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DEICORP PTY LTD

Dewatering Management Plan

Tallawong Station Precinct South, Rouse Hill NSW - Site 2

E24445.E16.2_Rev1
5 August 2021

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0	Original	29 March 2021	-
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1. INTRODUCTION

1.1 Background

Deicorp Pty Ltd (the client) engaged EI Australia (EI) to prepare a Dewatering Management Plan (DMP) for Tallawong Station Precinct South, Rouse Hill NSW (the site).

The site is located within the local government area of Blacktown City Council (**Figure 1**, **Appendix A**), covering an area of approximately 4.4 hectares (**Figure 2**, **Appendix A**). The overall site consists of two vacant lots, divided by Conferta Avenue into a northern half (Site 1, Lot 294 in Deposited Plan (DP) 1213279) and a southern half (Site 2, Lot 293 in DP 1213279). It was understood that Site 2 (covering an area of approximately 2.7 hectares) is the subject of this DMP.

EI understands that redevelopment of the site is a State Significant Development (SSD), a Secretary's Environment Assessment Requirements (SEARs) was prepared for the site. The redevelopment is proposed for mixed residential and commercial land use activities, including multi-levels of basement car park. The basement structure will be constructed at a depth which will intercept the local groundwater table and temporary dewatering is required.

This DMP outlines the site-specific measures for the management of groundwater discharge required during construction of the basement, to achieve compliance with any requirements of Blacktown City Council and the NSW Office of Water (WaterNSW) in relation to the proposed dewatering activities. EI understands this DMP is required to address the recommendations provided by the Department of Planning, Industry and Environment (DPIE) Water and the Natural Resources Access Regulator (NRAR) (Ref. OUT20/408, *Tallawong Precinct Station South Stage 2 Response to Submissions*, dated 5 March 2021) and will be submitted to WaterNSW as part of a temporary dewatering licence application.

1.2 Proposed Development

Based on the supplied plans (**Appendix B**), the proposed development of the overall site involves the construction of up to 16 mixed-use apartment towers, with two to three basement levels and interconnected roadways and landscaped areas including a private park.

Site 2 will consist of three separate, two to three levels of basement car park, with the lowest basement proposed to have a finished floor level (FFL) of 44.5m Australian Height Datum (AHD). A bulk excavation level (BEL) of 44.2m AHD has been assumed, which includes allowance for the construction of the basement slab. Locally deeper excavations may be required for footings, lift overrun pits, crane pads and service trenches.

1.3 DMP Objectives

The objectives of this DMP are to:

- Describe the dewatering methodology, groundwater treatment requirements, monitoring and reporting procedures to be employed during temporary dewatering activities occurring for the construction phase of the proposed basement;
- Provide effective management and contingency procedures, to ensure that the discharge of extracted groundwater does not pose unacceptable risks to the receiving environment, in compliance with the *Protection of the Environment Operations Act 1997*; and
- Meeting the regulatory obligations under the *Water Management Act 2000*, relevant water sharing plans and the NSW Aquifer Interference Policy.

1.4 Scope of Work

With reference to the DMP objectives, the following works were undertaken:

- A desktop study including:
  - Review of the development proposal;
  - Review of geological, landscape and acid sulfate soil (ASS) risk maps for the area;
  - A search of registered groundwater bores licensed by Water NSW located within a 500m radius of the site;
  - Review of previous environmental reports, to identify potential on- and off-site sources of contamination that may impact on dewatering discharge water quality; and
  - Review of relevant existing reports and laboratory analytical data obtained during previous groundwater monitoring events (GME) to characterise groundwater quality prior to dewatering.
- Preparation of this Dewatering Management Plan (DMP).

1.5 Regulatory Framework

The following regulatory framework and guidelines were considered during the preparation of this report:

Table 1-1 Regulatory Framework

NSW Legislation and Regulatory Instruments	Requirements
Contaminated Land Management Act 1997 (CLM Act)	Promotes the effective management of contaminated land in NSW by setting out the roles and responsibilities of the EPA and the rules they use.
Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act stipulates the regulations and gives rise to state environmental planning policy (SEPP) to assist regulators with the protection of human and environmental health.
Protection of the Environment Operations Act 1997 (POEO Act)	The objective of the POEO Act is to achieve the protection, restoration and enhancement of the quality of the environment.
Water Management Act 2000 and *Water Act 1912* (WM Act)	Protects the health of rivers, streams and groundwater systems and gives rise to Water Sharing Plans and quality objectives for catchments within the state of NSW. Manages aquifer interference activities which involve: ▪ The penetration of an aquifer ▪ The interference of water in an aquifer ▪ The obstruction of water flow or taking of water from an aquifer when carrying out prescribed activities; and ▪ The disposal of water taken from an aquifer.
NSW Office of Water (2012) *NSW Aquifer Interference Policy*	Details the scope of aquifer interference activities and provides specific guidance on the licensing and approval requirements for activities that interfere with aquifers.
State Environmental Protection Policies (SEPPs)	▪ State Environmental Planning Policy No.55 - *Remediation of Land* (1998); and ▪ SEPP *(Sydney Regional Growth Centres) 2006*.

NSW Legislation and Regulatory Instruments	Requirements
National Protection (Assessment of Site Contamination) Measures, 1999, Amendment 2013 (NEPM)	Outlines methodology for contaminated land assessment and provides risk-based criteria for ecological and human health receptors of site contamination.
Blacktown City Council Plans and Policies	Provides controls and guidelines for development in the area. ▪ The *Blacktown City Council Growth Centre Precincts Development Control Plan (2010);* ▪ The *Blacktown Development Control Plan* (2015); and ▪ The *Blacktown Local Environmental Plan* (2015).
Relevant Guidelines (but not limited to)	▪ ANZG (2018) *Guidelines for Fresh and Marine Water Quality;* ▪ NHMRC (2011) *Australian Drinking Water Guidelines;* ▪ NHMRC (2008) *Guidelines for Managing Risks in Recreational Water;* ▪ NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* (March 2007); ▪ NSW DPIE (2021) *Minimum Requirements for building site groundwater investigations and reporting*, January 2021 (DPIE, 2021); ▪ NSW EPA (1995) *Sample Design Guidelines*; and ▪ EPA (2020) *Guidelines for Consultants Reporting on Contaminated Land.*

2. SITE DESCRIPTION

2.1 Property Identification, Location and Physical Setting

The site identification details and associated information are summarised in **Table 2-1**. Site locality and layout plans are provided in **Appendix A**.

Table 2-1 Site Identification, Location and Zoning

Attribute	Description
Street Address	Tallawong Station Precinct South, Rouse Hill NSW - Site 2
Lot and Deposited Plan	Site 2 - Lot 293 in DP 1213279
Site Area	Site 2 - approximately 2.7 hectares
Site Coordinates	Northern-eastern corner of site (GDA2020-MGA56): ▪ Easting: 306020.839; ▪ Northing: 6269941.115. (Source: http://maps.six.nsw.gov.au)
Local Government Authority	Blacktown City Council
Parish	Gidley
County	Cumberland
Current Zoning	R3: Medium Density Residential SP2: Infrastructure (south-eastern corner of the site) (*State Environmental Planning Policy (Sydney Regional Growth Centres) Amendment (Area 20 Precinct), 2015*)
Surrounding Land Use	Site 2 is bounded by Conferta Avenue (north), Cudgegong Road (east), Schofields Road (south) and an open car park (west).
Typical Soil Profile	Based on previous environmental investigations, the soil profile was described as a layer of anthropogenic filling overlying residual clays then weathered shale.

2.2 Regional Setting

The topography, hydrogeology, geology and soil landscape information is given in **Table 2-2**.

Table 2-2 Regional Setting Information

Attribute	Description
Topography	Site 2 slopes towards the south east. Elevations range from approx. 58m AHD in the north-western corner to approx. 50m AHD in the south-eastern corner.
Site Drainage	Site drainage is likely to consist of mostly surface infiltration. Any run off would be expected to flow into the dam in the middle portion of Site 2 or to municipal stormwater pits on Schofields Road and then flow to the nearest drainage line.
Regional Geology	Site 2 lies on the boundary of two formations within the Wianamatta Group, comprising the Bringelly Shale (Rwb) and Ashfield Shale (Rwa) *1:100,000 scale Geological Series Sheet 9130* (Penrith).
Soil Landscape	The Soil Conservation Service of NSW *Soil Landscapes of the Penrith 1:100,000 Sheet* (Bannerman SM and Hazelton PA, 1990) indicates that the site overlies a Blacktown (*bt*) residual soil landscape. This landscape type is characterised by gently undulating rises on Wianamatta Group shales.

Attribute	Description
Acid Sulfate Soils	The *Acid Sulfate Soil (ASS) Risk Maps* (1:25,000 scale; Murphy, 1997) and *Blacktown Local Environmental Plan 2015* indicate the site is not located in an ASS classed area. EI (2020a) conducted an acid sulfate soil assessment during the Detailed Site Investigation (DSI) of the site, which indicated no ASS were present.
Nearest Surface Water Feature	Second Ponds Creek, located approximately 182m east of the site.
Hydrogeology & Groundwater Use	Groundwater was interpreted to flow easterly towards Second Ponds Creek (EI, 2020d). An online search for groundwater bores registered with WaterNSW showed that there are no registered bores within a 500m radius of the site.

3. GROUNDWATER CONDITIONS

3.1 Previous Investigations

Contaminated land investigations were completed by EI during 2020, as part of the consenting activities of the site. The findings of these works provided details regarding the local groundwater conditions at the site, which were reported as:

- EI (2020a) *Detailed Site Investigation, Tallawong Station Precinct South, Rouse Hill NSW.* Report No. E24445.E02_Rev2, dated 1 May 2020 (the DSI);
- EI (2020d) *Additional Groundwater Investigation, Tallawong Station Precinct South, Rouse Hill NSW.* Report No. E24445.E17_Rev0, dated 1 October 2020 (the AGI); and
- EI (2021) *Groundwater Take Assessment, Tallawong Station Precinct South, Rouse Hill NSW.* Report No. E24445.G12_Rev1, dated 30 September 2021 (the GTA).

Relevant details on groundwater quality were extracted from the DSI (EI, 2020a). Site specific dewatering requirements, including standing water levels, inflow and discharge volumes, management measures and shoring were reported in the EI (2021) GTA, attached as **Appendix C**.

Other site reports not reviewed for the DMP works include:

- EI (2020b) *Remediation Action Plan, Tallawong Station Precinct South, Rouse Hill NSW.* Report No. E24445.E06_Rev1, dated 16 April 2020; and
- EI (2020c) *Construction Environmental Management Plan, Tallawong Station Precinct South, Rouse Hill NSW.* Report No. E24445.E13_Rev0, dated 27 July 2020.

3.2 Groundwater Depth and Flow Direction

The EI (2021) GTA indicates the groundwater was recorded at depths ranging from RL of 48.9-54.6m AHD, during a pump out test in 2020. To account for groundwater level variation which may occur in the future, a design groundwater level of RL 52.4m AHD was adopted for Site 2.

Groundwater beneath Site 2 was interpreted to flow easterly towards Second Ponds Creek (EI, 2020d).

3.3 Groundwater Quality

The EI (2020a) DSI investigated the quality of groundwater within Site 2. Groundwater samples were analysed for the potential contaminants of concern, and the results were compared to the adopted criteria (**Section 5.2**). The reported results were generally within the adopted criteria, with the exception of:

- Heavy metals (copper, nickel, zinc and manganese) exceeded the adopted criteria; and
- F2 TRH fraction exceeded the adopted criteria at BH7M and BH13M.

An additional GME was recommended following excavation and removal of potential on-site contamination sources. This can be completed prior to dewatering to further characterise pre-dewatering groundwater quality. The methodology for these works are detailed in **Section 5** and the adopted criteria recommended for the initial (and on-going) assessment of discharge water quality are listed in **Table 5-1**, **Section 5.2**.

4. DEWATERING METHODOLOGY

4.1 Excavation and Shoring

As stated in **Section 1.2**, the proposed development of Site 2 includes the construction of three separate, two to three levels of basement facilities. A BEL of approximately 44.2m AHD has been assumed. Locally deeper excavations may be required for footings, service trenches, crane pads, and lift overrun pits.

With reference to the GTA (EI, 2021) (**Appendix C**), the following shoring system was assumed:

- Soldier pile wall: Piles will be socketed 1m into at least Class II/III bedrock.
- Vertical sandstone excavation below the soldier pile wall.

Groundwater was assumed to be freely draining between the soldier piles and through the defects of the vertical sandstone excavation.

4.2 Estimated Groundwater Volumes

The EI (2021) GTA estimated the total take volume for the basement construction activities proposed for Site 2, based on the following assumptions:

- The subsurface conditions were horizontal along the site. Permeability values presented in **Table 1** (EI, 2021) were adopted for each unit.
- The soldier pile shoring walls are assumed to allow seepage ingress and free to drain.
- The vertical sandstone excavations were modelled as freely draining.
- For the simplicity of this model, temporary dewatering will be undertaken within the basement retaining wall perimeter to the BEL, being a depth of approximately 44.2m AHD.
- External design groundwater level of 52.4m AHD was assumed to be constant at 75m away from the shoring wall.
- A “No-Flow” boundary is defined along the symmetric line (the centre of the excavation), at 50m from the perimeter shoring walls.
- The shoring walls surrounding the basement excavation have a maximum length of about 680m.
- The model has assumed 150 days for the construction of the basement.

Based on these assumptions, the total take volume for dewatering of Site 2 was calculated as:

- **0.35 mega litres** (**ML**) over 150 days during construction and **0.86 ML** over 12 months (365 days) during operation.

4.3 Dewatering Level

The EI (2021) GTA reports that dewatering would be required to achieve draw down of the groundwater table to the depth of the BEL, at approximately 44.2m AHD, to enable the basement to be constructed in ‘dry’ conditions. The dewatering level would require confirmation and further analysis once the basement is completed.

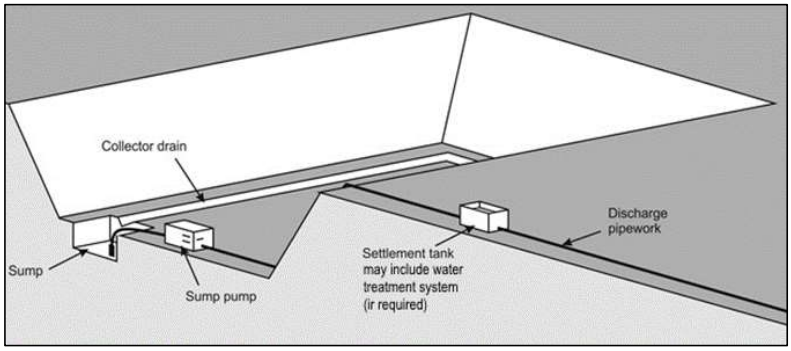
Groundwater elevations would require continuous monitoring. This should occur from the date of consent until at least two months after the cessation of pumping and/or until groundwater levels recover to pre-dewatering elevations. Standing water levels (SWL) of the underlying groundwater should be recorded from within specified monitoring wells installed outside the

shored area (on all sides), to confirm drawdown and recovery levels. Monitoring of drawdown is required to validate the accuracy of the seepage model, and pumping rates should be adjusted where needed. EI recommend the use of automatic groundwater level loggers, to be installed within the selected groundwater monitoring wells for the continual monitoring of SWL across the site. EI note that the existing groundwater monitoring wells are located within the basement footprint, and will be removed as part of the bulk excavation works. The installation of additional groundwater monitoring wells would be required; however the construction design and positioning of these monitoring wells should be discussed with a qualified environmental consultant prior to completing the works.

4.4 Dewatering Method

At the time of preparing this plan, EI had not received details of the proposed dewatering system design (including number and depth of well points, alignment, pumping rates and discharge points). Dewatering at sites with similar geological conditions is generally undertaken sump and pump system as illustrated in **Figure 4-1**.

Figure 4-1 Hypothetical layout of a *Sump and Pump* seepage collection System



During construction, it is recommended that, any pumped-out groundwater be discharged initially into a vessel (basin, or equivalent). The preferred vessel type will require capacity to accommodate the rate of groundwater seepage, which was estimated by EI (2021) to be 2.35 m^3/day (**Appendix C**). This would allow for the treatment of groundwater within the vessel prior to discharge (if necessary). EI assumed that all water removed from the site would be discharged to the municipal stormwater system, which drains into Second Ponds Creek. The pumping system may operate on a full time or intermittent basis (as required) to achieve the required groundwater levels for construction and shoring of the basement.

Based on the GTA (EI, 2021), the groundwater volumes expected per year appeared to be manageable using a drained basement system of its lifetime, considering the size of the proposed basement. “Tanking” of the basement is not warranted and a drained basement is possible for the development.

The Principal Contractor/Site Manager, Dewatering Contractor and Water Treatment Specialist must agree on a dewatering strategy to confirm that dewatering treatment systems and water retention tanks can be positioned appropriately within approved areas of the site, prior to the commencement of excavation works.

4.5 Drawdown Impacts

In specific cases, dewatering may induce ground subsidence on neighbouring properties, associated with the increased vertical effective stress of the underlying landform. Due to the underlying Ashfield and Bringelly Shales, it is considered that there is a low risk that dewatering would generate significant drawdown and settlement in the shales.

Any potential settlement calculations should be verified by an experienced geotechnical engineer.

5. WATER QUALITY MANAGEMENT

5.1 Responsibility

The Principal Contractor or Site Manager, appointed by the client for the construction works, will be responsible for implementing the management procedures for water quality as described by this DMP.

5.2 Adopted Criteria for Discharging Water

In accordance with the NSW Water Quality and River Flow Objectives, extracted waters from site dewatering operations must be tested to ensure compliance with the Australian and New Zealand Government, *Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) trigger values for the 95% species protection of Fresh Water (and 99% Trigger Values for bio-accumulative contaminants). Where the ANZG (2018) guidelines do not provide values, relevant default criteria may be applied in accordance with the *National Environmental Protection (Assessment of Site Contamination) Measure* 1999, as amended in 2013 (NEPC, 2013).

The groundwater acceptance criteria for discharging waters were selected in accordance with the guidelines endorsed from time to time by Section 105 of the *Contaminated Land Management Act* (1997), and complies with the requirements of the NSW *Protection of the Environment Operations Act 1997.* The criteria adopted are presented in **Table 5-1** and must be adhered to during the dewatering program.

Table 5-1 Discharge Water Criteria

Analyte	Discharge Water Criterion (µg/L) [1]
Physico-Chemical Parameters	
pH	6.5 to 8.0 [3]
Turbidity (NTU)	1-50 [4]
Electrical Conductivity (µS/cm)	125 - 2,200 [4]
Total Dissolved Solids (mg/L)	<1200 [5]
Hardness (mg/L as $CaCO_3$)	<60 – 500 [5]
Metals	
Aluminium (pH>6.5)	55
Arsenic [III]	24
Arsenic [V]	13
Cadmium	0.2
Chromium [III]	27.4
Chromium [VI]	1.0
Copper	1.4
Lead	3.4
Mercury (total)	0.06
Nickel	11
Zinc	8

Analyte	Discharge Water Criterion (µg/L) [1]
Total Recoverable Hydrocarbons (TRH)	
F1 (C_6-C_{10} minus BTEX)	50 [6]
F2 (>C_{10}-C_{16} minus naphthalene)	60 [6]
F3 (>C_{16}-C_{34})	500 [6]
F4 (>C_{34}-C_{40})	500 [6]
Monocyclic Aromatic Hydrocarbons (BTEX)	
Benzene	950
Toluene	180 [2]
Ethylbenzene	80 [2]
o - xylene	350
p - xylene	200
m - xylene	75 [2]
Polycyclic Aromatic Hydrocarbons (PAH)	
Total PAH	1 [6]
Other Parameters	
Phenol (total)	320
Cyanide (total)	7

Note 1 Discharge water quality criteria are the ANZG (2018) *95% Fresh Water Trigger Values* (with the *99% Trigger Values* applied for the bio-accumulative parameters - mercury), unless otherwise indicated.

Note 2 Low reliability toxicity data, refer to ANZECC / ARMCANZ (2000).

Note 3 From Table 3.3.2 in ANZECC/ARMCANZ (2000) *Default trigger values for physical and chemical stressors*.

Note 4 In the absence of an ANZG (2018) criterion, an alternative criterion from ANZECC / ARMCANZ (2000) is applied (turbidity and electrical conductivity valies sourced from Table 3.3.3 *Default trigger values for physical and chemical stressors*, with the marine criterion for EC applied, in the absence of a fresh water criterion).

Note 5 Based on NHMRC (2018) *Drinking Water Guidelines*.

Note 6 In lack of a published criterion, the laboratory PQL will be adopted, as per DEC (2007). The PQL of SGS Australia Pty Ltd is given here.

5.3 Groundwater Quality Monitoring

5.3.1 Visual Monitoring

Visual inspections of the dewatering measures and equipment should occur regularly (daily where possible) by the Principal Contractor or Site Manager to ensure:

- The effective operation of all dewatering treatment equipment;
- Short circuiting of water around baffles and filter media within sediment retention tanks;
- No hydrocarbon sheens are visible and no hydrocarbon odours are emitted from the groundwater or sediment;
- No green blue or extremely clear water indicating high levels of dissolved aluminium is present;
- No sediment or suspended load is allow to bypass the baffles and sediment tanks; and
- Appropriate quantities of chemical product are available for use within the dosing system (if required).

The Site Manager must keep a record of all visual observations, as well as flow rates to enable the determination of groundwater extraction/discharge volumes following the completion of dewatering activities.

5.3.2 Discharge Water Quality Monitoring

To assess the ongoing suitability of the extracted water for discharge to the municipal stormwater system, monitoring of the water quality will be required. Sampling of groundwater should be completed prior to commencement of dewatering activities to establish a baseline, and should continue for the duration of the dewatering activities occurring at the site. The monitoring should be completed by a suitably qualified environmental scientist or equivalent, and samples should be analysed by a NATA accredited laboratory, for the parameters listed in **Table 5-1**.

All laboratory analytical results for the groundwater samples must be retained, and kept onsite by the appointed contractor, to be made available upon request by Council and/or Water NSW. The contractor should seek advice from the environmental consultant prior to deviating from any of the above monitoring requirements. The Site Manager should seek advice from the environmental consultant prior to deviating from the agreed monitoring program, to ensure the quality of discharged groundwater is not compromised. Once the Site Manager and consultant have been appointed, their names and contact information are to be clearly displayed in the site office.

The following activities are to be implemented for the site:

- **Initial Assessment - Post Remediation and Pre-Dewatering Groundwater Monitoring Event**: Following excavation confirming that the potential on-site contaminant source has been removed, an additional round of groundwater sampling would be required to further characterise pre-dewatering groundwater quality, which may coincide with the installation of the dewatering system. The collected groundwater sample(s) should be tested for the target quality parameters listed in **Table 5-1** as a minimum, to establish baseline (initial) groundwater quality conditions. A review of the proposed discharge water quality requirements will then be conducted. **NOTE:** Should deviations from the adopted criteria be considered technically justifiable, approval from Council and/or WaterNSW must be sought to allow any alternative discharge criteria to be applied.
- **Trial-Run Period:** Prior to the discharge of any extracted groundwater to the stormwater network, a trial run will be required. The trial run shall be completed as follows:
  - The initial groundwater volumes pumped from the site would be diverted back into the excavation, to infiltrate site strata and re-enter the underlying groundwater aquifer, thus allowing a reduction in suspended sediments, which are expected in the initial pump-out waters;
  - Samples of the treated groundwater will be collected and laboratory analysed for the water quality parameters listed in **Table 5-1**; and
  - After confirmation that the water quality complies with criteria, the extracted groundwater will be directed to the stormwater discharge point.

  A bi-weekly (twice per week) sampling frequency should occur during the trial-run of the onsite water treatment system. As a minimum, the trial run sampling program should comprise two samples, collected prior to, and post treatment of the extracted groundwater. The analytical results of these samples will be compared to each other, to assess the performance of the water treatment system, and the results of each sampling event will be recorded, to establish the trend of water quality change.

  Bi-weekly sampling should be maintained for a minimum of two weeks following commencement of the dewatering treatment, unless stated otherwise by the environmental

consultant. Sampling for trial run purposes will cease once the target parameters in treated water stabilise (i.e. consecutive tests are within ± 10% of the observed results) and contaminant concentrations are within the adopted discharge criteria for three consecutive sampling events. The Trial-Run period may be extended if stabilisation is not observed, or if the treated water does not satisfy the adopted criteria (**Table 5-1**).

The contractor should seek advice from an appropriately qualified consultant regarding the termination of the Trial-Run Period. During the Trial-Run period, all collected groundwater seepage (including treated water) should be retained on-site and stored in appropriate bulk containers, or allowed to infiltrate back to the aquifer. No collected groundwater should be discharged to the stormwater system until it is proven to meet the adopted criteria.

- **Discharge Monitoring Period (Weekly to Fortnightly):** After the Trial-Run Period, and subject to statutory authority approval, treated water may be discharged directly to the stormwater system. A weekly sampling frequency will be adopted for four weeks. The sampling program will involve the collection of one system discharge (i.e. treated) sample (as a minimum), to be analysed for the target parameters stated in **Table 5-1**, to confirm the system is functioning as intended.

  After four weeks, the weekly sampling frequency may be extended to fortnightly monitoring for a month and then monthly for the remaining duration of dewatering, provided the analytical monitoring results indicate the treated water quality consistently meets the adopted criteria. If this is not achieved and contingency measures have been implemented, weekly monitoring will re-commence, until consistency in the discharged water results is re-established.

  Dewatering contingency measures are detailed within **Section 6.5**, **Table 6-1**, and should be implemented where groundwater results exceed the adopted criteria for any one monitoring event. Any changes to the sampling frequency are to be determined by the appointed environmental consultant.

5.3.3 Reporting of Water Quality Results

Dewatering management procedures and monitoring results will be reviewed by the appointed environmental consultant to ensure that the treatment procedures are effective, and that the discharge waters are in compliance with the adopted criteria (**Table 5-1**). Discharge water quality reporting will be required as follows:

- A summary report will be prepared upon completion of the initial assessment (**Section 5.3.2**). The report will be submitted to the Site Manager, Dewatering Contractor and Council upon request.
- Interim Monitoring Reports will be prepared upon receipt of laboratory data for each round of water quality monitoring for the discharged waters. The interim reports will detail the sampling methods and procedures, and will provide a comparison of historic and current results obtained from the site, against the adopted criteria and shall corrective actions and recommendations based on the results, where required.
- Following completion of dewatering activities, a Dewatering Completion Report will be prepared by the appointed environmental consultant, and must include copies of all analytical results and interim monitoring reports issued during the dewatering period. A clear statement will be made regarding the overall quality of groundwater discharged to the stormwater system in comparison to the acceptable quality standards. The final report will be submitted to Council and Water NSW.

Reporting of Other Information

The Site Manager must keep records of complaints, water treatment chemicals and treatment methods employed and cumulative discharge volume records as measured from the installed calibrated flow meter. In addition, any periods of dewatering stoppage should also be recorded.

These records must be available on-site at all times and should be provided to the appointed water quality expert for monitoring report purposes.

5.3.4 Discharge Flow and Volume Monitoring

The cumulative volume of water discharged to stormwater must be monitored by calibrated flow meter (or equivalent alternative means) to comply with regulatory requirements. This will require a regular (preferably) daily record to be maintained, to document the total volume discharged, and reporting of the cumulative volume discharged in the interim monitoring report.

Flow monitoring will be undertaken by a suitably trained site employee under the supervision of the Project Manager and tabulated records should be maintained on site and made available to the environmental consultant for inclusion in the routine monitoring event reports.

These records will be used to calculate the actual groundwater volume discharged from the site and will be included in the final Dewatering Completion Report (**Section 5.3.3**) to be issued to Council and WaterNSW after the completion of dewatering activities.

5.4 Groundwater Treatment

All extracted groundwater that exceeds the adopted criteria values will require treatment on-site using approved technologies prior to discharge. Engagement of a suitably qualified and experienced water treatment specialist is necessary, to design and install any treatment measures that may be required, which should include (but not necessarily be limited to):

- A treatment tank with minimum capacity capable of containing the expected inflow for the basement (as described in **Section 4.4**);
- Groundwater filtration to reduce fine particulates;
- Automated in-line chemical dosing systems for the addition of buffering solutions and coagulants for the management of water pH and other parameters, which may be required from time to time, as described in **Section 6.5** *Dewatering Contingencies*;
- Groundwater treatment to reduce concentrations of the metals (if required) to below the adopted criteria detailed in **Table 5-1**;
- Spare retention tank(s) to provide additional residence time and sedimentation, in the case that non-compliant water quality is identified during routine monitoring, triggering temporary redirection of discharge while adjustments to the water treatment system are being implemented; and
- A means of monitoring flow rate to enable the accurate determination of total discharge volume (addressed in more detail in **Section 5.3.4**).

Selection of the preferred water treatment system shall be made by the appointed dewatering contractor with guidance from the water treatment specialist. The water treatment system should be installed, tested and operational prior to the commencement of dewatering, to ensure that only treated water that meets the adopted quality criteria is discharged to storm water.

System Maintenance

The groundwater treatment system(s) must be regularly maintained by the dewatering contractor. Maintenance must include:

- Regular cleaning and or replacement of the geo-fabric filters within the retention tanks; and
- Regular removal of sediment from the retention tanks by an appropriately-licensed waste contractor.

6. SITE MANAGEMENT CONTROLS

6.1 Deviations from this Plan

The Principal Contractor or Site Manager should seek advice from the environmental consultant whenever deviation from the agreed monitoring program is considered. To ensure the monitoring data set and the early warning objectives of the DMP are not compromised, variations will only be considered where technical justification exists, and any deviations that may be accepted will be documented within the corresponding reports, and must include all justifications for the variation accepted.

6.2 Contact Details for Key Personnel

Once the site manager, dewatering contractor, water treatment specialist, environmental consultant (water quality expert) and geotechnical engineer have been appointed, their names and contact information must be clearly displayed on site, within the site office. An example format is as follows:

Site Manager/Principal Contractor	Name: Company:	Mobile phone: Email:
Dewatering Contractor	Name: Company:	Mobile phone: Email:
Water Treatment Specialist	Name: Company:	Mobile phone: Email:
Environmental Consultant (Water Quality Expert)	Name: Company:	Mobile phone: Email:
Geotechnical Engineer	Name: Company:	Mobile phone: Email:

6.3 Summary of Specific Activities

The appointed contractor and/or Site Manager will be responsible for ensuring that the following activities (requirements) are undertaken during the dewatering program:

- Maintain erosion and sediment control measures in a functioning condition, until all construction activities are completed;
- Perform daily visual inspection of stormwater diversions and sediment / erosion control devices, as specified in **Section 5.3.1**;
- Implement appropriate remedial measures where any controls or devices are not functioning effectively or are inappropriate;
- Collate records and comments on the condition of existing erosion and run-off controls (drains, silt fences, catch drains etc.), dewatering procedures and test results, and any site instructions issued to sub-contractors to undertake remedial works;
- Maintain general rainfall records describing each day as dry, light rain, heavy rain and the approximate duration of the rain event (to be filed on site);
- Confirm water quality parameters meet the relevant discharge limits, by disclosing supporting documentation upon request;

- Reporting any incidents of poor drainage or uncontrolled discharge; and
- Recording all daily inspection reports, environmental incidents and cumulative discharge volumes, as read from the installed flow meter (described in **Section 5.3.4**), which may be reviewed during any dewatering audit that may occur at the site.

6.4 Vibration, Noise, and Odour Management

The following vibration, noise and odour risks may occur during dewatering:

- Excessive vibration and noise levels associated with site plant / dewatering equipment; and
- Odours released from collected groundwater, which may pose a risk to human health and/or the aesthetic condition of the environment.

It is the responsibility of the Site Manager to ensure appropriate management of vibration, noise and odour during dewatering operations. Appropriate management methodologies include the following:

- Undertaking dilapidation surveys of neighbouring buildings, in accordance with potential for impacts in final design type.
- All sub-contractors to be managed to ensure they work only within defined hours set by the DA conditions.
- All reasonable steps shall be taken to muffle and acoustically baffle all plant and equipment. Noise and vibration levels generated by site works must be within the limits set by the DA conditions, the site specific environmental management plan and the *Protection of Environmental Operation Act 1997*.
- Give consideration to the noise emission of plant / equipment prior to its selection / mobilisation to site, and schedule the use of noisy equipment at the least-sensitive time of day.
- Situate noisy equipment at the greatest distance from the noise-sensitive area, or orient the equipment so that noise emissions are directed away from sensitive areas, to achieve the maximum attenuation of noise. Where there are several noisy pieces of equipment, schedule operations to minimise cumulative impacts.
- Keep equipment well maintained.
- Ensure engine shrouds (acoustic linings) are installed (where feasible).

6.5 Dewatering Contingencies

Contingent actions for scenarios that may arise during dewatering are detailed in **Table 6-1**.

Table 6-1 Mitigation Measures for Potential Dewatering Issues

Anticipated Problem	Corrective Actions
Water Quality Criteria Non-Compliance	
Water Quality Criteria Exceedance Laboratory analytical report for any monitoring event reveals that the quality of treated discharge water does not satisfy the adopted criteria detailed in **Table 5-1**	Immediate action must be taken to halt the release of water into the municipal stormwater system, where water quality is found not to meet the adopted criteria detailed in **Table 5-1.** Discharge to the stormwater system must be suspended to enable the following procedure to be implemented: 1) Discharge water will be redirected to the spare retention basin; 2) A water sample will then be collected and sent to the laboratory for confirmation analysis for the non-compliant parameter(s) on an express (24hr) results turn-around basis; 3) Should the analytical result for the confirmation sample show that the previously non-compliant parameter(s) is/are now meet the adopted criteria, the treated water outlet may be redirected to the stormwater system; 4) Should the analytical result for the confirmation sample show that the discharge water quality does not comply with the adopted criteria, the environmental consultant / water treatment specialist will be required to modify the water treatment system, in order to achieve compliant discharge water quality. Collection of further treated water samples will be required to confirm the effectiveness of the modifications; 5) After laboratory confirmation that the revised treated water quality complies with criteria, extracted groundwater may be re-directed to the stormwater discharge point; and 6) Weekly monitoring of treated discharge water quality monitoring will be required, until such time that contaminant concentrations are within the adopted criteria values for three consecutive sampling events. Once this is achieved, fortnightly monitoring may be reinstated. **Note:** It may be necessary to have collected waters removed by a licensed wastewater contractor, should quantities exceed the on-site capacity for temporary storage.
Visible and Olfactory Impacts Visual and/or olfactory anomalies (e.g. change in water colour, turbidity, odour, presence of oil / grease) are observed in extracted groundwater	Similar to the above procedure (Steps 1 to 6) treated water will be redirected to an alternative retention vessel, while the treatment system is adjusted. It may be necessary to have collected waters removed by a licensed wastewater contractor, should retained quantities exceed the on-site capacity for temporary storage. The contractor is to seek advice from a suitably experienced environmental consultant in regard to the additional assessment and treatment that may be required for any observed changes to water appearance or detectable odours. In accordance with Council's Contaminated Land Policy, no nuisance odours are to be detected at any site boundary during the dewatering stage. Should odour emissions be detected at a site boundary, the following measures will be implemented: 1. Stop work, to allow odour to subside. 2. Monitor ambient air across the site and boundaries with a portable photo-ionisation detector (PID). 3. Implement control measures, including respirators for on-site workers, use of odour suppressants and wetting down of excavated material.

Anticipated Problem	Corrective Actions
	4. Notify the occupants of adjoining premises regarding odour issues. Notification should be in writing, providing the contact details of the responsible site personnel. 5. Record logs for volatile emissions and odours.
Repeated Criteria Exceedances After three non-compliances for discharge water quality	Retain extracted water on-site in spare retention basin(s) and appropriate bulk containers, until it can be removed by a licensed waste contractor. Determine an alternative discharge method, if necessary, updating the DMP accordingly.
Groundwater Take Non-Compliance	
Excessive Extraction Daily discharge rate is greater than expected and it is apparent that the projected total groundwater extraction volume will be exceeded	Advise the appointed environmental consultant and determine the cause of the increased dewatering rate. If reduction in dewatering rate cannot be implemented, WaterNSW should be contacted to review options, which may include a combination of: ▪ Temporary retention of tail water on-site in appropriate bulk containers for subsequent removal by a licensed wastewater contractor; ▪ Aquifer re-injection after obtaining regulatory approval; and/or ▪ Fast-tracking of construction works to complete dewatering sooner than the scheduled timeframe.
System Performance Issues	
Dewatering system failures	Ensure that spare equipment parts (where practical) are on hand. Ensure that the failed equipment can be serviced by site personnel or an appointed contractor who can rapidly report to site when needed.
Power outages	Ensure that a backup generator is readily available. In this event, an assessment across the site and surrounding sites should also be completed in order to identify whether any other lights and electrical equipment are working so to identify if the issue is site specific or if it is across a whole area. In addition to having the back-up generator running, the contractor should also seek advice from an electrician in regard to the additional assessment and repairs that may be required.
Unexpected contaminants found during monitoring	Contact the appointed environmental consultant / water quality expert and collect samples for analysis, to assess the identified concentrations against relevant criteria. If the contaminant is found to exceed the adopted criteria for the 95% species protection for fresh waters (ANZG, 2018), follow the corrective actions corresponding to *Water Quality Criteria Exceedance* above. Expand the adopted criteria accordingly.
Chemical / fuel spill and leaks from machinery	Stop earthworks, notify site project manager. Use accessible soil or appropriate absorbent material to absorb the spill (if practicable). Stockpile the impacted material in a secure location, on builder's plastic to avoid cross contamination. Inspect groundwater and note any visual and/or changes. The contractor should also seek advice from environmental consultant in regard to the additional assessment and treatment that may be required.
Excessive rainfall	Ensure sediment and surface water controls are in place and functioning as intended, as per the designs provided in the site specific Soil and Water Management Plan. Any non-conformance is to be documented and rectified. The capacity of the dewatering system to dispose larger volumes of water should be evaluated and if required, a

Anticipated Problem	Corrective Actions
	temporary system should be utilised following correspondence with Council / WaterNSW and the environmental consultant.
Excessive noise	Identify the source and isolate if possible. Modify the actions of the source or erect temporary noise barriers if required.
Impacts on the stability of adjacent structures	Contractor to seek advice from qualified professional (such as a geotechnical engineer and/or structural consultant) in regards to the additional assessment and monitoring that may be required.
Complaint management	Notify client, project manager(s) and environmental consultant (if required) following complaint, and report complaint as per management procedures. Implement control measures to address reason of complaint (if possible) and notify complainant of outcome.

7. DEWATERING MANAGEMENT SUMMARY

The requirements of this Dewatering Management Plan are summarised in **Table 7-1**.

Table 7-1 Dewatering Management Summary

Item	Requirement / Procedure
Objective of DMP	Ensure that the proposed dewatering operations do not impact on the quality of the receiving surface waters (i.e. at the point of groundwater discharge). Where necessary, groundwater will be treated to achieve an acceptable water quality prior to discharge: ▪ *See **Section 3** for groundwater conditions.* ▪ *See **Section 5.2** for groundwater quality discharge requirements.* ▪ *See **Sections 4.4** and **5.4** for groundwater treatment options.* Provide comment on groundwater level changes that occur during dewatering: ▪ *See **Section 4** for summary of groundwater take assessment and dewatering drawdown impacts.* ▪ *Refer to **Appendix C** for groundwater take assessment model.*
Person Responsible for Implementation of DMP	The principal contractor / site manager will be responsible for ensuring the implementation of appropriate treatment of extracted groundwater, as outlined in this document.
Operation Policy	To ensure that all extracted groundwater is effectively treated prior to discharge to the stormwater network.
Pre-Dewatering Groundwater Assessment	As set out in **Section 5.3.2**, a representative sample(s) must be collected prior to any dewatering. It will be tested for the identified potential contaminants, to provide baseline groundwater quality data and review the proposed discharge water quality requirements.
Discharge Performance Criteria	All groundwater designated for discharge into the local stormwater network is to meet (at the very least) the criteria outlined within **Table 5-1**.
Implementation Strategy	All extracted groundwater will be monitored and treated (where necessary). On-going testing to be performed, to confirm water quality meets the adopted criteria prior to release into the stormwater network. Additional treatment / waste disposal to be undertaken if the criteria values are not met.
Monitoring Requirements	As specified in **Section 5.3.2**: 1. Initial Assessment = Prior to dewatering 2. Trial-Run Period = Twice per week* 3. Discharge Monitoring Period = Weekly for a month to fortnightly for a month then monthly* **provided the analytical results indicate treated water quality meets the adopted criteria, or risks are considered to be significantly low. Should analytical results exceed the adopted discharge criteria, contingencies listed in **Section 6.5** must be followed.*
Auditing	The appointed environmental consultant (water quality expert) will undertake weekly audits during the Trial-Run Period (if required), and monthly audits during the Monitoring Period, to ensure that all discharges to the stormwater network comply with the criteria specified in **Section 5.2**.

Item	Requirement / Procedure
Reporting	The contractor responsible for dewatering will keep records of all monitoring and laboratory test results, as well as quantities of treatment agents applied during the dewatering process. All records should be made available for inspection onsite during the construction phase.
Corrective Actions	As specified in the contingency measures, outlined in **Section 6.5**.

8. STATEMENT OF LIMITATIONS

This plan has been prepared for the exclusive use of Deicorp Pty Ltd, whom is the only intended beneficiary of EI's work. The scope of work completed for the purpose of this plan is limited to that agreed with Deicorp Pty Ltd.

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in drafting similar plans by reputable members of the environmental industry in Australia, as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section must be read in conjunction with the whole of this plan, including its appendices.

EI's professional opinions are reasonable and based on its judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation or observations. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

Should you have any queries regarding this plan, please do not hesitate to contact EI.

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ABBREVIATIONS

AGI	Additional Groundwater Investigation
AHD	Australian Height Datum
ANZG	Australian and New Zealand Governments
ASS	Acid Sulfate Soils
BEL	Bulk Excavation Level
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
DA	Development Application
DMP	Dewatering Management Plan
DP	Deposited Plan
DPIE	Department of Planning, Industry and Environment
DSI	Detailed Site Investigation
DWC	Discharge Water Criteria
EC	Electrical Conductivity
FFL	Finished Floor Level
GME	Groundwater Monitoring Event
GTA	Groundwater Take Assessment
km	Kilometres
LEP	Local Environmental Plan
LGA	Local Government Area
LOR	Limit of Reporting (limit of reporting for respective analytical method)
m	metres
ML	Megalitres
mg/L	Milligrams per litre
µg/L	Micrograms per litre
µS/cm	Microsiemens per Centimetre
NA	Not Applicable
NATA	National Association of Testing Authorities
NC	No Criterion
NRAR	Natural Resources Access Regulator
NTU	Nepholemetric Turbidity Units
OCP	Organochlorine Pesticides
OPP	Organophosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
pH	Potential Hydrogen (a measure of the acidity or basicity of an aqueous solution)
PID	Photo-Ionisation Detector
PQL	Practical Quantitation Limit (quantitative limit for respective analytical method)
RL	Reduced Level
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TPH	Total Petroleum Hydrocarbons (superseded term equivalent to TRH)
TRH	Total Recoverable Hydrocarbons (non-specific analysis of organic compounds)
UST	Underground Storage Tank

Appendix A - Figures

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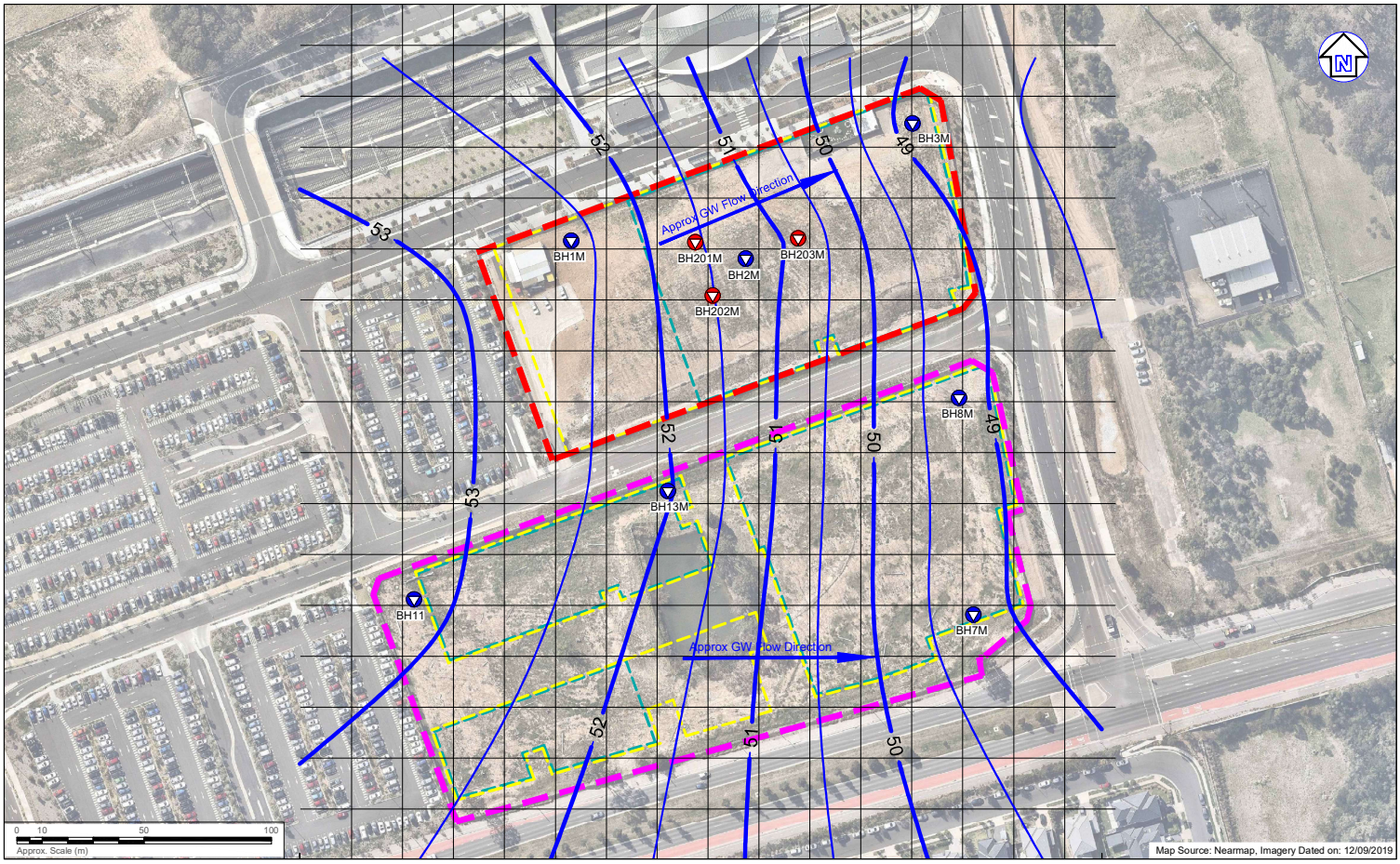
Drawn:	AM.H.
Approved:	N.G.
Date:	26-03-21
Scale:	Not To Scale

Deicorp Pty Ltd
Dewatering Management Plan
Tallawong Station Precinct South, Rouse Hill NSW
Site Locality Plan

Figure: 1

Project: E24445.E16



LEGEND

- Approximate Site 1 boundary (E24445.E16.1 - DMP)
- Approximate Site 2 boundary (E24445.E16.2 - DMP)
- Approximate basement 1 and 2 boundary
- Approximate basement 2 and 3 boundary
- Approximate monitoring well location by EI (AGI, 2020)
- Approximate monitoring well location by EI (DSI, 2020)
- Approximate groundwater flow direction
- Approximate groundwater level (RL mAHD)
- Contour interval 0.5 m

eiaustralia
Contamination | Remediation | Geotechnical
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Drawn:	AM.H.	**Deicorp Pty Ltd** Dewatering Management Plan Tallawong Station Precinct South, Rouse Hill NSW - Site 2 Site Layout Plan	Figure: 2
Approved:	N.G.		
Date:	26-03-21		Project: E24445.E16.2

Appendix B - Proposed Development Plans

NOTES

KEY PLAN

LEGEND

Rev	Date	Approved By	Issue Name
J	15.12.20	YO	PRELIMINARY
K	15.12.20	YO	PRELIMINARY
L	4.5.21	AR	PRELIMINARY
M	11.5.21	YO	PRELIMINARY
N	17.5.21	YO	PRELIMINARY
O	24.5.21	YO	For Coordination
P	27.5.21	YO	For Coordination
Q	1.6.21	YO	For Coordination
R	2.6.21	YO	For Coordination
S	3.6.21	YO	For Coordination
T	3.6.21	YO	For Coordination
U	21.6.21	YO	For Coordination
V	6.7.21	YO	For Coordination

CLIENT

Project Title
Tallawong Station Precinct South
1-15 & 2-12 Conferta Avenue Rouse Hill NSW 2155

Drawing Title
GA Plans Overall
Basement 03 & 02

Scale	Project No.	Drawn by	North
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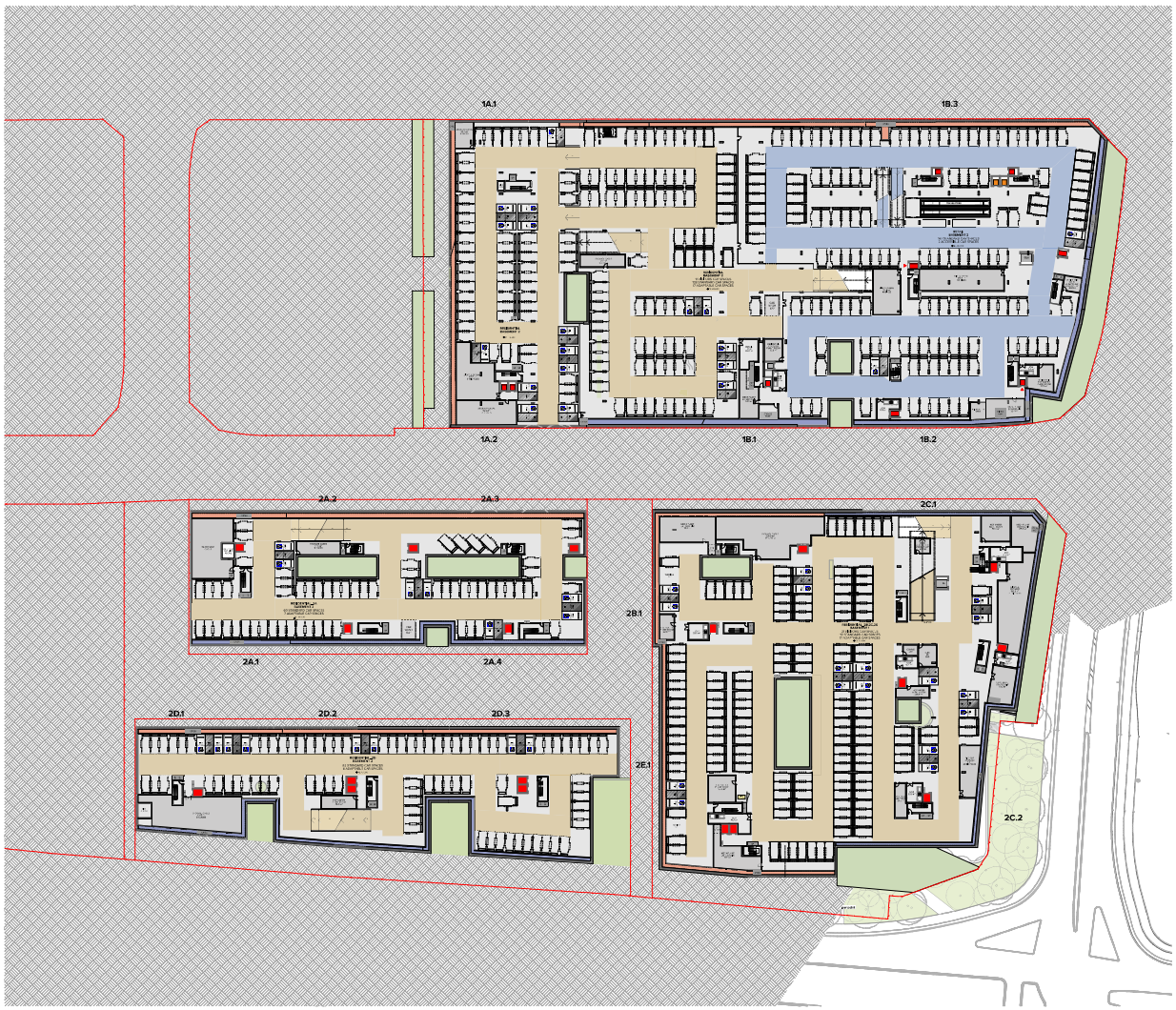
Status	Dwg No.	Rev	
For Coordination	DA-110-006	V	

TURNER



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KEY PLAN

LEGEND

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L	4.5.21	AR	PRELIMINARY
M	11.5.21	YO	PRELIMINARY
N	17.5.21	YO	PRELIMINARY
O	24.5.21	YO	For Coordination
P	28.5.21	YO	For Coordination
Q	1.6.21	YO	For Coordination
R	2.6.21	YO	For Coordination
S	3.6.21	YO	For Coordination
T	3.6.21	YO	For Coordination
U	21.6.21	YO	For Coordination
V	6.7.21	YO	For Coordination

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Drawing Title
GA Plans Overall
Basement 02 & 01

Scale	Project No.	Drawn by	North
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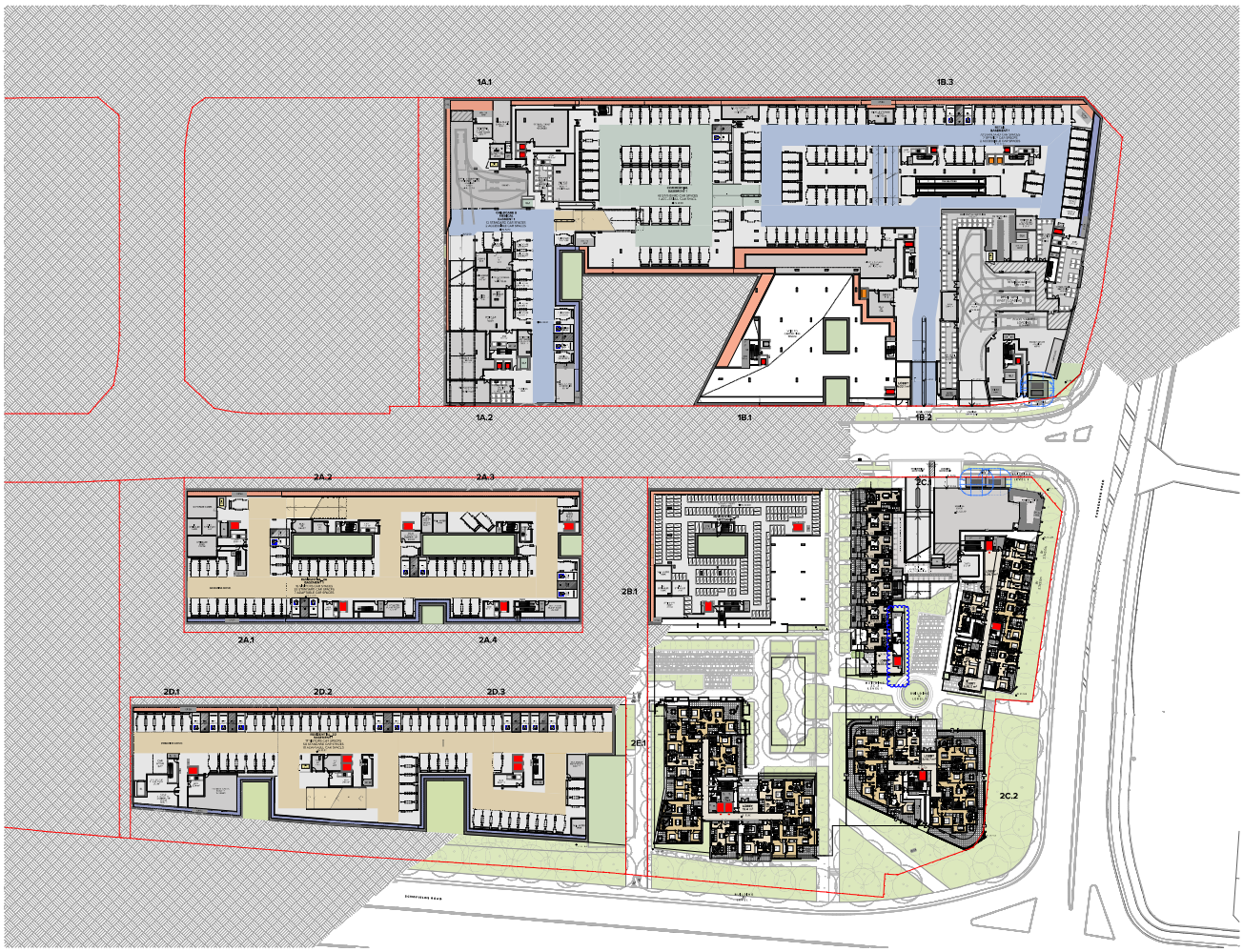
Status	Dwg No.	Rev	
For Coordination	DA-110-007	V	

TURNER



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KEY PLAN

LEGEND

Rev	Date	Approved By	Issue Name
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L	16.12.25	YO	PRELIMINARY
M	17.12.25	YO	PRELIMINARY
N	17.12.25	YO	PRELIMINARY
O	24.12.25	YO	For Coordination
P	29.12.25	YO	For Coordination
Q	13.01.26	YO	For Coordination
R	20.02.26	YO	For Coordination
S	23.02.26	YO	For Coordination
T	30.03.26	YO	For Coordination
U	31.03.26	YO	For Coordination
V	01.04.26	YO	For Coordination

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Drawing Title
GA Plans Overall
Basement 01, Mezz, & Level 1

Scale	Project No.	Drawn by	North
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Status	Dwg No.	Rev	
For Coordination	DA-110-008	V	

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Appendix C - Groundwater Take Assessment

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30 July 2021
E24445.G12_Rev1

Mr. Greg Colbran
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REDFERN NSW 2016

Groundwater Take Assessment
Tallawong Station Precinct South, Rouse Hill, NSW

1. INTRODUCTION

1.1. BACKGROUND

At the request of Mr. Greg Colbran of Deicorp Pty Ltd (the Client), EI Australia (EI) has prepared this Groundwater Take Assessment (GTA) for Tallawong Station Precinct South, Rouse Hill, NSW (the site).

EI had previously prepared a Geotechnical Investigation (GI) report for the site, referenced E24445.G03_Rev1, dated 15 April 2020. An Additional Groundwater Investigation (AGI), referenced E24445.E17_0, dated 1 October 2020 was also completed. This GTA report should be read in conjunction with the GI and AGI reports.

1.2. PROPOSED DEVELOPMENT

The following documents were used to assist in the preparation of this analysis:

- Architectural Drawings by TURNER, Project No.: 18095, Drawing Nos.: DA-110-06, DA-110-010, DA-110-008, DA-110-010 and DA-110-020, Revision V, dated 8 April 2020 and Drawing Nos DA-110-030, DA-110-040, DA-110-050, DA-110-060, DA-110-070, DA-110-080, DA-110-090 and DA-110-100, Revision J, dated 8 April 2020.
- Site Survey Plan, prepared by Daw & Walton Consulting Surveyors, Project No: 4900-20, Sheets 1-7, Revision 03, dated 3 April 2020. The datum in the survey plan is in Australian Height Datum (AHD), hence all Reduced Levels (RL) mentioned in this report are henceforth in AHD.

Based on the provided documents, EI understands that the proposed mixed use development involves the construction of up to 16 buildings of varying heights, to a maximum of eight storeys, with up to two to three basement levels and interconnected roadways and landscaped areas including a private park. Four separate basements are shared by the buildings.

The lowest basement levels are proposed to have finished floor levels (FFL) ranging between RL 44.500m and 49.500m. Bulk Excavation Levels (BEL) ranging between RL 44.20m and 49.20m have been assumed, which includes allowance for the construction of the basement slab. To achieve the BEL, excavation depths ranging from 5.10m Below Existing Ground Level (BEGL) to 13.3m (BEGL) have been estimated. Locally deeper excavations may be required for footings, lift overrun pits, crane pads, and service trenches.

1.3. ASSESSMENT OBJECTIVES

The objective of this GTA is to provide an estimation of the groundwater take volumes that require pumping out during the construction and operational stage of the development, estimation of the groundwater drawdown as a result of the dewatering, and its associated ground settlements (if any).

2. SITE MODEL

2.1. SUBSURFACE CONDITIONS PERMEABILITY

For the purpose of the groundwater take assessment, the average subsurface conditions outlined our geotechnical investigation report (E24445.G03_Rev1, dated 5 June 2020) have been adopted. A summary of the permeability values which were adopted for the assessment of groundwater take volumes are presented in **Table 3** below.

Table 1 Summary of Subsurface Conditions and Adopted Design Parameters

Material [1]	Model 1 (Site 1, North)		Model 2 (Site 2, South)		Adopted Permeability (m/s)
	Depth to Top of Unit (m BEGL) [2]	Approximate RL of Top of Unit (m AHD) [2]	Depth to Top of Unit (m BEGL) [2]	Approximate RL of Top of Unit (m AHD) [2]	
Fill [3]	0	56.9	0	54.4	1×10^{-6}
Residual Soil [3]	3.7	52.7	1.4	52.9	1×10^{-9}
Class V/IV Shale [4]	4.6	52.4	3.5	51.1	H: 1×10^{-7} V: 1×10^{-9}
Class III/II Shale	7.4	49.5	6.3	48.1	H: 1×10^{-8} V: 1×10^{-9}

Notes:

1 For more detailed descriptions of subsurface conditions reference should be made to the Geotechnical Investigation Report.
2 Depths and levels presented in **Table 1** above are generalised using the most conservative levels from the Geotechnical Investigation across the excavation area for the purpose of groundwater seepage modelling.
3 Permeability values have been correlated for material encountered during the GTA using Look (2014).
4 Permeability value of Bedrock was calculated based on the average result of the pump out test carried out by EI.

The permeability the Shale/Laminite bedrock was calculated based on the pump-out test rests completed within monitoring wells. The monitoring wells and pump out test results are summarised in **Table 2** below.

2.2. GROUNDWATER OBSERVATIONS AND PUMP OUT TESTS

As part of the GI and AGI scope, EI had installed 10 monitoring wells (BH1M, BH2M, BH3M, BH7M, BH8M, BH11M, BH13M, BH201M, BH202M and BH203M) for groundwater monitoring. EI carried out a Pump out Test on 23 September 2020 within six of the monitoring wells installed by EI. Groundwater was observed to be at depths of between 1.6m and 8.6m BEGL (RL 48.9m and 54.6m) which were typically along the residual soil/rock interface.

Table 2 Monitoring Well Details and Pump Out Test Results

Monitoring Well/ Test ID	Total Well Depth (m BEGL)	Screen Length (m)	Screened Section	Date of Test	Approximate RL of Groundwater Level (m AHD)	Adopted Permeability (m/s)
BH7M	8.0	6	Shale/Laminite	23-Sept-2020	48.9	9.5×10^{-8}
BH8M	7.0	3	Shale	23-Sept-2020	49.4	1.4×10^{-7}
BH11M	11.6	6	Shale/Laminite	23-Sept-2020	52.8	8.3×10^{-9}
BH13M	7.0	3	Shale	23-Sept-2020	54.6	1.2×10^{-6}
BH201M	9.6	3	Shale	23-Sept-2020	50.6	8.1×10^{-9}
BH203M	9.1	3	Shale	23-Sept-2020	50.2	9.5×10^{-9}

To account for any groundwater level fluctuations due to seasonal variation, design groundwater should be considered 1m above the average recorded groundwater levels for each basement. We have conservatively assumed that design groundwater level for Model 1 and Model 2 to be at RL 51.4m and RL 52.4m AHD with the absence of long-term monitoring.

2.3. SHORING SYSTEM

At the time of this assessment, no detailed structural designs were available. Hence, the following shoring system was assumed for the model based on the recommendations of the GI:

- Solider pile wall: Piles will be socketed 1m into at least Class II/III bedrock.
- Vertical sandstone excavation below the soldier pile wall

Groundwater is assumed to be freely draining between the soldier piles and through the defects of the vertical sandstone excavation.

This assessment does not assess the overall stability and embedment depth of the shoring system. Once final designs are made available, this assessment should be revised accordingly.

3. GROUNDWATER TAKE ASSESSMENT

3.1. GROUNDWATER SEEPAGE VOLUMES DURING CONSTRUCTION PHASE

Groundwater seepage analysis for flow through and beneath the shoring wall during construction has been undertaken using SEEP/W, a finite element groundwater seepage analysis software. SEEP/W estimates the seepage rate of water entering the excavation from beneath the shoring wall. This model estimates the volume of water which will be required to be dewatered during the construction of the basement and until the dewatering is turned off.

For the purpose of this modelling, it has been assumed that:

- Two models were undertaken to estimate the flows into the basements:
  - **Model 1**: The area for the two to three-level basement underneath Buildings 1A.1 and 1B.3 (Site 1), located in the northern half of the site, and
  - **Model 2**: The area for a three, two to three-level basement underneath Buildings 2A.2, 2A.3, 2B.1, 2C.1, 2C.2, 2D.1, 2D.2, 2D.3 and 2E.1 (Site 2), located in the southern half of the site. The three basements were modelled as one large basement for the purpose of this assessment.
- The subsurface conditions were horizontal along the site. The permeability values presented in **Table 1** above were adopted for each unit.
- The soldier pile shoring walls are assumed to be permeable and free to drain.
- The vertical sandstone excavations were modelled as freely draining.
- For the simplicity of this model, temporary dewatering will be undertaken within the basements retaining wall perimeter to BEL, or about RL 44.7m (Model 1) and RL 44.2m (Model 2).
- External design groundwater levels of RL 51.4m (Model 1) and RL 52.4m (Model 2) were assumed to be constant at 75m away from the shoring wall.
- A “No-Flow” boundary is defined along the symmetric line (the centre of the excavation), at 45m (Model 1) and 50m (Model 2) from the perimeter shoring wall.
- The shoring walls surrounding the basement excavation has a maximum length of about 510m (Model 1) and 680m (Model 2).
- The basement will be constructed in 150 days.

The SEEP/W model is presented in **Appendix A. Table 3** below provides the estimated groundwater inflow rate into the basement.

Table 3 Summary of Analysis Results

Model	Inflow per m length of perimeter wall (m^3/sec)	Inflow per m length of perimeter wall (m^3/day)	Inflow into excavation (m^3/day)	Total Inflow during construction (ML/150 days)
Site 1	3.0×10^{-8}	0.003	1.32	0.20
Site 2	4.0×10^{-8}	0.003	2.35	0.35

3.2. ASSESSMENT OF GROUNDWATER TAKE DURING OPERATIONAL PHASE

A drained basement using sub-soil drainage and a sump-and-pump system was assumed. Based on the SEEP/W results, the estimated volume of groundwater removed beneath the basement during the operational phase of the development is expected to be approximately 0.48ML per year for Stage 1 and 0.86ML per year for Stage 2.

4. CONCLUSIONS AND COMMENTS

Based on the findings of this report and within the limitations of available data, EI concludes that:

- Construction and operational phase groundwater take will be approximately:
  - Stage 1: 0.20ML / 150 days during construction and 0.48ML / year during operation
  - Stage 2: 0.35ML / 150 days during construction and 0.86ML / year during operation
- The above estimate is based on the following assumptions:
  - The soldier pile shoring walls are assumed to be permeable and free to drain, and the vertical sandstone excavation was modelled as freely draining.
  - Temporary dewatering will be undertaken within the basement retaining wall perimeter to BEL, or about RL 44.7m (Model A1) and RL 44.2m (Model A2).
  - The basement walls and slab are designed as drained for the developments lifetime.
  - Construction of the basement will take 150 days.
  - This assessment does not take into consideration any excavation that may be required for footings, service trenches, lift pits, or crane pads. This additional excavation, if required, is not expected to affect the retention or the dewatering system.
- In our opinion, the drawdown as a result of the dewatering will have negligible, if any, adverse impact on the neighbouring properties.
- Based on our assessment, considering the size of the proposed basements the groundwater volumes expected per year appear to be manageable using a drained basement system for its lifetime. Hence in our opinion “tanking” of the basement is not warranted and a drained basement is possible for the development.
- Should any design or construction conditions differ from that adopted in this report; this GTA should be reviewed and updated as required.

5. LIMITATIONS

The advice and parameters presented in this Groundwater Take Assessment are for preliminary assessment of the expected groundwater take based upon the proposed development and encountered site conditions of the previous GA. This report is not a dewatering management plan. This assessment does not assess the overall stability of the assumed shoring system. The shoring system will need to be designed to satisfy stability, piping, founding and groundwater cut-off considerations by the structural engineer. A suitably qualified dewatering contractor should be engaged to confirm dewatering requirements.

Your attention is drawn to the document "Important Information", attached as **Appendix B** at the end of this letter report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by EI, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

This letter report was prepared by EI for the sole use of Deicorp Pty Ltd for the particular project and purpose described. No responsibility is accepted for the use of any part of this letter report in any other content or for any other purpose.

EI has used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality and has relied on the accuracy of information provided by Deicorp Pty Ltd. No other warranty expressed or implied is made or intended.

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6. CLOSURE

Please do not hesitate to contact the undersigned should you have any questions.

For and on behalf of:
EI AUSTRALIA

Authors

Stephanie Liew
Geotechnical Engineer

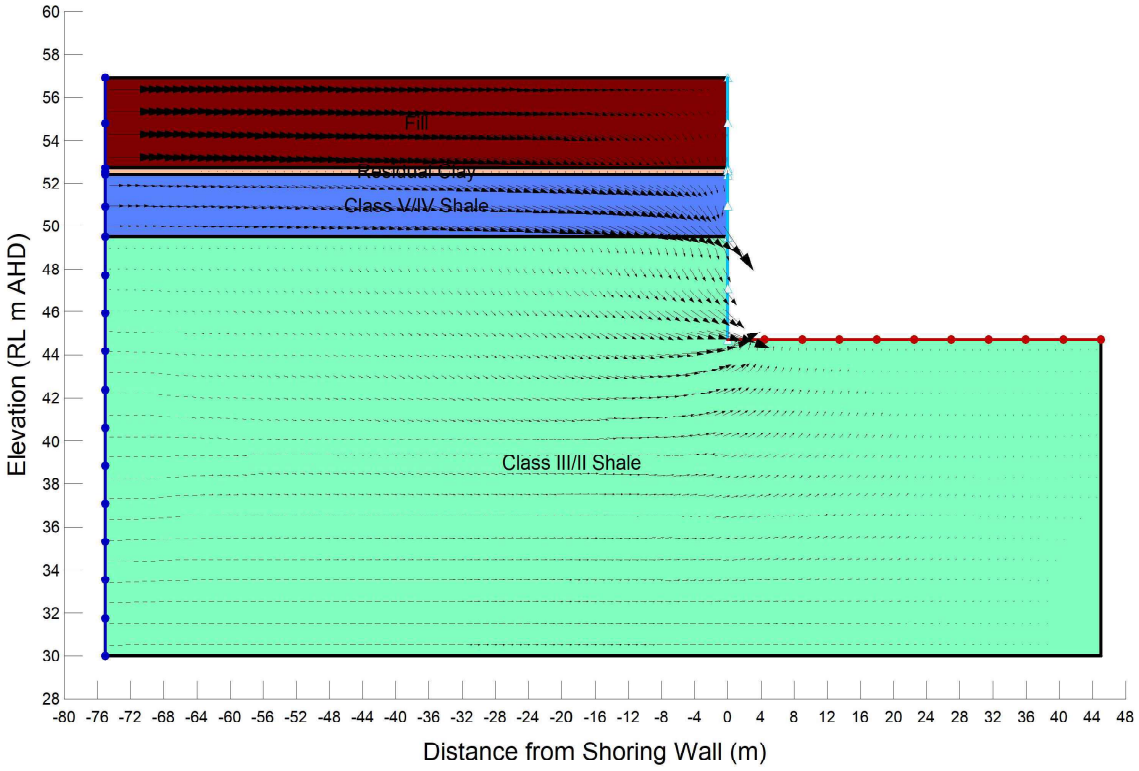
Technical Reviewer

Stephen Kim
Senior Geotechnical Engineer

Attachments: Appendix A – Seep/W Model Results
Appendix B – Important Information

APPENDIX A

Seep/W Model



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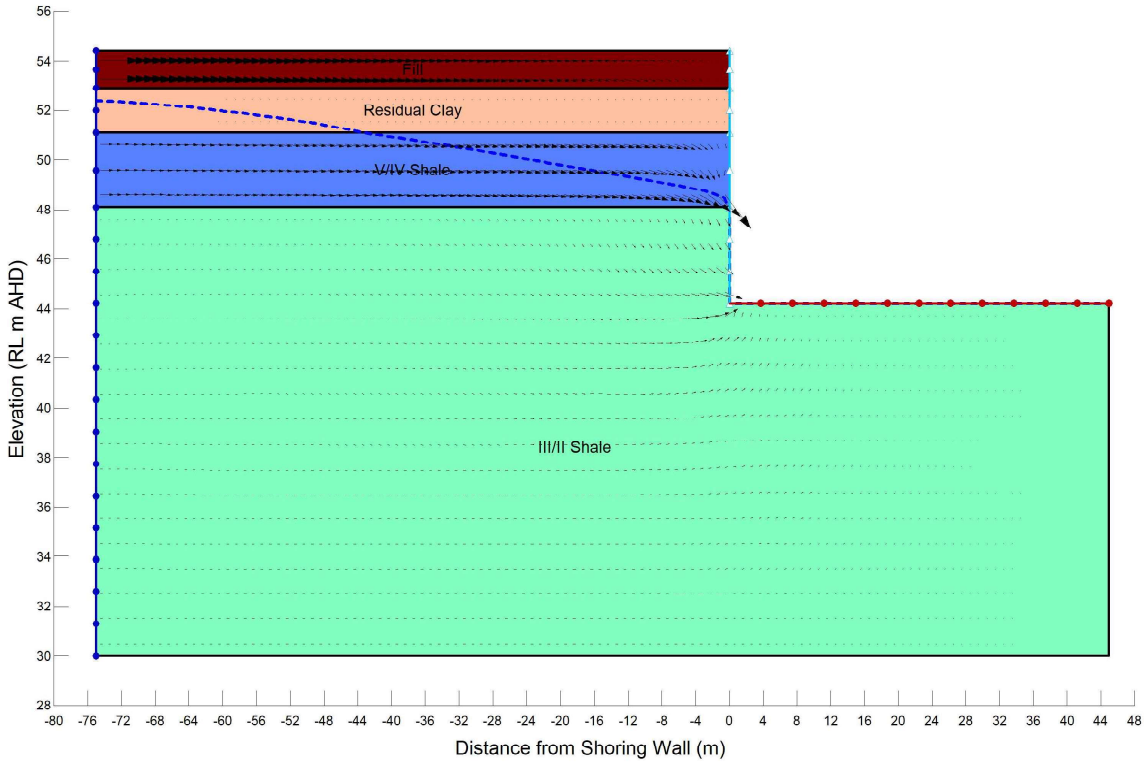
Approx Scale:	As Shown

Deicorp Pty Ltd
Groundwater Take Assessment
Tallawong Precinct South, Rouse Hill, NSW
SEEP/W Model and Results - Site 1

Appendix:
A1

Project: E24445.G12_Rev1



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Deicorp Pty Ltd
Groundwater Take Assessment
Tallawong Precinct South, Rouse Hill, NSW
SEEP/W Model and Results - Site 2

Appendix:
A2

Project: E24445.G12_Rev1

APPENDIX B

Important Information

Important Information

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client And EI Australia ("EI"). The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

EI has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. EI has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, EI will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to EI.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. EI should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that EI be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. EI assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of EI or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

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