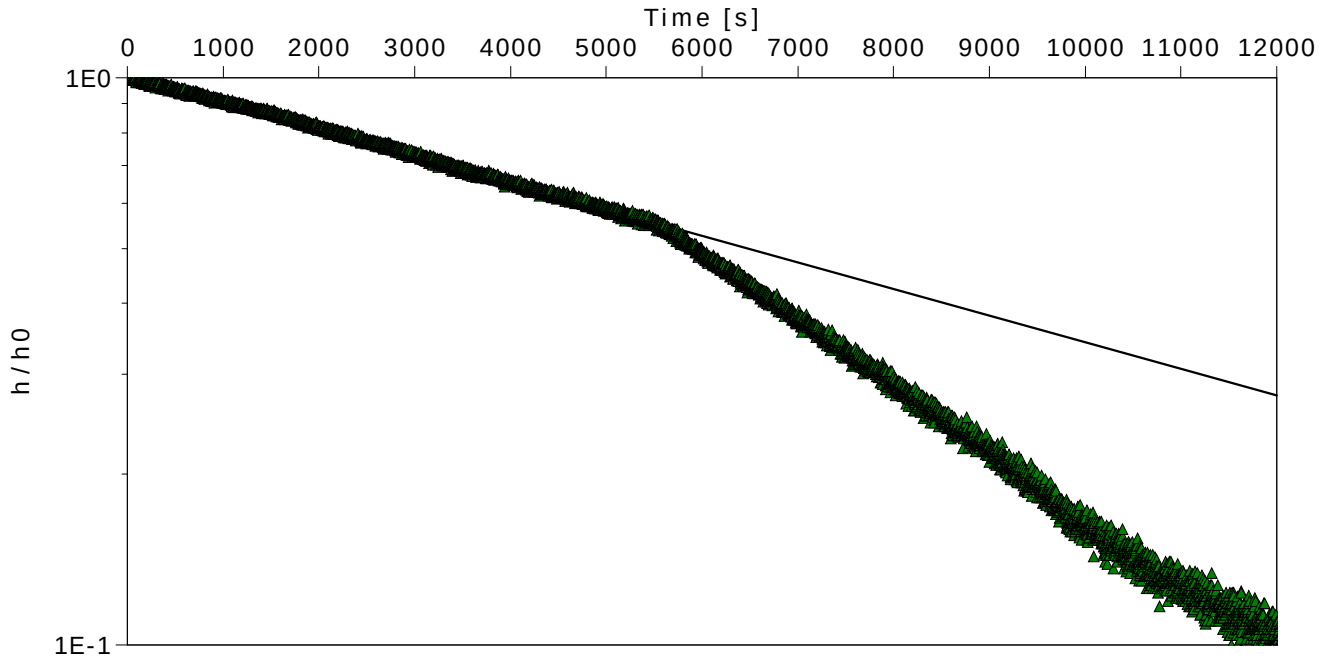


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
202	3.50×10^{-3}	

Douglas Partners Geotechnics / Environment / Groundwater	**Slug Test Analysis Report**
	Project: Proposed Northside Private Hospital
	Number: 83574.04
	Client: Erilyan Pty Ltd

Location: 22 Faunce St. West, Gosford	Slug Test: Bore 203_RHT	Test Well: 203
Test Conducted by: DP		Test Date: 21/01/2021
Analysis Performed by: JJT		Analysis Date: 10/02/2021
Aquifer Thickness: 4.00 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/d]	
203	4.50×10^{-3}	

Appendix D

Laboratory Test Results

SCA0742

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 83574.04	**To:**	Envirolab Services
Contact Person: Brent Kerry	**Project Name:** West Gosford	**Contact Person:**	Aileen Hie
Project Mgr: Brent Kerry	**PO No.:**	**Address:**	12 Ashley Street
	lab Quote No. : 2016-2017 List		Chatswood NSW 2068
Address: 5/3 Teanster Cl	**Date results required:** Standard TAT	**Phone:**	02 9910 6200
Tuggerah NSW 2259		**Fax:**	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	**Email:**	ahie@envirolab.com.au
Phone: 4351 1422 **Mob:**	**Report format:** Esdat/PDF / Excel	**Laboratory Report No:**	
Email: brent.kerry@douglaspartners.com.au	**Comments:**	**Lab Comments:**	

Sample information						Tests Required											Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	Combo #3L	Ionic Balance	HM	OCP	TRH/BTEX	CEC	pH	Scr Suite	COMBO #7A	COMBO #7	Asbestos ID	Provide as much information about the sample as you can
1	201	-	21/01/2021	Bottles	GW	X	X										Metal samples were field filtered
2	202	-	21/01/2021	Bottles	GW	X	X										
3	203	-	21/01/2021	Bottles	GW	X	X										Metal Suite to include As, Cd, Cr, Cu, Pb, Hg, Ni, Al, Fe, Zn
4	QA200	-	21/01/2021	Bottles	GW	X											

ENVIROLAB
~~Envirolab Services~~
~~12 Ashley St~~
~~Chatswood NSW 2067~~
~~Ph: (02) 9910 6200~~

Job No: 260097
Date Received: 22/01/2021
Time Received: 10:40
Received By: MT
Temp: ~~Cool~~/Ambient 21.0
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Courier (by whom) TNT	**Received by (Company):** Env Sydney	**Samples Received** Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle) cool	**Print Name:** Mary Yan Ta	**Temperature Received at:** 21.0 (if applicable)
Temperature (if Applicable):	**Date & Time:** 22/01/2021 10:40	**Transported by:** Hand delivered / courier
Print Name: Brent Kerry	**Signature:** MT	
Date & Time: 21/1/21		
Signature:		

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry

Sample Login Details

Your reference	83574.04, West Gosford
Envirolab Reference	260097
Date Sample Received	22/01/2021
Date Instructions Received	22/01/2021
Date Results Expected to be Reported	01/02/2021

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	4 water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	21
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Low Level	HM in water - dissolved	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance
201	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
202	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
203	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
QA200	✓	✓	✓	✓											

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

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

CERTIFICATE OF ANALYSIS 260097

Client Details

Client	Douglas Partners Tuggerah
Attention	Brent Kerry
Address	Unit 5, 3 Teamster Close, Tuggerah, NSW, 2259

Sample Details

Your Reference	**83574.04, West Gosford**
Number of Samples	4 water
Date samples received	22/01/2021
Date completed instructions received	22/01/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	01/02/2021
Date of Issue	01/02/2021

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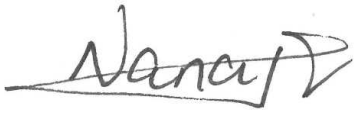
Results Approved By
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water					
Our Reference		260097-1	260097-2	260097-3	260097-4
Your Reference	UNITS	201	202	203	QA200
Date Sampled		21/01/2021	21/01/2021	21/01/2021	21/01/2021
Type of sample		water	water	water	water
Date extracted	-	27/01/2021	27/01/2021	27/01/2021	27/01/2021
Date analysed	-	27/01/2021	27/01/2021	27/01/2021	27/01/2021
TRH C_6 - C_9	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	86	102	76	100
Surrogate toluene-d8	%	83	79	102	102
Surrogate 4-BFB	%	98	93	90	96

svTRH (C10-C40) in Water					
Our Reference		260097-1	260097-2	260097-3	260097-4
Your Reference	UNITS	201	202	203	QA200
Date Sampled		21/01/2021	21/01/2021	21/01/2021	21/01/2021
Type of sample		water	water	water	water
Date extracted	-	27/01/2021	27/01/2021	27/01/2021	27/01/2021
Date analysed	-	28/01/2021	28/01/2021	28/01/2021	28/01/2021
TRH C_{10} - C_{14}	µg/L	<50	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	88	79	83	87

PAHs in Water - Low Level					
Our Reference	UNITS	260097-1	260097-2	260097-3	260097-4
Your Reference		201	202	203	QA200
Date Sampled		21/01/2021	21/01/2021	21/01/2021	21/01/2021
Type of sample		water	water	water	water
Date extracted	-	27/01/2021	27/01/2021	27/01/2021	27/01/2021
Date analysed	-	29/01/2021	29/01/2021	29/01/2021	29/01/2021
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	0.4	<0.1	0.2
Fluorene	µg/L	<0.1	0.5	<0.1	0.4
Phenanthrene	µg/L	<0.1	1.3	<0.1	1.2
Anthracene	µg/L	<0.1	1	<0.1	0.9
Fluoranthene	µg/L	<0.1	0.5	<0.1	0.4
Pyrene	µg/L	<0.1	0.3	<0.1	0.3
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	4.0	<0.1	3.4
Surrogate p-Terphenyl-d14	%	71	71	72	67

HM in water - dissolved					
Our Reference	UNITS	260097-1	260097-2	260097-3	260097-4
Your Reference		201	202	203	QA200
Date Sampled		21/01/2021	21/01/2021	21/01/2021	21/01/2021
Type of sample		water	water	water	water
Date prepared	-	25/01/2021	25/01/2021	25/01/2021	25/01/2021
Date analysed	-	25/01/2021	25/01/2021	25/01/2021	25/01/2021
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	0.3	<0.1	0.4	<0.1
Chromium-Dissolved	µg/L	<1	<1	1	<1
Copper-Dissolved	µg/L	5	<1	5	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	32	10	96	10
Zinc-Dissolved	µg/L	73	13	80	13
Aluminium-Dissolved	µg/L	70	<10	310	10
Iron-Dissolved	µg/L	6,100	310	12,000	310

Ion Balance				
Our Reference		260097-1	260097-2	260097-3
Your Reference	UNITS	201	202	203
Date Sampled		21/01/2021	21/01/2021	21/01/2021
Type of sample		water	water	water
Date prepared	-	22/01/2021	22/01/2021	22/01/2021
Date analysed	-	22/01/2021	22/01/2021	22/01/2021
Calcium - Dissolved	mg/L	10	4.4	7.6
Potassium - Dissolved	mg/L	11	5.4	22
Sodium - Dissolved	mg/L	110	20	150
Magnesium - Dissolved	mg/L	10	1.6	11
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	21	21	11
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	21	21	11
Sulphate, SO4	mg/L	18	9	34
Chloride, Cl	mg/L	220	28	300
Ionic Balance	%	-4.0	-1.0	-6.0

Method ID	Methodology Summary
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 10% ie total anions = total cations +/-10%.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			27/01/2021	[NT]	[NT]	[NT]	[NT]	27/01/2021	[NT]
Date analysed	-			27/01/2021	[NT]	[NT]	[NT]	[NT]	27/01/2021	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	112	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	93	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	101	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-023	102	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate 4-BFB	%		Org-023	95	[NT]	[NT]	[NT]	[NT]	88	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			27/01/2021	[NT]	[NT]	[NT]	[NT]	27/01/2021	[NT]
Date analysed	-			28/01/2021	[NT]	[NT]	[NT]	[NT]	28/01/2021	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	96	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	93	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate o-Terphenyl	%		Org-020	90	[NT]	[NT]	[NT]	[NT]	90	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date extracted	-			27/01/2021	[NT]	[NT]	[NT]	[NT]	27/01/2021	[NT]
Date analysed	-			29/01/2021	[NT]	[NT]	[NT]	[NT]	29/01/2021	[NT]
Naphthalene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	91	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	72	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	77	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	71	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	84	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	70	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	72	[NT]	[NT]	[NT]	[NT]	73	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			25/01/2021	[NT]	[NT]	[NT]	[NT]	25/01/2021	[NT]
Date analysed	-			25/01/2021	[NT]	[NT]	[NT]	[NT]	25/01/2021	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	112	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	96	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	100	[NT]

QUALITY CONTROL: Ion Balance					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			22/01/2021	[NT]	[NT]	[NT]	[NT]	22/01/2021	[NT]
Date analysed	-			22/01/2021	[NT]	[NT]	[NT]	[NT]	22/01/2021	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	109	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	101	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	107	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	116	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

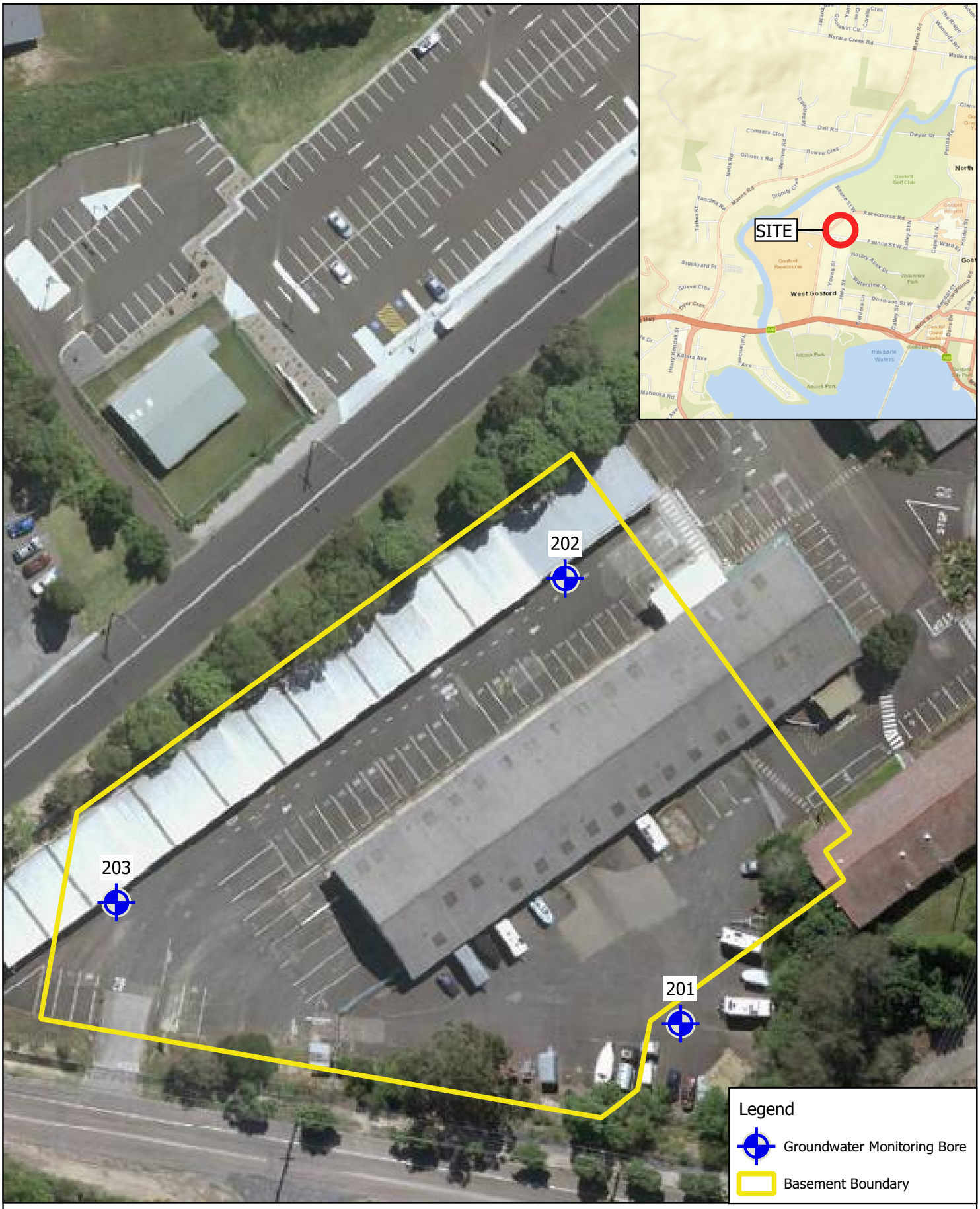
Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

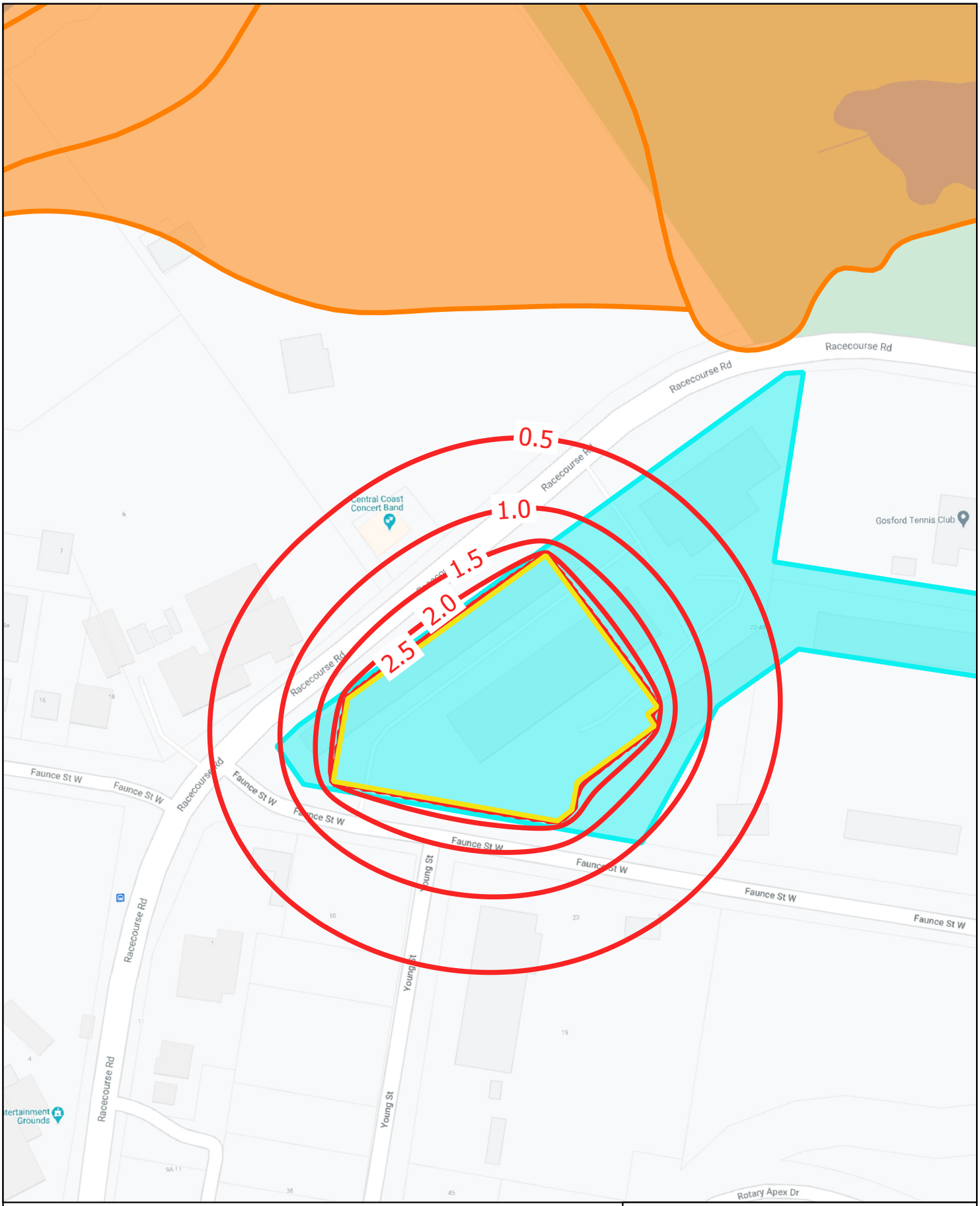
Appendix E

Drawings



Note:
1. Image obtained from Metromap

Douglas Partners Geotechnics / Environment / Groundwater	**SITE LOCATION PLAN** Groundwater Investigation and Dewatering Management Plan Proposed Northside Private Hospital 22 Faunce Street West, West Gosford			OFFICE: Brisbane DRAWN BY: JJT DATE: 12.02.2021
CLIENT: Erilyan Pty Ltd	PROJECT No: 83574.04	DRAWING No: 1	REVISION: 0	SCALE: 1:800



0 20 40 60 80 100 m

Note:
1. Image obtained from Metromap

- End of construction drawdown (0.5 m interval)
- Basement Boundary
- High probability of occurence of acid sulfate soil
- 22 Faunce St W, WEST GOSFORD NSW 2250

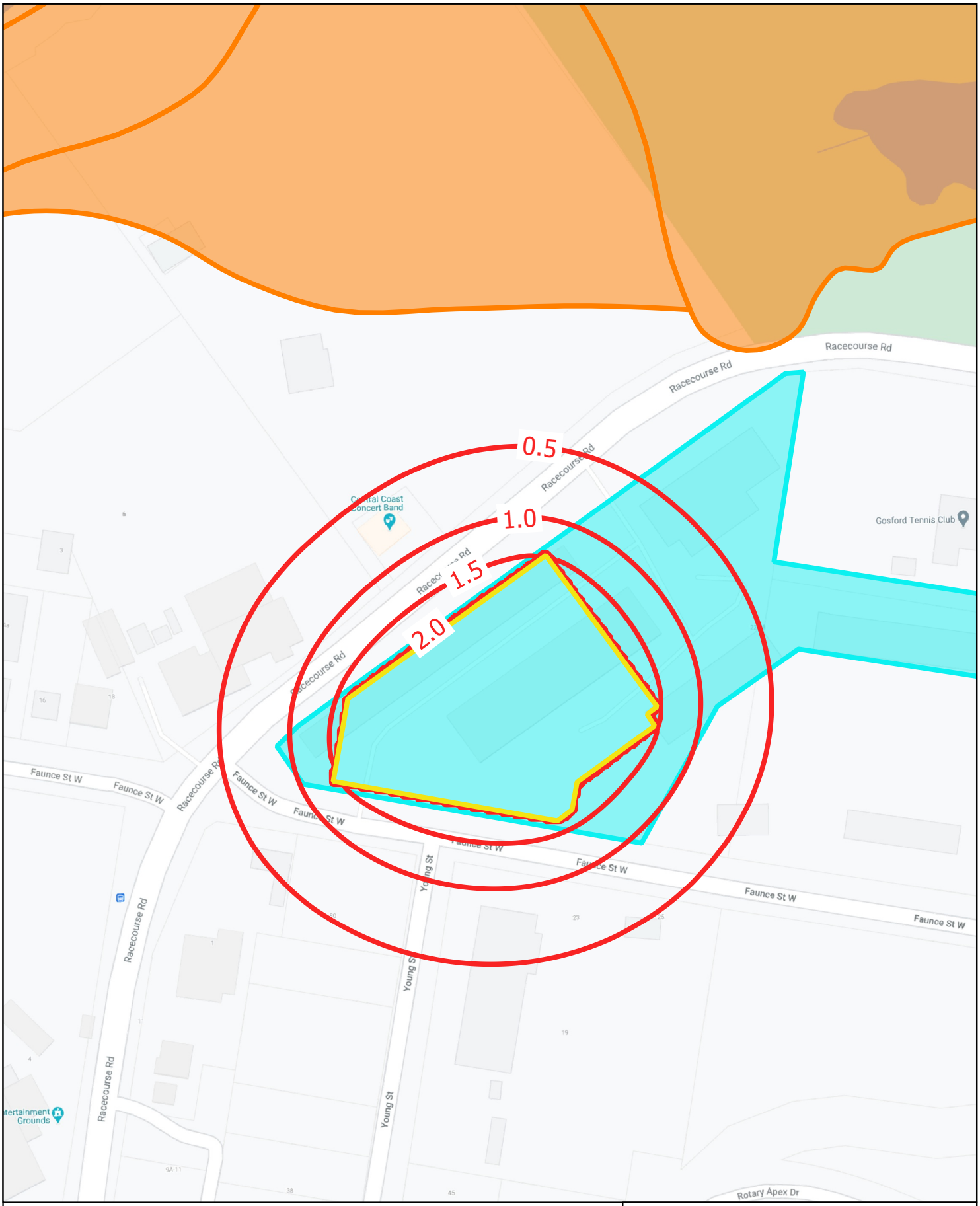
Douglas Partners
Geotechnics / Environment / Groundwater

SIMULATED END OF EXCAVATION DRAWDOWN (RUN 1)
Groundwater Investigation and Dewatering Management Plan
Proposed Northside Private Hospital
22 Faunce Street West, West Gosford

N

OFFICE: Brisbane
DRAWN BY: JJT
DATE: 26.02.2021

CLIENT: Erilyan Pty Ltd
PROJECT No: 83574.04
DRAWING No: 2
REVISION: 0
SCALE: 1:2,000



0 20 40 60 80 100 m

Note:
1. Image obtained from Metromap

- End of construction drawdown (0.5 m interval)
- Basement Boundary
- High probability of occurence of acid sulfate soil
- 22 Faunce St W, WEST GOSFORD NSW 2250

Douglas Partners
Geotechnics / Environment / Groundwater

SIMULATED END OF EXCAVATION DRAWDOWN (RUN 3)
Groundwater Investigation and Dewatering Management Plan
Proposed Northside Private Hospital
22 Faunce Street West, West Gosford

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