Clyde Western Area Remediation Project, Stage 2 Audit Area 4

Site Audit Report No. 081-2127799

Viva Energy Australia Pty Ltd

14 June 2024

→ **The Power of Commitment**

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The Power of Commitment

Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.

List of Acronyms

Acronym	Definition
ACM	Asbestos containing material
AEC	Areas of environmental concern
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
AOC	Accidentally oil contaminated
AS	Australian Standard
ASS	Acid sulphate soil
BGL	Below ground level
BH	Borehole
BTEX	Benzene, toluene, ethylbenzene and xylenes
CLM	Contaminated Land Management
COC	Chain of custody
CoPC	Contaminant of potential concern
CRC CARE	Cooperative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual site model
CTCP	Clyde Terminal Conversion Project
DO	Dissolved oxygen
DPIE	Department of Planning, Industry, and Environment
DQIs	Data quality indicators
DQOs	Data quality objectives
EC	Electrical conductivity
EIL	Ecologically based investigation level
EIS	Environmental Impact Statement
ENM	Excavated natural material
EPA	Environment Protection Authority
EPL	Environment protection license
ERM	Environmental Resources Management
ESA	Environmental site assessment
ESL	Ecological screening level
FA	Fibrous asbestos
GME	Groundwater monitoring event
GMP	Groundwater management plan
GWMP	Groundwater monitoring plan
Ha	hectares

Acronym	Definition
HHERA	Human health and ecological risk assessment
HIL	Health-based investigation level
HSL	Health screening level
IMW	Intrusive maintenance workers
km	kilometre
LEP	Local Environment Plan
LNAPL	Light non-aqueous phase liquid
LOR	Limit of reporting
LTEMP	Long Term Environmental Management Plan
m	metre
m AHD	metres Australian Height Datum
m bgl	metres below ground level
m btoc	metres below top of casing
m^3	Cubic metres
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
MW	Monitoring well
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NSW	New South Wales
OCP	Organochlorine pesticides
OEH	Office of Environment and Heritage
OPP	Organophosphorus pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential acid sulfate soils
PCB	Polychlorinated biphenyls
PID	Photo-ionisation detector
POEO	Protection of the Environment Operations
PPE	Personal protective equipment
PPM	parts per million
PSI	Preliminary Site Investigation
QA	Quality assurance
QC	Quality control
RAP	Remedial action plan
EMP	Environmental management plan
RLs	Relative levels

Acronym	Definition
RPD	Relative percentage difference
RSI	Remediation site investigation
SAQP	Sampling and analytical quality plan
SPOCAS	Suspension peroxide oxidation
SSD	State Significant Development
SSTLs	Site-specific target levels
SWL	Standing water level
TP	Test pit
TRH	Total recoverable hydrocarbons
USTs	Underground storage tank
µg/kg	micrograms per kilogram
µg/L	micrograms per litre
VENM	Virgin excavated natural material
VOC	Volatile organic compound
WARP	Western Area Remediation Project
WWTP	Wastewater treatment plant

Glossary

Glossary term	Definition
the site	Includes the Clyde Terminal, the Parramatta Terminal, the Wetland, and the Western Area Remediation Project (WARP).
the Western Area Remediation project (the WARP)	The WARP is a vacant area of approximately 40 hectares located in the southwestern part of the site. The WARP is subdivided into three stages of remediation (Stage 1 to Stage 3 remediation Areas).
the Clyde Terminal	A part of the site currently operating a storage and distribution terminal for finished petroleum products.
the Parramatta Terminal	It is situated in the northwestern part of the Clyde Terminal.
the Wetland	A large undeveloped wetland area in the northeastern part of the Clyde Terminal close to the confluence of the Parramatta and Duck Rivers.
the Stage 2 Area	It extends from Devon Street to the north to the Duck River at the southern boundary of the WARP.
the AEC-4	Area of Environmental Concern 4 (AEC-4), or the Southern Buried Waste Area, is one of the remediation and management areas within the Stage 2 Area of the WARP. It is in the southwestern portion of the Stage 2 Area. It is the subject of remediation documented in this site audit report.
the Audited Area or Stage 2 AA4	The Audited Area encompass the AEC-4 and a portion of the north-western of the AEC-4, all located within the Stage 2 AA4.

Contents

Table index

Appendices

1. Introduction

This Site Audit Report (SAR) and associated Site Audit Statement (SAS) have been produced for Viva Energy Australia Pty Ltd (Viva Energy) for the Stage 2 Audited Area 4 (AA4). Further details about this audit are presented in **Sections 1.1** and **1.2.** This SAR documents the findings of a site audit, conducted by Andrew Kohlrusch (the auditor) of GHD Pty Ltd (GHD), a New South Wales Environment Protection Authority (NSW EPA) Contaminated Land Accredited Site Auditor under Part 4 of the *Contaminated Land Management Act 1997* (the Act).

This site audit has been conducted in accordance with the requirements of the Act as follows:

"site audit" means a review:

a. *that relates to management (whether under this Act or otherwise) of the actual or possible contamination of land, and*

b. *that is conducted for the purpose of determining any one or more of the following matters:*

(i) the nature and extent of any contamination of the land,

(ii) the nature and extent of any management of actual or possible contamination of the land,

(iii) whether the land is suitable for any specified use or range of uses,

(iv) what management remains necessary before the land is suitable for any specified use or range of uses,

(v) the suitability and appropriateness of a plan of management, long-term management plan or a voluntary management proposal.

Furthermore, the Act provides the following definitions:

– *Site Audit Report - means a site audit report prepared by a site auditor in accordance with Part 4 [of the Act].*

– *Site Audit Statement - means a site audit statement prepared by a site auditor in accordance with Part 4 [of the Act].*

The Contaminated Land Management: *Guidelines for the NSW Auditor Scheme (3rd edition)* (NSW EPA, 2017)[1] state that the services of a site auditor can be utilised by anyone requiring an independent review of information concerning potential or actual site contamination. Such reviews may include independent expert technical advice or 'sign-off' of contaminated site assessments, remediation, or validation work conducted by a contaminated site consultant. The Auditor Guidelines outline the site assessment and audit processes, where the contaminated land consultant is responsible for designing and conducting the site assessments. If necessary, the contaminated land consultant can also manage all remediation and validation activities to achieve specified objectives.

1.1 Site audit details

The auditor was commissioned by Viva Energy to conduct a site audit of Audit Area Four (AA4) within Stage 2 Area of the Western Area Remediation Project (WARP) located at Durham Street, Rosehill, NSW. The location of the audited area (i.e. the Stage 2 AA4) is shown in Figures F1 and F2 in **Appendix A** (ERM, 2024b). All figures and tables presented in this report were extracted from the audit documentation listed in **Sections 1.6** and **1.7**.

The reports reviewed as part of this audit, along with the relevant background reports, are listed in **Sections 1.6** and **1.7**. The details of the site audit are presented in **Table 1**.

[1] Also referred to in this SAR as the Auditor Guidelines.

Table 1 Site audit details

Information	Details
Site auditor	Andrew Kohlrusch
NSW EPA site auditor accreditation nº	0403
NSW EPA SAS nº	081-2127799
Audit category	Statutory – Further details are presented in **Section 1.4.2**
Legal audited area description [(2)]	Part Lot 1 in Deposit Plan (DP) 1271927 (formerly Part of Lot 100 in DP 1168951)
Audited area	- Stage 2 AA4: 2.35 hectares - AEC-4: Approximately 1.4 hectares
Local Government Authority	City of Parramatta Council
Stage 2 AA4 owner	VE Property Pty Ltd
Previous site use	Industrial and/or commercial
Current land use	Vacant site
Proposed land use	Open area (commercial/industrial)
Audit trigger	Remediation requirements as per the SSD 9302 – Further details are presented in **Section 1.5.1**

1.2 Background

The WARP comprises approximately 40 hectares of the Clyde Terminal (the site) that is no longer required by Viva Energy for operational purposes. Given the scale of remedial works, the WARP was declared a State Significant Development (SSD). To assess the potential environmental impacts of the remediation, an Environmental Impact Statement (EIS) containing a Conceptual Remedial Action Plan (CRAP) was submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) (formerly the Department of Planning, Industry and Environment [DPIE]) in late 2019.

The Consent Conditions were issued on 7 May 2020 (the SSD 9302), and according to the requirements of Clause A9, the WARP has been remediated in stages as follows:

– Stage 1: Former Process West
– Stage 2: Former Utilities and Movements
– Stage 3: Former Process East

Viva Energy has conducted remediation of the WARP as per SSD 9302 to facilitate sale and redevelopment for commercial/industrial use in accordance with the site zoning E5 as per the Parramatta Council Local Environmental Plan (LEP) 2023. The permissible land uses under the LEP are further detailed in **Section 1.9**.

In consideration of the redevelopment strategy for Stage 2, the auditor notes that the proposed lots were divided into four audit areas (AA1 to AA4), each of which has been progressively remediated and validated. The subdivision works are being undertaken as per the SSD 10459 granted under the EP&A Act. Further discussion on the regulatory context is presented in **Section 1.5**. The proposed lots, as per the subdivision of the WARP, have been grouped as follows:

– AA1: Proposed lots 51 to 55 and adjoining proposed road (remediation completed December 2021).
– AA2: Proposed lots 59, 60, 63, and adjoining proposed road (remediation completed March 2021).
– AA3: Proposed lots 56, 58, 61, 62, and adjoining proposed road (completed June 2022).
– AA4: Proposed lot 64 (subject area of this audit).

Previous SASs associated with the WARP are summarised in **Table 2**.

Table 2 Previous audit documentation

Area audited and information audited	Purpose of the SAS	SAS number
Stage 1 Remedial Action Plan (RAP)	Endorsement of the Stage1 RAP, including the review and endorsement of the Remedial Site Investigation (RSI) report and Human health and Ecological Risk Assessment (HHERA).	043-2127799
Stage 1 Remediation and Validation	Confirmation of the suitability of the Stage 1 area for commercial/industrial land following the remediation and validation program, subject to implementation of a LTEMP (which included a groundwater monitoring program).	055-2127799
Stage 2 RAP	Endorsement of the Stage 2 RAP (incorporating all four audit areas).	065-2127799
Stage 1 ongoing groundwater monitoring post-remediation	Commentary on the outcomes of the ongoing groundwater monitoring events post-remediation according with the Conditions Consent B22 of SSD 9302.	065A-2127799
Stage 2 AA1	Confirmation of suitability of the Stage 2 AA1 for commercial/industrial land use following remediation and validation program, subject to implementation of a LTEMP	068-2127799
Stage 2 AA2	Confirmation of the suitability of the Stage 2 AA2 following the remediation and validation program, subject to implementation of a LTEMP	072-2127799
Stage 1 Amended LTEMP	Endorsement of the amended Stage 1 LTEMP – which no longer included groundwater monitoring within the Stage 1 Area.	073-2127799
Stage 2 AA3	Confirmation of the suitability of the Stage 2 AA3 for commercial/industrial land use following the remediation and validation program, subject to implementation of a LTEMP.	075-2127799

The auditor noted that following submission of the aforementioned SAS, in July 2022 the NSW EPA issued a Notice to Repeal significantly contaminated land declaration (Notice no. 20224418) for Stage 1 Area and Stage 2 Audit Areas 1 to 3. Details of the Notice of Repeal are presented in **Section 1.5.5**.

1.3 Proposed future land use

As part of the investigation works undertaken across the WARP, Environmental Resources Management Australia Pty Ltd (ERM) determined that remediation and management of contaminated soils, specifically the encapsulation works at the Southern Buried Waste Area (Area of Environmental Concern 4, herein referred to as AEC-4), were required to manage potential human health risks to future on-site receptors for proposed ongoing commercial/industrial land use.

The Stage 2 RAP identified that the construction of an engineered cap, with ongoing management under a LTEMP was the preferred remediation approach for AEC-4. The Stage 2 RAP prepared by ERM outlined the remediation objectives for AEC-4 and key considerations to guide the preparation of the detailed design and technical specification. Specific details relating to the capping construction were incorporated into the Detailed Design (prepared by Costin Roe Consulting as Design Consultant) and Technical Specification to meet the remediation objectives.

The auditor notes that the LTEMP details the requirements that are to be followed should any building be proposed, namely:

At this stage no enclosed buildings exist or are proposed within Proposed Lot 64. However, should any future buildings be proposed, the design must include appropriate management controls and measures assessed consistent with the Hazardous Ground Gas Guidelines, and

Proposed Lot 64 will be suitable for use under a commercial / industrial land use scenario, given that appropriate controls are implemented to manage potential gas/ vapour accumulation in enclosed air spaces of future buildings.

1.4 Site audit purpose and nature

1.4.1 Purpose of this audit

The purpose of this site audit is to independently review the Stage 2 AA4 Validation report (ERM, 2024b) and the Stage 2 AA4 LTEMP (ERM, 2024c) prepared by ERM to assess whether:

– The Stage 2 AA4 Validation report and the Stage 2 AA4 LTEMP were prepared in a manner consistent with NSW EPA made or endorsed guidelines listed in **Section 1.8**.
– The site is suitable for commercial/industrial use following completion of remediation and subsequent validation program subject to compliance with the Stage 2 AA4 LTEMP.

To achieve the audit objectives, the auditor reviewed the reports and/or documentation prepared by ERM – as listed in **Section 1.6** and assessed whether information therein demonstrated that Stage 2 AA4 is suitable for its proposed commercial/industrial uses.

1.4.2 Nature of this audit

This audit is statutory, as triggered by Consent Condition B3 of SSD 9302, further discussed in **Section 1.5.1**.

1.5 Regulatory context and audit triggers

1.5.1 Consent Conditions SSD 9302

On 7 May 2020, the former DPIE issued the Conditions of Consent for the remediation of contaminated soils and the management of contaminated groundwater in the WARP to enable its future commercial and industrial land uses. Part B of the Conditions of Consent for SSD 9302 specified the environmental requirements for the remediation.

1.5.2 Consent Conditions SSD 10459

The Sydney Central Industrial Estate project, which includes the construction of public roads and the proposed subdivision of the Stage 2 Area, has been granted approval by the former DPIE under Consent Conditions 10459. Stage 2 AA4 is subject to subdivision under SSD 10459.

1.5.3 NSW EPA contaminated land records

The site has also been notified to the EPA under Section 60 of the Act.

1.5.4 NSW EPA Declaration Order 20131110

Following the announcement of the closure of the former Clyde Refinery, in June 2012, the NSW EPA issued a Preliminary Investigation Order to Viva Energy under the CLM Act requesting reports on environmental contamination. Following receipt of several reports, on 8 June 2016, the NSW EPA declared the following areas of the site contaminated land under the CLM Act (Declaration Order 20131110).

– Not subjected to the current of previous site audits listed in **Table 2**:
  - Lot 398 in DP 41324
  - Lot 2 in DP 224288
  - Lot 1 in DP 383675

- Lot 101 in DP 809340

– Subjected to the current of previous site audit listed in **Table 2**:

- Lot 100 DP of 1168951

1.5.5 Notice to repeal significantly contaminated land declaration 20224418

Following completion of remediation and issue of SAS listed in **Table 2**, on 29 July 2022, the NSW EPA issued under Section 44 of the CLM Act the Notice to repeal significantly contaminated land declaration 20224418 ('the Notice').

The Notice stated:

– Pursuant to section 44 of the CLM Act, declaration of significantly contaminated land (20131110), dated 8 June 2016, ceases to be in force on the date on which this notice is signed in so far as the declaration and order apply to the land to Part of Lot 100 in DP 116851 as defined by survey plan of:

- Stage 1 Audit Area (proposed Lot 6).
- Stage 2 Audit Area 1 (proposed Lots 51 to 55 and portion of the proposed road).
- Stage 2 Audit Area 2 (proposed Lots 59, 60, 63, and portion of the proposed road).
- Stage 2 Audit Area 3 (proposed Lots 56, 58, 61, 62, and portion of the proposed road).

The auditor noted that the Declaration Order 20131110 is still in force in for the Stage 2 Audit Area 4. (proposed Lot 64) which is the subject of this SAR.

1.6 Audited documentation

This SAR included a review of the following reports to assess whether they had been prepared in a manner consistent with guidelines made or endorsed by the NSW EPA:

– ERM (2024a). *Clyde Western Area Remediation Project, Quarter 4 (2023) Stage 2 Groundwater Monitoring Project, 14 March 2024* (the **Quarter 4 2023 GMP**).

– ERM (2024b). *Clyde Western Area Remediation Project, Stage 2 Validation Report (Audit Area 4)*, 13 June 2024 (the **Stage 2 AA4 Validation**).

– ERM (2024c). *Clyde Western Area Remediation Project Proposed Lot 64– Long Term Environmental Management Plan*, 12 une 2024 (the Stage 2 **AA4 LTEMP**).

– ERM (2023a). *Clyde Western Area Remediation Project – Proposed Lot 64 – Baseline Ground Gas Monitoring Events*, 14 July 2023 (the **Bulk Ground Gases Assessment**).

– ERM (2023b). *Clyde Western Area Remediation Project Proposed Lot 64 – AEC-4, Capping Construction Technical Specification, Rev05*, 14 March 2024 (the **Capping Technical Specification**).

– ERM (2021b). *Supplementary Environmental Site Assessment – Southern Buried Waste Area (AEC-4)*, 7 June 2021 (the **AEC-4 Supplementary Assessment**)

– ERM (2021e). *Clyde Western Area Remediation Project - Remediation Options Analysis – "AEC – 4"*, 7 June 2021 (the **AEC-4 ROA**).

– ERM (2021d). *Clyde Western Area Remediation Project, Stage 2 - Detailed Remediation Action Plan*, 9 June 2021 (the **Stage 2 RAP**).

The outcome of the reviews of aforementioned documents associated with the remediation and validation of Stage 2 AA4 was presented in interim audit advice letters (IAAs) or tracked in an audit commentary spreadsheet.

Copies of IAAs and the audit spreadsheet in which the reviews of the reports are documented are presented in **Appendix B**.

1.7 Background reports

In preparing this SAR, the auditor considered the information presented in the following historical documents:

- ERM (2018). *Clyde Terminal Durham Street Rosehill NSW, PFAS Conceptual Site Model and Model and Flux Assessment*, 20 December 2018 (the **PFAS CSM**).
- AECOM (2019). *Viva Energy Clyde Western Area Remediation Project – Appendix C: Conceptual Remedial Action Plan*, 21 January 2019 (the **CRAP**).
- ERM (2020a). C*lyde Western Area Remediation Project - Remediation Site Investigation*, 7 February 2020 (the **RSI**).
- ERM (2020b). *Clyde Western Area Remediation Project, Human Health and Ecological Risk Assessment*, 16 February 2020 (the **HHERA**).
- ERM (2020c). *Clyde Western Area Remediation Project – Remedial Options Assessment, Rev2*, 7 April 2020 (the **ROA**).
- ERM (2021a). *Clyde Western Area Remediation Project, Stage 2 Air Emission Verification Report*, June 2021 (the **Stage 2 AEVR**).
- ERM (2021c). *Clyde Western Area Remediation Project – Stage 2 Environmental Site Assessment*, 17 June 2021 (the **Stage 2 ESA**).
- ERM (2021e) *Clyde Western Area Remediation Project – Groundwater Monitoring Program – Stage 2, Final*, July 2021 (the **GWMP**).

The auditor noted that all reports listed above were subjected to review and commentary presented in previous site audit reports and statements.

1.8 Regulatory guidelines

This SAR was prepared with reference to the following guidelines which have been made or approved for use by NSW EPA under s.105 of the Act at the time of the site audit include:

- NSW EPA (2022). *Contaminated Land Guidelines: Sampling design guidelines part 1 – application* (the **Sampling Guidelines**) – where relevant, given some of the audited document were issued before 2022.
- NSW EPA (2020a). *Contaminated Land Guidelines: Consultants reporting on contaminated land* (the **Consultant Guidelines**).
- NSW EPA (2020b). *Contaminated Land Guidelines: Assessment and management of hazardous ground gases* (the **Ground Gas Guidelines**).
- NSW EPA (2017). *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd edition)* (the **Auditor Guidelines**).
- NSW DEC (2007). *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination* (the **Groundwater Guidelines**).

Other NSW regulatory endorsed documents considered in reviewing documents reviewed as part of the site audit included:

- WA Department of Health (2021). *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (the **Asbestos Guidelines**).
- CRC CARE (2015). *A Practitioner's guide for the analysis, management and remediation of LNAPL. Technical Report Nº 34.*
- NEPC (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (Nº 1),* National Environment Protection Council, May 2013 (the **NEPM**).

– ANZECC/ARMCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, 2000.*

– NHRMC/NRMMC (2011). *Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council.*

1.9 Permitted land uses

The Stage 2 AA4 is zoned as E5– Heavy Industrial under the Parramatta Council Local Environmental Plan 2023 – current version for 4 March 2024. Permissible uses allowed under this zoning (with consent), include the following:

– *Agricultural produce industries; Building identification signs; Business identification signs; Depots; Freight transport facilities; General industries; Hardware and building supplies; Hazardous storage establishments; Heavy industries; Horticulture; Kiosks; Medical centres; Offensive storage establishments; Pubs; Roads; Rural supplies; Sawmill or log processing works; Take away food and drink premises; Timber yards; Warehouse or distribution centres; Water storage facilities.*

1.10 Site visit

The auditor, Andrew Kohlrusch, and/or the auditor assistant, Daniela Balbachevsky, have conducted several site visits to view the site and the remedial works stages carried out within the WARP since the project commenced in 2019. Specifically, five site visits were completed between February and May 2024 to observe the remedial works within the Stage 2 AA4. The observations from these visits, along with accompanying photolog are detailed in **Appendix G**.

1.11 Site audit report structure

This SAR documents the audit of the reports referenced in **Section 1.6**. Where the auditor has provided comments on the work, these are highlighted in yellow shaded dialogue boxes. The remainder of this report is organised as follows:

Section 2 Stage 2 AA4 conditions and environmental setting

Section 3 Historical land use

Section 4 Background reports

Section 5 Stage 2 AA4 environmental characterisation

Section 6 Stage 2 Remedial Action Plan

Section 7 Capping Construction Technical Specifications

Section 8 Stage 2 AA4 remediation and validation implementation

Section 9 Evaluation of quality assurance and quality control

Section 10 Stage 2 AA4 Conceptual site model post remediation

Section 11 Stage 2 AA4 Long Term Environmental Management Plan

Section 12 Other considerations

Section 13 Compliance with regulatory requirements

Section 14 Audit conclusions

Section 15 Disclaimer

2. Stage 2 AA4 conditions and environmental setting

A summary of the Stage 2 AA4 conditions and environmental setting provided by ERM in the reports listed in **Sections 1.6** and **1.7** is presented in **Table 3**.

Table 3 Summay of Stage 2 AA4 conditions and environmental setting

Information	Description
Site identification	The Stage 2 AA4 identification is summarised in **Table 1**. The Stage 2 AA4 location and layout is shown on Figures F1 and F2 in **Appendix A** (ERM, 2024b).
Site description prior to remediation	Prior to remediation, the Stage 2 AA4 had been vacant since circa 2018. It is a raised area (relative to the Duck River to the south and the surrounding Viva owned land). It was sealed with asphalt and/or bitumen circa 2000, which was prior to remediation in 2024 in poor condition.
Topography and drainage	ERM (2024b) reported that the local surface runoff within the Stage 2 AA4 flows overland from the sealed asphalt surface to the unsealed slopes of the mound to the north, south and east. Field observations during rainfall events indicated that overland flow likely pools and infiltrates into unsealed ground. ERM (2024b) documented that the broader topography of the site and the surrounding area was observed to be generally flat, with the Stage 2 AA4 raised by 1.5 to 2 metres from the surrounding site elevation.
Surface water bodies	ERM (2021b) described that the Duck River is the closest surface water body to Stage 2 AA4. It is lined with mangroves and is considered a moderately disturbed catchment given the industries that are located along its route. The tidal limit of the Duck River extends approximately one kilometre upstream of the site to the Clyde Railway culvert (Cardno Lawson-Treloar, 2008). The upper reaches of the Duck River extend approximately 10 kilometres south to Condell Park, within the Bankstown Local Government Authority (LGA) where stormwater flows in a series of storm water pipes and open concrete drains. The Duck River discharges into the Parramatta River to the north-east of the site.
Geology and potential acid sulfate soils	ERM (2024b) documented the following general fill / soils profiles within Stage 2 AA4: - The average thickness of fill material is as follows: • Western Extent: between 1 - 1.2 m bgl (MW20/03 and MW20/04). • Central Mound Area: 4.2 - 4.5 m bgl (MW20/13, MW20/07). • Southern Access Road (boundary with Duck River): 1.2 - 3.5 m bgl. • Depth of visual observations of impacts identified within the buried waste area extended to depths of up to 6 m bgl. - Acid Sulfate Soils (ASS) in the WARP are classified as Class 4 ASS risk – i.e., potential for ASS to occur in greater depths, often more than 2 meters below the surface (m bgl). Previous investigations within Stage 2 AA4 have identified low potential for ASS/Potential Acid Sulfate Soil (PASS) present. A data gap for the Stage 2 AA4 was identified by ERM. Details on this data gap assessment is presented in **Section 5**.
Groundwater depth	A shallow unconfined aquifer is present in Stage 2 AA4 within fill and estuarine-alluvial sediments at depths between 1 m bgl and 3 m bgl.
Groundwater flow direction	Following installation of additional wells (ERM, 2024a), a radial flow direction from AEC-4 was inferred to the south-west, south and south-east towards to the Duck River. A groundwater flow direction map prepared using data collected in November 2023 (the Baseline GME) is shown on Figure F3 in **Appendix A** (ERM, 2024a).
Hydraulic gradient	ERM (2024a) reported an average hydraulic gradient of 0.003 along the up-gradient portion of the Western Area to 0.011 m/m across the southern portions of the Stage 2 AA4.

Information	Description
Hydraulic conductivity	ERM (2024a) reported that generally, hydraulic conductivity values ranged from a minimum 5 x 10^{-5} m/day at the up gradient of the Stage 2 AA4 boundary to 4 x 10^{-2} m/day closer to the southern audited area boundary due to the presence of sand/silt estuarine deposits closer to the Duck River.
Vertical and lateral migration	ERM (2021b) discussed the following two hydrologic aspects that formed key elements of the conceptual site model (CSM) pertinent not only for the Stage 2 AA4, but for the WARP: - Vertical migration of groundwater is limited by the soil profile which comprises unconsolidated fill underlain by low permeability clay. In addition, groundwater data that had been collected across the WARP did not demonstrate there to be groundwater impacts at many of the areas, including the above ground storage tanks (ASTs) that were formerly in the northern portion of Stage 2 area. Based on the robust dataset collected for almost two decades, ERM concluded that vertical migration of contaminants of potential concern (CoPC) is limited by the nature of the soil profile and the aquifer. The CoPC for the Stage 2 AA4 is discussed in **Section 5**. - Lateral migration of CoPC in groundwater is limited by the low permeability of the lithology and relatively flat hydraulic gradient. ERM reported that this observation was supported by the documented limited lateral extent of impacted groundwater, indicating that, where present, areas of impacted groundwater are stable and lateral migration is minimal.
Tidal assessment	ERM (2021b) reported that based on static water level data obtained from monitoring wells adjacent to the Duck River (down gradient of Stage 2 AA4), tidal interaction of surface water within the Duck River with groundwater is not considered likely and is consistent with tidal assessments undertaken within the Clyde Terminal.

2.1 Auditor's discussion – Site conditions and environmental setting

In the auditor's opinion the information presented by ERM in the reports listed in **Sections 1.6** and **1.7** provided a detailed description of the physical features of Stage 2 AA4. The auditor considered that the Stage 2 AA4 Validation report and the relevant supporting information outlined in **Section 1.7** presented a detailed summary of the topography, site geology and hydrogeology that formed the basis for understanding these elements in the CSM.

The descriptions of Stage 2 AA4 and those of the immediate surrounding land uses reported by ERM were consistent with the auditor's observations made during the site visits. The site visit observations, accompanied by a photolog are provided in **Appendix G**. Based on the local geology information presented by ERM in the reports outlined in **Sections 1.6** and **1.7** and auditor observations made during the site visits when excavations were undertaken, the auditor concurred with key ERM's conclusions that:

- Vertical migration of groundwater is limited by the soil profile, which comprises a thin layer of unconsolidated fill underlain by low-permeability clay.
- Lateral migration of CoPC in groundwater is limited by the low permeability of the lithology and relatively flat hydraulic gradient, indicating that where present, areas of impacted groundwater are likely to be stable with resultant limited migration. Historical groundwater dataset collected over the last decades supports these conclusions.

The auditor's considers that the Stage 2 A4 conditions and environmental setting information presented by ERM in the Stage 2 AA4 Validation report together with other reports reviewed as part of this audit contained the relevant information as recommended in Schedule B2 of the NEPM and the Consultant Guidelines.

3. Historical land use

The summary of the historical land uses developed by ERM based on desktop reviews, interviews and aerial photograph reviews undertaken during previous investigations is presented in **Table 4**.

Table 4 Historical land uses

Location	Description
Former Clyde Refinery	The former Clyde Refinery, initially part of an 850-acre land grant to John Macarthur, underwent ownership changes over the years. It began refining operations in 1926 under Shell Refining Pty Ltd, expanding until 1939. Refining ceased in 2012, transitioning to a terminal for petroleum product receipt, storage, and distribution. Since then, the Clyde Terminal receives products from the Gore Bay Terminal and distributes them to the Parramatta Terminal.
WARP	Following the Clyde Terminal Conversion Project (SSD No 5147), 40 hectares of the terminal (the WARP) became surplus to operational requirements. Due to the presence of contaminated soil in this area, remediation is underway in accordance with conditions outlined in SSD No 9302 to facilitate future commercial or industrial land uses.
Stage 2 AA4	ERM (2022b) noted that based on information provided by Coffey (1998) the Stage 2 AA4 was historically used as a suspected solid material landfill since the 1950s. The following details were highlighted: - The area of environmental concern (AEC) 4 which comprises the south portion of the Stage 2 AA4 area was gradually filled from the 1950s to the 1980s. - The AEC-4 served as a dumping ground for materials from excavations across the refinery and for leaded sludge drums. - AEC-4 was never developed or part of the refinery's operations. - Subsequently, the AEC-4 was leased to Oceania Vehicle Processors from 1999 to 2006 and to AutoNexus from 2006 to 2018. Both tenants utilised it as a car park, with leveling and sealing with asphalt around 2000.

3.1 Auditor’s discussion – Historical land use

The auditor notes that environmental assessments undertaken for more than a decade have incorporated a detailed description of the former Clyde Refinery and associated environmental conditions. The historical land use of the Stage 1 area and Stage 2 AA1 to AA3 is well known and was previously audited, with the auditor’s opinions documented in the previous SAS and SARs outlined in **Table 2**.

Regarding the Stage 2 AA4, the auditor noted that the primary uses that could have resulted in contamination were that is was a burial area for solid waste – which was further confirmed through the intrusive investigation findings as discussed in **Section 5**.

The auditor considers that the information as documented in the reports outlined in **Sections 1.6** and **1.7**, largely met the requirements of the NEPM. The auditor considered the information to be sufficiently detailed and adequate for identifying potential contamination at Stage 2 AA4 and assisted the design of the environmental assessment plans that further led to the Staged RAPs.

4. Background reports

A summary of the objectives and scope of the investigations since 1994 is presented in **Table 5**.

Table 5 Summary of historical reports

Author	Year	Objectives	Scope of works
Former Clyde Refinery			
Groundwater Technology	1994	Assessment of soil and groundwater conditions.	Installation of six monitoring wells.
Woodward Clyde	1998	Groundwater assessment.	Drilling of 13 soil bores and installation of four monitoring wells.
Coffey	1998	Green mound environmental assessment.	Drilling of 15 test pits within the AEC-4.
ERM	2009	Investigation of shallow soils within the Old Admin Area.	Drilling of 15 soil vapour bores.
ERM	2008 to 2020	GMEs for compliance purposes	Groundwater sampling of existing network.
Douglas Partners	2010	Geotechnical investigation for Sydney Metro	Installation of five monitoring wells.
ERM	2011	Tank 30 release Investigation	Drilling of six soil bores and installation of two temporary groundwater monitoring wells.
ERM	2012	Stage 1 and 2 Environmental site assessments	Drilling of 11 soil bores (BH12/29- BH12/39) and installation of 12 monitoring wells.
AECOM	2018	Targeted Site Investigation (TSI)	Installation of two groundwater wells and drilling of 15 test pits.
ERM	2018	Development of PFAS CSM and Model Flux	Groundwater sampling, hydraulic testing in existing wells and mass flux modelling.
ERM	2018	Lease Exit Investigation for Autonexus	Drilling of 15 soil bores within the AEC-4.
WARP			
ERM	2019	Remediation site investigation (the RSI).	Drilling of 57 test pits and installation of six soil vapour bores.
ERM	2019 to 2020	Remediation trials	Excavation of approximately 1200 m^3 of soil from process west for bioremediation treatability trials.
ERM	2020	Stage 2 Drainage decommissioning and validation.	Drilling of 14 test pits and sampling of nine sludge samples characterisation.
ERM	2020	Stage 2 Characterisation of stockpiled material on-site	Sampling of four stockpiles and visual inspection of 11 demolition waste stockpiles for presence of asbestos containing material (ACM).
ERM	2021	Stage 2 Additional environmental site assessment for increased sample density for validation of future subdivision	Drilling of 97 test pits, collection of 63 samples for laboratory analysis of CoPC and 34 soil samples for visual observation and field screening.

5. Stage 2 AA4 characterisation

A summary of the site characterisation at Stage 2 AA4 that led to the preparation of remedial planning for this area is presented in the following sections.

5.1 Background

To facilitate remedial design across the WARP a Remediation Option Assessment (ROA) was prepared in 2020 to identify preferred remedial strategies for areas of concern (AECs) across Stage 1 and Stage 2 areas. However, due to the specific nature of the contamination identified within AEC-4 (located at Stage 2 AA4), it was subsequently decided that a separate and more targeted ROA for AEC-4 (the AEC-4 ROA) was necessary.

Prior to the completion of the AEC-4 ROA (ERM, 2021e), ERM conducted additional investigations to better delineate the nature and extent of contamination within AEC-4 and to assess the potential for off-site migration. The results of these investigations were reported within the AEC-4 Supplementary Environmental Site Assessment (ERM, 2021b).

Based on historical investigations the nominated CoPC for the Stage 2 AA4 are as follows:

– Soil: LNAPL/Sludge, TRH fractions, benzene, asbestos (bonded and friable), hexavalent chromium, carcinogenic PAH and PFAS.
– Groundwater: benzene, PAHs, PFOS.

5.2 AEC-4 Supplementary Environmental Site Assessment

ERM (2021b) outlined the following objectives:

– Delineate the horizontal and vertical extent of impacted fill/soil material within AEC-4.
– Collect data to support acid sulfate soil assessment.
– Provide a comprehensive groundwater monitoring well network down gradient of the Stage 2 AA4 to investigate current conditions and enable future management and monitoring.
– Investigate the nature and extent of groundwater impacts associated with buried waste.
– Establish if groundwater impacts pose a potential for risk to off-site receptors.

The works completed as part of ERM (2021b) included the following:

– Drilling 20 soil bores to a maximum depth of 6.5 m bgl, that were subsequently converted to groundwater monitoring wells, screened to target the shallow water bearing unit. An additional two up gradient groundwater monitoring wells were installed to 10 m bgl to confirm the depth of bedrock, lithology and transmissivity of deeper strata.
– Collection of 11 soil samples for laboratory analysis of TRH[3] C_6-C_{40}, TRH silica gel clean-up, BTEX[4], PAH[5], chromium (trivalent and hexavalent chromium), ASS field testing (pH and pH Fox) and chromium reducible sulfur (CRS suite).

[3] Total recoverable hydrocarbons.
[4] Benzene, toluene, ethylbenzene, xylenes, naphthalene.
[5] Polycyclic aromatic hydrocarbons.

- Gauging and sampling (using Hydrasleeve samplers) of new and existing monitoring wells within the vicinity of AEC-4.
- Collection of 24 groundwater samples for laboratory analysis – TRH C_6-C_{40} fractions (pre and post silica gel clean-up), BTEX, PAH and chromium (trivalent and hexavalent).
- Hydraulic testing (rising head slug tests) on 24 monitoring wells to assess hydraulic conductivity values for the purposes of mass flux assessment if required.
- Collection of static water level data (compensated for barometric pressure) from three monitoring wells across a period of 17 days to assess potential for tidal influence on groundwater within AEC-4 from the Duck River.

A summary of key findings documented in the report is presented in **Table 6**. A figure showing the sampling locations is presented in Figure F6A to 6C in **Appendix A** (ERM, 2021b). A copy of tabulated results is presented in **Appendix C** (ERM, 2021b).

Table 6 Summary of key findings

Objective	Findings
Delineate the extent of impacted fill/soil within AEC-4	Buried waste thickness was documented as follows: – Western Extent: between 1 and 1.2 m bgl (MW20/03 and MW20/04). – Central Mound Area: between 4.2 and 4.5 m bgl (MW20/13, MW20/07). – Southern Access Road (boundary with Duck River): between 1.2 and 3.5 m bgl. – Depth of visual observations of impacts identified within the buried waste area extended to depths of up to 6 m bgl (observed during monitoring wells installation). The lateral extent of buried waste within AEC-4 was considered by ERM to be limited to Viva Energy's property boundary.
Collect data to support acid sulfate soil assessment	Evidence of PASS was indicated by exceedances of the ASSMAC (1998) net acidity criteria (acidity and sulphur units) in samples collected at or below the water table. However, ERM noted the remediation within AEC-4 will not intercept groundwater or involve disturbance of natural soils.
Provide a comprehensive groundwater monitoring well network down- gradient of the site to investigate current conditions and enable future management and monitoring	Twenty-two new groundwater monitoring wells were installed as part of the Supplementary ESA.
Investigate the nature and extent of groundwater impacts associated with buried waste	The following key observations were noted regarding groundwater results from the investigation: – Reported exceedances were only recorded in samples collected within AEC-4 buried waste and were directly associated with observation of LNAPL[6] in soil. – No exceedances of SSTLs for current and future on-site receptors were reported for CoPC in groundwater. – No exceedances of assessment criteria for off-site receptors on the down gradient site (south) boundary bordering Duck River. – A minor exceedance of recreational criterion for benzene and ecological criteria for PAHs was noted on the western extent of the AEC-4 area. However, these on-site exceedances noted by ERM are not relevant for on-site receptors based on the CSM.

[6] Light non aqueous phase liquid.

Objective	Findings
	– Additional discussion on the groundwater discharge on the Duck River is presented below. The auditor also noted that it is highly unlikely the Duck River would be used for recreational purposes (as per the assumptions used in generating recreational water quality criteria).
Determine if groundwater impacts pose a potential for risk to off-site receptors	Dissolved phase groundwater impacts were confined within the AEC-4 and had been delineated to below adopted screening criteria – data from the down gradient monitoring wells. A potential risk to off-site receptors at AEC-4 was considered by ERM unlikely based on the following lines of evidence: – Direct exposure by recreational receptors to benzene in groundwater is not a feasible exposure pathway given no feasible access by recreational users to the storm water channel. – The average groundwater discharge concentration for benzene from AEC-4 to the drainage channel could also be expected to be below the recreational criterion given no benzene detections bordering the drainage channel in other wells to the south and to the north. – Contribution of groundwater to overall flows within the drainage channel is considered negligible in the context of contributing flows from the three 910 mm concrete drainage pipes from public roadways to the north and would be expected to provide further dilution effect prior to discharge to the Duck River. The water collected from the public roadways could also be expected to have oil, fuels and other substances common to urban stormwater runoff. – Ecological exceedances of PAHs are considered indicative of a near source impact (immobile NAPL within the soil profile) rather than a down gradient plume of PAHs. The low solubility and high sorption properties of these PAHs restrict their potential to migrate in groundwater flow, as was evident with no detections reported down-gradient of the burred waste area. – LNAPL was only found within the boundary of AEC-4. – Ongoing stability of LNAPL and dissolved phase impacts is expected based on the following: • The significant time since deposition of waste in AEC-4 (greater than 40 years). • The absence of LNAPL or dissolved phase concentrations in down gradient boundary wells suggest that the observed LNAPL is immobile. • Ongoing contribution of contaminants to dissolved phase is also low given the weathered nature of the LNAPL. • The residual nature of LNAPL source and presence of an impermeable asphalt cap over the majority of AEC-4 to limit infiltration do not provide sufficient driving head to allow significant LNAPL migration in the subsurface. • The viscous properties of the product (diesel oil/ lube oil mixture) observed across the buried waste area have a demonstrated tendency to bind to soil particles and these properties are anticipated to inhibit mobility of LNAPL through the soil matrix. • LNAPL mass has been observed at the depth of groundwater and at depths below the water table within laterally discontinuous zones of more porous materials (higher sand content). Where LNAPL is present beneath the water table, there is a restriction of pore-space for migration of LNAPL.

Objective	Findings
	• This stability is evidenced by there being no measurable LNAPL thickness in wells or observations at depth during installation (MW20/03, MW20/07 and MW20/13). • As demonstrated through data obtained from the Additional ESA and previous tidal assessment work, limited to no tidal connectivity with the Duck River reduces potential for interaction and migrations of LNAPL or dissolved phase hydrocarbons to the Duck River.

5.2.1 Auditor discussion – AEC-4 Supplementary Environmental Assessment

The auditor considered that a significant number of assessments have been conducted over the past 30 years within the former Clyde Refinery, as indicated in **Section 4**. Since the decision to divest the WARP, additional environmental works have been completed to support the development of the Stage 2 RAP and to meet the requirements of the Soil Sampling Design Guidelines. In the auditor's opinion, these efforts have appropriately characterised Stage 2 AA4. The auditor reviewed the environmental reports issued since his engagement in 2019 and was satisfied with the information provided. The outcomes of these reviews have been documented in the SARs and SAS listed in **Table 2**.

Based on an extensive groundwater dataset, the auditor concurred with ERM's opinion that the nature and extent of groundwater impacts within the Stage 2 AA4 were appropriately delineated. The auditor notes that although LNAPL has historically been observed in groundwater within wells at AEC-4, it is weathered and has been demonstrated to be highly immobile due in part to the local geology and local hydrogeological conditions (relatively flat hydraulic gradient).

In the auditor's opinion the Stage 2 AA4 had been environmentally characterised according to relevant guidelines, and the outcomes of those environmental assessments were sufficient to assist in the design of the engineered on-site above ground capping layer. The auditor noted that the above-ground capping containment remedial strategy was assessed as part of the Stage 2 RAP audit, with the auditor's discussion documented in SAS 065-2127799 (**Table 2**). A summary of the Stage 2 RAP is presented in **Section 6**, while the technical specifications of the remedial design are further discussed in **Section 7**.

5.3 Hazardous Ground Gases Assessment

ERM (2023a) documented that a baseline hazardous ground gases monitoring was conducted to assess whether the degradation and weathering of LNAPL identified across within the Stage 2 AA4 once capped could result in accumulation of hazardous bulk ground gases methane (CH_4) and carbon dioxide (CO_2) in the subsurface. To address this data gap, ERM (2024a) completed two rounds of ground gas monitoring (August 2022 and March 2023) of viable monitoring wells within and down gradient of the proposed capping footprint to assess the potential for generation, accumulation and migration of hazardous ground gases as a consequence of degradation of LNAPL in this area. Monitoring wells were selected for monitoring as follows:

– AEC-4 buried waste mound (MW12/01, MW20/05, MW20/06 and MW2007) – representative of greatest potential ground gas accumulation (i.e. source material) within the AEC-4 buried waste mound (uncontrolled fill, LNAPL, petroleum hydrocarbon impacted soils).

– Adjacent to the proposed capping extent (boundary) (BH116, MW12/20, MW20/04 and MW94/6) – baseline monitoring of lateral gas migration from buried waste mound.

ERM (2023a) documented the following sampling method:

- Prior to sampling of the subject wells, existing groundwater monitoring well caps were fitted with 'TriCapGas' monitoring caps to allow for direct connection with landfill gas monitoring equipment.
- Monitoring wells were gauged for depth to water and/or LNAPL presence to confirm the appropriateness of wells for sampling.
- Field staff recorded field monitoring data at the subject wells with a GA5000 portable landfill gas analyser and a Photo-Ionisation Detector (PID). The following parameters were collected at each well:
  - Peak and stabilised landfill gas concentrations (%) – methane (CH_4), hydrogen sulfide (H_2S), oxygen (O_2), carbon dioxide (CO_2), Carbon Monoxide (CO)
  - Ambient air readings (CH_4, O_2 and CO_2)
  - Total Volatile Organic Compounds (VOCs)
  - Barometric pressure
  - Gas flow rate of each well
- Climatic conditions applicable to the day of sampling were downloaded from the Australian Bureau of Meteorology (BOM).
- Representative laboratory samples of gas were collected with the landfill gas analyser following purging and stabilisation of gas parameters during the August 2022 and March 2023 monitoring round from the subject wells with summa canisters provided by Eurofins Environment Testing (Eurofins). Summa canister flow rates were set to 100 mL/ min.
- Laboratory analysis of Summa Canisters was undertaken given that field methane measurements could be influenced of VOCs on field methane readings associated with known petroleum hydrocarbon sources (LNAPL).
- Documentation of pre- and post-sampling vacuum was undertaken, leaving measurable vacuum within the canisters for quality assurance purposes during transport to the laboratory.
- Gas samples were analysed by Eurofins for permanent gases (test suite ASTM D1945/D1946).

ERM (2023a) documented that the gas screening values (GSV), and characteristic situation (CS) classification were calculated for carbon dioxide and methane in wells within the Stage 2 AA4 buried waste mound. Risk classification up to CS4 (moderate to high risk) was identified based on methane and flow rates recorded at monitoring well MW20/05 within the source area. Methane readings of 9 to 81% were measured in wells within the source area, with risk classification influenced by borehole flow rates, particularly in heterogeneous, transmissive areas of fill. Calculated CS values at downgradient wells were CS1 (very low risk), indicating negligible lateral migration of ground gases from the source area.

ERM documented that the buried waste mound, capped in asphalt for approximately 25 years has mitigated vertical gas movement. The potential for dissolved methane to reform as a gas downgradient was deemed unlikely, due to groundwater conditions and lack of rapid pressure or temperature changes.

ERM (2024a) concluded that there were currently no potential exposure pathways for receptors, as the Stage 2 AA4 will be an open-air environment without enclosed spaces. This restriction prevents the build-up of ground gas from the buried waste mound, mitigating risks of asphyxiation or generation of hazardous atmospheres.

The potential for lateral migration of ground gases off-site was considered unlikely by ERM due to natural barriers like Duck River and drainage channels. However, as a precaution, the following specific considerations for ground gas hazards in the proposed capping design was proposed by ERM:

- Installation of an impermeable liner across the buried waste area.

- Limiting future construction of enclosed spaces with a legally enforceable LTEMP.
- Incorporating utility trenches with liners for future service burial without disturbing the cap.
- Constructing stormwater features above the liner to minimize gas migration pathways.

Further, ERM proposed to monitor gas migration potential after construction completion, including monthly monitoring of enclosed spaces for up to 6 months and comparing gas concentrations with established criteria.

5.3.1 Auditor discussion – Hazardous Ground Gases Assessment

The auditor reviewed a preliminary version of the Hazardous Ground Gases Assessment report issued in April 2023. This review was documented in the audit trackingsheet. ERM subsequently revised the report, which the auditor found had addressed comments on the preliminary version. The auditor review was documented in IAA19 and accompanied the audit trackingsheet, a copy of which is provided in **Appendix B**

The primary objective of the ground gas assessment was to understand the presence and behaviour of hazardous ground gases. The recorded methane concentrations in the buried waste mound (AEC-4 source) ranged from 9% to 81%, leading to generation of a CS4 classification (moderate to high risk) as per the Ground Gas Guidelines (NSW EPA 2019). Data from downgradient wells generated a CS1 (very low risk) classification, suggesting minimal lateral gas migration. The auditor noted that currently, there are no buildings on the capped area, the surrounding environment is well-ventilated and any future development that includes construction of buildings will need to be as per the requirements of the LTEMP.

On this basis, the CSM indicated incomplete source-pathway-receptor linkages associated with ground gases impacts, demonstrating low risks to human receptors in the current land use and managed as outlined in the LTEMP for any future development.

5.4 Baseline Groundwater Monitoring Event

A number of groundwater monitoring events have been carried out at the site since 2011, with the majority of the monitoring wells relevant to the Stage 2 AA4 installed in 2020. The Quarter 4 2023 groundwater monitoring project report (the Q4 2023 GME) provided a baseline of groundwater conditions prior to commencement of capping works within the Stage 2 AA4 – as required by Consent Condition B22 of SSD 9302.

The objectives of the Q4 2023 GME can be summarised as follows:

- Establish a baseline dataset for the Stage 2 AA4.
- Assess the off-site risks to human and ecological receptors associated with Duck River.
- Assess whether natural attenuation of contaminants in groundwater is occurring.

The scope of the Q4 2023 GME comprised:

- Gauging of 23 groundwater monitoring wells, including the assessment of the presence of LNAPL.
- Sampling of the wells not impacted with LNAPL using no-purge techniques (Hydrasleeve samplers) and analysis for CoPC[7] in accordance with ERM (2021e).
- Analysis of current and historical data sets including statistical trend analysis for relevant CoPC.

[7] CoPC in groundwater: BTEX, TRH fractions, PAH, and PFAS.

The results as presented by ERM (2024a) are provided in **Appendix C.** The field observations of the baseline investigation are summarised in **Table 7**. Sampling locations are shown in Figure F2 in **Appendix A**.

Table 7 Summary of the field observations

Component	Key results
Groundwater gauging results	- The inferred regional and localised groundwater flow direction was to the south and south-east towards the Duck River. Groundwater elevations ranged from 3.5 m relative to Australian Height Datum (AHD) upgradient of the Stage 2 AA4 to 0.6 m AHD downgradient of the Stage 2 AA4 and adjacent the Duck River. - LNAPL was detected in wells MW12/01, MW20/05, MW20/06 and MW20/07, situated within the Stage 2 AA4 buried waste area. - Results were consistent with historical investigations.
Field groundwater quality parameters	Field results showed that groundwater is characterised by electrical conductivities ranging from 6,395 to 35,933 S/cm, and oxygen conditions varying from hypoxic to slightly oxic, with concentrations ranging from 0.98 to 8.73 mg/L.

ERM (2024a) conducted a trend analysis on LNAPL and dissolved phase concentrations of benzene, TRH C_6-C_9, and TRH C_{10}-C_{36}, which were identified as indicators of potential petroleum hydrocarbon plume migration. Notably, most monitoring wells relevant to the Stage 2 AA4 were installed in 2020 and therefore the ability to infer long-term trends was limited given the size of the datasets. Further groundwater monitoring is to continue as per the Stage 2 AA4 LTEMP requirements.

Dissolved phase contaminant data sets were analysed statistically using the Groundwater Spatiotemporal Data Analysis Tool (GWSDAT) and the Mann Kendall non-parametric test. The results provided by ERM (2024a) are summarised in **Table 8**.

Table 8 Summary of the trend analysis results

Component	Key results
LNAPL	ERM concluded that the spatial distribution of LNAPL remained consistent with previous groundwater monitoring events. The LNAPL observations in wells MW12/01, MW20/05, MW20/06, and MW20/07 were consistent with observations made in previous GMEs.
Benzene – dissolved phase	The Mann Kendall statistical analysis identified a stable or decreasing trend for benzene.
TRH C_6-C_9 – dissolved phase	The Mann Kendall statistical analysis identified a stable or decreasing trend for TRH C_6-C_9.
TRH C_{10}-C_{36} – dissolved phase	- ERM prepared a trend assessment using data related to groundwater samples analysed for TRH analysis following silica gel clean-up, a method designed to remove natural, non-toxic biogenic substances. ERM concluded that analytical data for TRH C_{10}-C_{40} fractions without silica gel clean-up were not sufficiently representative of the contamination conditions and were therefore discarded. - The Mann Kendall statistical analysis did not identify any statistically significant trends for TRH C_{10}-C_{40} following silica gel clean-up.
Historical maximum concentrations of CoPC	The concentrations of CoPC detected during the Q4 2023 monitoring event were lower than the maximum concentrations observed historically.

5.4.1 Natural attenuation of hydrocarbon impacts

ERM (2023a) evaluated whether there was evidence of natural attenuation of hydrocarbon impacts in the Stage 2 AA4. The assessment was conducted based on a weight of evidence approach, the results of which can be summarised as follows:

Primary lines of evidence

– The Mann Kendall statistical analysis of benzene, TRH C_6-C_9 and TRH C_{10}-C_{36} fractions demonstrated stable to decreasing trends in concentrations of these CoPC since 2011.

– Some increases in concentrations of the TRH C_{10}-C_{36} fraction were observed. However, available data indicated that these increases were associated with microbial degradation and the subsequent production of polar metabolites, as shown by groundwater analytical results following silica gel clean-up.

Secondary lines of evidence

– ERM examined natural attenuation parameters such as redox conditions, oxygen, nitrate, sulfate, methane, and ferrous iron concentrations, in relation to recorded contaminant concentrations in the Stage 2 AA4. The review suggested that methanogenesis is likely occurring within the waste mound and serves as an indicator of anaerobic biodegradation of hydrocarbon impacts, including LNAPL.

ERM (2023a) provided a summary of departures from the Stage 2 GMP along with their respective justifications. In summary, four groundwater monitoring wells could not be sampled, namely MW12/21, MW20/01B, MW20/02B, and MW20/20. ERM provided rationale for each deviation and concluded that the absence of data from these locations did not significantly impact the investigation's findings and the ability to assess contaminant data trends.

5.4.2 Auditor discussion – Baseline Groundwater Monitoring EEvent

The auditor considered that the baseline groundwater monitoring carried out by ERM was generally completed in accordance with the Groundwater Monitoring Management Plan (GWMP) and that the Consent Conditions B22 of the SSD 9302 (regarding a baseline GME) were met.

The current CSM indicates that concentrations of CoPC in groundwater present low and acceptable risks to human and ecological receptors associated with Duck River. This is supported by trend analysis that indicated stable or decreasing trends over time for LNAPL and dissolved phase CoPC such as TRH and aromatics such as benzene with little evidence of migration beyond the waste mound. Furthermore, natural attenuation of hydrocarbon contamination in groundwater is occurring, further contributing to mitigation of risks to human health and the environment.

The auditor also agreed it would be beneficial to conduct supplementary rounds of groundwater monitoring after remediation to better understand temporal trends in CoPC concentrations and to confirm the occurrence of natural attenuation processes.

5.5 Conceptual site model prior to remediation

Based on the historical information, ERM (2024b) designed a CSM prior to the remediation to further support the AEC-4 Capping Construction Technical Specification report. This CSM is depicted in **Table 9.**

Table 9 Conceptual site model pre remediation

Potential sources and associated CoPC	Identified CoPC	Potentially complete SPR linkages	
		Human Health	Ecological
Primary sources within AEC-4 - Include buried waste materials which remain in-situ CoPC assessed include: - TRH C_6-C_{40} - BTEXN - Metals - PAH - Phenols - SVOC[8] - pH (associated with acids) - Dioxins - PFAS[9] - Asbestos	***SOIL*** - LNAPL – visual evidence in unsaturated soils - TRH C_6-C_{10} - Benzene - Asbestos (ACM and fibres within fill) - Metals (hexavalent chromium) - Carcinogenic PAHs - PFAS	***SOIL*** - Indoor inhalation of vapours: by commercial or industrial workers in future indoor settings from LNAPL and hydrocarbon impacted soil (benzene, TRH C_6-C_{10}. **Pathway will be limited within the AEC-4 footprint via LTEMP controls on the design and construction of future buildings with appropriate gas/vapour mitigation**. - Inhalation of dusts or potential asbestos fibres: from ACM, fibrous asbestos and asbestos fines within soil by current and future on-site construction or intrusive maintenance workers or undertaking earthworks. **Pathway to be mitigated through administrative controls such as work permits, PPE and airborne asbestos monitoring which is to be outlined within the Contractor's Asbestos Management Plan (AMP) to be included in the LTEMP**. - Direct contact or ingestion of impacted soils: by current and future on-site intrusive maintenance or construction workers undertaking earthworks (TRH C_6-C_{10}, carcinogenic PAHs, hexavalent chromium). **Pathway to be mitigated through administrative controls such as work permits, PPE and management controls, which are to be outlined within the Contractor's Occupational Health and Safety Plans and Work Method Statements. Future exposure will be mitigated via restriction of excavation works below a marker layer under a future LTEMP**. - Potential for staining and/or odours: based on the observed presence of LNAPL within soil and groundwater (highly weathered, stable and limited to the extent of the AEC-4 buried waste mound), there is potential for staining and/or odours within future excavations undertaken by on-site intrusive maintenance or construction workers. **The potential for generation of odours and aesthetic impacts from residual TRH impacts outside the AEC-4 capped extent requires consideration within the future LTEMP.**	***SOIL*** No potentially complete SPR linkages via soil exposure to identified ecological receptors (limited to off-site - Duck River).
	GROUNDWATER - LNAPL (contained within AEC-4) - PAHs - PFAS (PFOS)	***GROUNDWATER*** No potentially complete SPR linkages were identified for on-site or off-site human health receptors via groundwater exposure under the current and proposed commercial / industrial land-use.	***GROUNDWATER*** Incomplete exposure pathways for the following CoPCs (identified in historical assessments): - PAHs (including naphthalene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene) exceeding relevant ecological criteria in groundwater. However, the extent of the contamination was laterally delineated to below assessment criteria within the Stage 2 AA4 boundary. - PFAS (including PFOS) exceeding relevant ecological direct toxicity criteria in wells downgradient of AEC-4 are considered consistent with the magnitude of concentrations assessed via mass flux estimates of groundwater at the site boundary for other areas of Stage 2 (ERM, 2018). The report concluded: o potential direct toxicity risks to offsite receptors were unlikely considering low mass contribution and overall volume of receiving water body. o Indirect human exposure via consumption of PFAS containing seafood unlikely given existing fishing bans and the volume of untreated stormwater that would discharge into Duck River. Off-site assessment of bio accumulative effects of PFAS in waterways is unlikely to provide meaningful input into site based PFAS management given magnitude of other off-site contributions to these systems.
	GROUND GASES - Methane and CO_2	***GROUND GASES*** - Gas Screening Values (GSV) and Characteristic Situation (CS) classification of bulk ground gases in the AEC-4 buried waste mound indicate a conservative risk classification up to CS4 (moderate to high risk) based on the maximum recorded methane and flow rates recorded at monitoring well MW20/05. Calculated CS Values for wells sampled down gradient of the buried waste mound were classified as CS1 (very low risk) and are indicative of negligible lateral migration of ground gases via advective or diffusive processes from AEC-4. - No potential exposure pathways for receptors given a well-ventilated open-air environment (i.e. no buildings, service trenches and pits within the entirety of Lot 64). Future monitoring is proposed within the LTEMP to monitor and manage potential for accumulation of ground gas from AEC-4. - Potential for lateral migration of bulk ground gases is unlikely: from AEC-4 to off-site receptors either currently or the future given the presence of the Duck River down gradient (south) and drainage channel to the west of AEC-4. These features provide barriers to off-site lateral migration of ground gas/ vapours via restriction of flow and pore space below the ground surface.	***GROUND GASES*** No potentially complete SPR linkages via ground gas exposure to ecological receptors identified (limited to off-site – Duck River).

[8] Semi-Volatile Organic Compounds.
[9] Per- and Polyfluoroalkyl Substances.

5.5.1 Auditor discussion – Stage 2 AA4 Conceptual site model prior to remediation

In the auditor's opinion the Stage 2 AA4 pre-remediation CSM identified the relevant sources of contamination (based on the historical site uses and data), the receptors (both on and off-site), and relevant pathways. The auditor concurred with ERM's SPR linkage assessment and the discussion on potential risks. The auditor noted that the identified potential human health risks to on-site commercial/industrial receptors and/or maintenance workers (surface and in shallow trenches) can be mitigated with the proposed remediation strategy (on-site capping containment above ground) and managed via an LTEMP.

The auditor concurred with ERM's opinion that residual groundwater impacts do not pose potential risks to on-site human health receptors and off-site human health and ecological receptors. Nevertheless, groundwater conditions and migration to off-site (towards Duck River) will be monitored by ERM via the LTEMP. The Stage 2 AA4 LTEMP is further discussed in **Section 11**.

6. Stage 2 Remedial Action Plan

The Stage 2 RAP prepared by ERM was reviewed by the auditor, the results of which were documented in SAS Nº 065-2127799 (refer to **Table 2**).

The Stage 2 RAP detailed the nature and approximate extent of identified soil contamination, the type and locations of remediation required, feasible remedial strategies to address the identified contamination, and the environmental management requirements to be implemented during remedial works.

The following key documents that were audited during the review of the Stage 2 RAP were considered by the auditor during this audit:

– ERM (2021a). Clyde Western Area Remediation Project – Stage 2 Air Emissions Verification Report, Final, Revision 2, dated 11 June 2021 (the **AEVR**).

– ERM (2021b). Clyde Western Area Remediation Project – Groundwater Monitoring Program – Stage 2, Final, Revision 3, dated 14 July 2021 (the **GMP**).

– AECOM (2021a). Stage 2 Remediation Environmental Management Plan – Clyde Western Area Remediation Project, Final, Revision 3, dated 2 July 2021 (the **REMP**) – it is noted that the REMP was a requirement of SSD 9302.

The REMP sub-plans included the following documentation:

– AECOM (2021b). Clyde Western Area Remediation Project – Stage 2 Remediation Environmental Management Plan – Air Quality Management Plan, Final, Revision 3, dated 2 July 2021 (the **AQMP**).

– AECOM (2021c). Clyde Western Area Remediation Project – Stage 2 Remediation Environmental Management Plan – Soil and Water Management Plan, Final, Revision 3, dated 1 July 2021 (the **SWMP**).

– AECOM (2021d). Clyde Western Area Remediation Project – Stage 2 Remediation Environmental Management Plan – Groundwater Monitoring and Management Plan, Final, Revision 3, dated 2 July 2021 (the **GMMP**).

– AECOM (2021e). Clyde Western Area Remediation Project – Stage 2 Remediation Environmental Management Plan – Waste Management Plan, Final, Revision 2, dated 30 June 2021 (the **WMP**).

– AECOM (2021f). Clyde Western Area Remediation Project – Stage 2 Remediation Environmental Management Plan – Traffic Management Plan, Final, Revision 2, dated 30 June 2021 (the **TMP**).

A list of remediation methods for the AECs identified within the Stage 2 area were presented in the Stage 2 RAP and each method evaluated against criteria of effectiveness, timeframe, health and safety, complexity, sustainability and cost in accordance with the CRC CARE (2018) guidance. Further, in 2023 to complement the Stage 2 RAP, ERM prepared a Capping Construction Technical Specification which is further discussed in **Section 7**.

6.1 AEC-4 Remedial Options Analysis

To support the Capping Construction Technical Specification, ERM prepared a Remedial Options Analysis – the AEC-4 ROA. The key features of the AEC-4 ROA are summarised in **Table 10** and in **Appendix C.x C.**

Table 10 AEC-4 ROA summary

Information	Discussion
Purpose	The purpose was to refine the understanding of potential remedial options for identified contamination within AEC-4.
Scope of works	The scope comprised:

Information	Discussion
	- Review of previous investigations undertaken within AEC-4 detailing site - specific environmental conditions and the nature and extent of contamination. - Definition of remedial goals based on the LNAPL CSM and refined CSM (including data from the AEC-4 Supplementary ESA). - Completion of an assessment of potential remedial options against the criteria of effectiveness, timeframes, health and safety, sustainability, cost and in consideration of NSW EPA regulatory guidance relating to remedial hierarchy. - Presentation of the preferred remedial strategy for AEC-4.
ROA process and criteria	A list of remediation methods available for CoPC was evaluated against relevant criteria to identify a preferred option given the variability of CoPC and site setting. Additionally, this analysis considered relevant sections of the following guidance: - The Introduction to the National Remediation Framework, Rev 3 (CRC Care 2018). - Guidelines for the assessment and remediation of site contamination (SA EPA July 2018). - US Federal Remediation Technologies Roundtable (FRTR) Remediation Technologies Screening Matrix and Reference Guide, Version 4.0 (2007). - Interstate Technology & Regulatory Council (ITRC's) Remediation Process Optimization: Identifying Opportunities for Enhanced and More Efficient Site Remediation (2004). - Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Non-Aqueous Phase Liquids Released to the Subsurface, ASTM International (2014). - Sustainable Remediation Forum (SuRF) ANZ; A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010). - Additionally, to the above guidelines, the order of preference for soil remediation and management from the Auditor guidelines was considered by ERM.
Preferred remediation strategy	The preferred strategy for AEC-4 was an engineered capping layer and ongoing management, limiting the exposure to current and future users and providing ongoing management / monitoring of the area to ensure there is no change to the risk to off-site receptors. ERM noted that a LTEMP will be required to document residual impacts, monitor groundwater conditions following implementation of the capping solution, and manage site conditions to mitigate exposure scenarios related to direct contact, vapour intrusion or and/or asbestos inhalation with respect to future works or development at the Stage 2 AA4. ERM also noted that proposed future use of the site is for car parking and/or container storage and that no permanent or occupied buildings are proposed.
Rationale supporting the selected remediation strategy	The CoPC in soils above SSTLs: benzene, TRH C6-C10, TRH C10-C34, Carcinogenic PAHs, Hexavalent chromium, PFOS, asbestos (including fibrous) and LNAPL (sludge). Due to the heterogeneous nature of contamination within soils located within AEC-4 and in consideration of the very low mobility of contaminants within groundwater and subsequent low risk of harm to nearby ecological receptors (the Duck River), materials within AEC-4 can be appropriately managed via an engineered cap and contain strategy.

6.2 Auditor discussion – AEC-4 ROA

The auditor review of the AEC-4 ROA was documented in an audit trackingsheet presented in **Appendix B**. In the auditor's opinion, the AEC-4 ROA followed the approach presented in CRC CARE (2018) and considered relevant Australian and international guidance. Additionally, the hierarchy for site clean-up and/or management outlined in the ASC NEPM was considered by ERM during its analysis. The auditor considered that results from previous investigations and risk assessments had demonstrated that soil and groundwater contamination within AEC-4 was delineated, had limited mobility and did not pose an unacceptable risk to human health or any off-site ecological receptors. As such, in conjunction with the construction of a managed capping layer, ongoing management of LNAPL could be incorporated in an LTEMP.

The auditor noted that the LTEMP will include details on monitoring requirements and potential trigger levels that would require consideration for alternative/active remedial approaches if a change in site conditions results in a potential risk to human health or off-site ecological receptors.

6.3 Remediation strategy

The selected remediation approach of constructing an engineered capping layer was based on the proposed land use, VE Property Pty Ltd ownership of the land and outcomes of the CSM as follows:

– Results from investigation works over more than a decade and that contamination within AEC-4 was appropriately laterally delineated to within the audited area boundary and does not pose a risk of harm to adjacent off-site receptors, including the Duck River.
– The contaminated materials and/or soils at AEC-4 have been in place for greater than 40 years, providing confidence in the stability of environmental conditions and low likelihood of any significant changes in future.
– LNAPL within groundwater has been identified to be degraded, low mobility, insoluble and not migrating off-site and would therefore be suitable for ongoing management under an LTEMP.
– Future vapour intrusion and/or potential bulk ground gas risks have been characterised and are limited to the extent of the proposed capped area, where it is understood land use in the short term may comprise activities such as to open air storage and/or car parking. Construction of permanent/ enclosed buildings within this area would need to be conducted as per the requirements presented in the LTEMP (which includes implementing controls consistent with the NSW EPA Hazardous Ground Gas Guidelines. Bulk ground gas monitoring will be included in the LTEMP.

6.4 Remediation objective

In accordance with the Stage 2 RAP objectives, the construction of an engineered capped surface aligns with the Stage 2 RAP objectives outlined by ERM in 2021, through the aim of achieving the following remedial goals:

– Physical Separation: Minimise the potential for inadvertent direct contact with contaminated soils or disturbance of asbestos in soils by future on-site workers conducting excavations.
– Infiltration reduction: Decrease the potential for surface water infiltration at the ground surface, thereby reducing potential contaminant mass flux and movement of LNAPL or dissolved contaminants in groundwater from the buried waste area.

6.5 Required remediation documentation

In order to address the conditions outlined in SSD 9302 Consent for the project, a Remediation Environmental Management Plan (REMP) and its associated sub-plans were developed by AECOM and approved for Stage 2 of WARP, including the capping construction. Further discussion on the REMPs is presented in **Section 8**. The REMP included the following sub-plans:

– Soil and Water Management Plan (SWMP).
– Groundwater Monitoring and Management Plan (GMMP).
– Air Quality and Odour Management Plan (AQMP).
– Waste Management Plan (WMP).
– Traffic Management Plan (TMP).

6.6 Monitoring wells decommissioning

ERM (2021d) reported that prior to the commencement of earthworks, eight groundwater monitoring wells within the capped extent (BH116, MW12/01, MW20/03, MW20/04, MW20/05, MW20/06, MW20/07, MW20/13) were decommissioned and sealed using grout, bentonite grout and concrete in accordance with Minimum Construction Requirements for Water Bores in Australia (4th edition) (NUDLC, 2020).

6.7 Groundwater monitoring – B22 Consent Condition of SSD 9302

The auditor noted the baseline groundwater assessment was conducted in November 2023 as summarised in **Section 5.4** in accordance with Consent Condition SSD 9302 B22.

6.8 Validation program

The remediation validation program prepared by ERM is summarised in **Table 11.**

Table 11 Summary of validation program

Item	Remedial Works scope item	Validation approach
01	Monitoring wells within capping footprint decommissioned	- Photographs - Field inspection forms
02	Vegetation Clearing and Grubbing	- Contractor daily field logs - Photographs
03	- Pre-works survey - Confirmation of existing site levels, key site features	- Survey of existing levels (DWG file, PDF)
04	Landforming and Surface Grading	- Survey of graded surface prior to capping
05	Import of fill - Approval of material prior to import from offsite source	- Approval of VENM documentation by ERM - Approval of geotechnical properties for engineered fill by Geotech consultant (Alliance)
06	Import of fill - Delivered material Inspection	- Photographs - Field Inspection forms
07	Import of fill – Material tracking	Contractor to provide the following to ERM: - Imported materials tracking register - Delivery dockets from supplier
08	Subgrade preparation – proof rolling and rectification of soft subgrade	- Contractor daily field logs - Level 1 Geotechnical Supervision – Field records
09	Anchor/ Utility Trench Excavation	- Contractor daily field logs - Photographs
10	Cushion Geotextile - Review of material specifications	- MQC data provided by contractor to ERM for review prior to bringing to site
11	Cushion Geotextile – Storage and Handling	- ERM field inspection records
12	Pre-placement of Cushion Geotextile – Asbestos Clearance by Licenced Asbestos Assessor	- Visual clearance certificate including laboratory results of clearance air monitoring - Photographs
13	LLDPE Geomembrane Installation – Installer Qualifications	- Documentation of specialist installer's experience relevant to project (CVs etc)
14	LLDPE Geomembrane Installation – Panel Plan Layout	- Panel layout plan (PDF and CAD file) - Written approval from ERM
15	LLDPE Geomembrane Installation – Review of Material Specifications and Independent Testing	- MQC data provided by contractor to ERM for review prior to bringing to site - Independent Tests results performed by ERM (field records and laboratory Reports)
16	LLDPE Geomembrane Installation – Daily Inspection for angular debris and deleterious material	- ERM daily inspection records

Item	Remedial Works scope item	Validation approach
17	LLDPE Geomembrane Installation – Pre-seam trial welds	- Geomembrane installer records – provided daily to ERM - Non-conformance records (NCR logs), as required
18	LLDPE Geomembrane Installation – Non-destructive field seam tests	- Contractor daily report - Geomembrane installer records and test results – provided daily to ERM - NCR logs, as required
19	LLDPE Geomembrane – Storage and Handling	- Contractor daily report - ERM field Inspection records NCR logs, as required
20	LLDPE Geomembrane Installation – Panel Placement	- Contractor daily report - ERM daily inspection record - Photographic evidence - NCR logs, as required
21	Pre-placement inspection of upper cushion geotextile placement	- Contractor daily report - VC daily inspection record - Photographic evidence - NCR logs, as required
22	Marker geotextile placement	- Contractor daily report - VC daily inspection record - Photographic evidence - NCR logs, as required
23	Pavement Installation and Compaction	- Contractor daily report - GC daily inspection records / ITR forms - Photographic evidence - NCR logs, as required
24	Finished Landform – Capped area to be free draining, stormwater drainage features installed	- Contractor as-built survey (CAD and PDF) - VC inspection record - Photographic evidence

6.9 Auditor discussion – Stage 2 Remedial Action Plan

The appropriateness of the Stage 2 RAP was discussed in a SAR and SAS (Nº 065-2127799) issued by the auditor in 2021. The auditor noted that the Stage 2 RAP was prepared based on a series of robust assessments, including two ROAs, an AEVR and the outcomes and lessons learnt in delivering the Stage 1 Area remediation. The Stage 2 RAP was considered by the auditor to have been prepared in a manner consistent with relevant guidelines.

The auditor has previously reviewed the REMPs during the previous audits listed in **Table 2**. In the auditor's opinion these plans establish a comprehensive framework for environmental management across all stages of the remediation process, ensuring compliance with relevant legislative and other requirements.

The preferred strategy presented for AEC-4 in the Stage 2 RAP was construction of an engineered capping layer and ongoing management of contaminated soil and groundwater via a LTEMP. This strategy was developed through a remedial options assessment, the results of which were formalised in technical specifications for the construction of the cap. The design and specifications were reviewed by the auditor and members of his specialist team.

The capping approach was considered to be appropriate based on the identified CoPCs, the future land use and NSW EPA made or endorsed guidelines. Further information and commentary on the technical specifications is presented in **Section 7**.

7. Capping Construction Technical Specifications

The Stage 2 RAP (ERM, 2021d) outlined that constructing an engineered capping layer with ongoing management under a legally enforceable LTEMP was the preferred remedial approach. The Stage 2 RAP established a framework for the development of a detailed design for the capping layer. ERM subsequently produced the Technical Specification report (ERM, 2024a) to define the technical requirements for the capping layer.

7.1 Overview of the capping design

The objectives of the capping design were to limit surface water infiltration into the underlying waste and maintain stability of the LNAPL plume and other contaminants in the groundwater. The capping design comprised:

– Liner and subsurface capping – a linear low-density polyethylene (LLDPE) geo-membrane liner was to be installed on the top of the impacted material followed by marker geotextile and then a 0.3 m cover reinforced with appropriate engineered materials (such as Miracell® Geocell). Specific geotechnical requirements were provided for soils to be placed above the geotextile material.

– Surface – Heavy duty asphalt pavement surface was selected due to its flexibility for heavy traffic and storage of heavy vehicles as well as ease of repairs.

– Retaining wall – Construction of sandstone block retaining walls on the northern, western and southern sides of the mounded area. A landscaped batter with a slope of 1:3 was created to the east to meet the requirement for an average 40 metre riparian corridor along Duck River (as per biodiversity consent conditions under SSD 10459).

– Footings for future illumination or similar – Installed outside the capped area with conduits for future perimeter lighting installation.

– Utility trench – Trenches were to be constructed above the LLDPE geomembrane and marker geotextile to reduce requirement for future excavations below the capping layer. Trenches to be backfilled with Virgin Excavated Natural Material (VENM) or soil excavated at the site which is suitable for reuse as per conditions outlined in the Stage 2 RAP.

7.2 Compliance with the Stage 2 RAP

ERM (2024a) states that the capping technical specification complies with the requirements of the Stage 2 RAP (ERM, 2021d), including:

– *Permanent hardstand such as concrete ground slab or asphalt surfaced pavement.*

– *A thickness of soil that is unlikely to be inadvertently penetrated by future site users. A minimum soil cover thickness of 0.2 m is nominated, underlain by a 'marker layer' in areas of exposed impacted soil.*

– *The marker layer shall consist of a distinctly bright coloured knitted High-density polyethylene (HDPE) or geofabric of density >300 g/m^3. The marker layer should be of a distinctive bright colour such that future workers who conduct excavations will be alerted to conditions as documented in the LTEMP prior to breaching this layer.*

– *For a barrier layer, capping material must:*

  - have an in-situ saturated permeability of less than 10-9 m/s, high plasticity with no particles greater than 50 mm dimension, as indicated by particle size distribution analysis conducted at source of imported material (the auditor notes that this requirement is not needed give the adoption of geomembrane materials);
  - *be designed with a final minimum ground surface slope of 1% to minimise potential for pooling on the surface of the capped area during rainfall events;*

- *be overlain by hardstand pavement and subgrade being geotechnically suitable for vehicle traffic and use as a carpark without compromising the future cap integrity.*

– *Where alternative capping systems are preferred, such as liners or membranes, average infiltration rates must not exceed 5% of annual rainfall".*

7.3 Construction phase

ERM (2024a) provided detailed requirements and information to inform the construction works, namely:

– Preliminaries – This section covered project responsibilities, documentation such as environmental and traffic management plans, and design drawings.

– Contractor documentation requirements – This included information on the management and installation of a geomembrane material, as well as documentation of warranties, construction drawings, and validation reports.

– Construction phase – This section provided requirements regarding:

  - Licences, permits and approvals.
  - Health and Safety.
  - Environmental Management, including the management of soil, water, waste, air quality (including odours), and asbestos.
  - Environmental monitoring, including responsibilities, monitoring details and frequency.
  - Site preparation.
  - A detailed description of capping construction including pavement and landform, retaining walls, drainage and installation of utilities.
  - Project close out.
  - A construction quality assurance plan, including key quality control points, documentation requirements, specifications, non-conformance reports and test plans to meet the project objectives.

7.4 Design drawings

ERM (2024a) provided detailed design drawings to illustrate the implementation of the capping system. The drawings provided visual representation of the proposed capping system, including its dimensions, materials and placement. They also provided detailed guidance to engineers and contractors regarding the construction process, to ensure that the capping system was installed correctly and effectively. The drawings, which are provided in the appendices of ERM (2024a), included the following:

– Civil and capping design drawings (prepared by Costin Roe Consulting) as following:

  - CO13919.06-C10: Drawing List and General Notes
  - CO13919.06-C11: General Arrangement Plan
  - CO13919.06-C12: Existing Site Levels and Features
  - CO13919.06-C13: Proposed Capping and Grading Plan
  - CO13919.06-C14: Proposed Earthworks Plan
  - CO13919.06-C15: Site Grading Sections
  - CO13919.06-C16: Typical Details – Sheet 1
  - CO13919.06-C17: Typical Details – Sheet 2
  - CO13919.06-C18: Typical Details – Sheet 3

– Lighting design drawings (prepared by Light Harmony).

– Landscape design drawings (prepared by Geoscape).

7.5 Auditor discussion – Capping construction technical specifications

Audit review of documentation and issued IAAs - During the review of the Technical Specification report, the auditor relied on one of his specialist support team members, Alison Horlyck – an experienced civil engineer in GHD's Waste Management team – to review the capping design drawings. Auditor commentary on the preliminary version of the Technical Specification report issued in April 2023 was documented in IAA18. ERM subsequently revised the report, which the auditor found had addressed comments on the preliminary version. The outcomes of the auditor reviews are documented in IAA 19 and accompanied audit tracking sheet a copy of which is provided in **Appendix B**.

Proposed land use - The auditor noted that the short term future land use for the AEC-4 is anticipated to comprise slab-on-grade outdoor storage. Construction of any buildings shall be as per the requirements of the legally enforceable LTEMP (as per SSD9302).

Remedial strategy review – The containment strategy involved constructing an engineered capping layer and implementing a legally enforceable LTEMP for ongoing management, including maintenance of the cap. The on-site capping approach is considered effective due to the stability of the contaminated materials. The benefits of the preferred remedial strategy included mitigating direct contact risks to future on-site workers, minimising air quality issues, reducing off-site disposal volumes (and reinstatement with soils from off-site sources), and preventing surface water infiltration. The preferred approach was selected based on the following factors:

- Consideration of the future commercial/industrial use and Viva Energy's ownership Stage 2 AA4.
- Historical assessments confirming lateral containment of contamination within AEC-4, which has not been identified to pose an unacceptable risk to off-site receptors including the Duck River.
- Confidence in the geochemical stability of contaminated materials, supporting the on-site containment approach.
- LNAPL within groundwater is not migrating off-site and does not require active remediation.

The implementation of the LTEMP will incorporate monitoring of groundwater conditions and management of potential exposure scenarios related to direct contact, vapor intrusion, or asbestos inhalation. Exceedances of vapour intrusion criteria and hazardous ground gases were limited to the capped area's footprint – the LTEMP outlines the protocols that are to be followed in relation to construction of buildings in Stage 2 AA4.

Proposed capping design and considerations regarding ground gas hazards – The auditor noted that the proposed capping design for the AEC-4 buried waste area includes specific measures to effectively address potential gas hazards. These considerations consisted of installing an impermeable liner across the entire area to mitigate gas migration vertically and volatilisation. A utility trench with an LLDPE liner will be included in the capped area for installing services without disturbing the cap structure and reducing potential of gas migration into the trench void. Stormwater pipes and pits will be positioned above the liner to prevent gas migration into and through these features. Despite the low likelihood of ground gas migration according to the CSM (refer to **Section 5**), monitoring of gas migration to other on-site areas will be undertaken. This will comprise monthly gas monitoring of enclosed spaces, such as stormwater pits, for a period of up to six months after cap construction ensuring prompt detection and mitigation of any unexpected gas migration. Gas concentration levels will be compared with the 'Gas accumulation Criterion' for enclosed structures (methane <1% v/v) and contingency actions/ notifications taken as per as per Section 5.4 of the Solid Waste Landfill Guidelines (NSW EPA 2016). A summary of the hazardous ground gas assessment is discussed in **Section 5.3**.

Appropriateness of the capping and requirements of the Auditor guidelines – Section 4.3.3 of the *Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (NSW EPA, 2017) states a capping and/or containment strategy must be appropriate for the contaminants of concern. In addition, the auditor must check that a containment strategy:

- *Maximises the long-term stability of the capping and/or containment system(s) and any proposed structures above it (from an engineering perspective) and, where applicable, minimises the potential for leachate formation and/or volatilisation*
- *Does not include the erection of structures on the capped and/or contained area that may result in a risk of harm to public health or the environment.*
- *Recommends a notification mechanism to ensure that the capped and/or contained areas are protected from any unintentional or uncontrolled disturbance that could breach the integrity of the physical barrier, such as recommending placing a notation or covenant on the property title or a notation on a s.149 certificate or issuing an order or placing a covenant on the title to land under the CLM Act to require ongoing maintenance under the Act.*

In the auditor's opinion the engineered on-site capping approach was technically feasible in managing the nature of the identified CoPC within the Stage 2 AA4 that could pose potential risks to commercial on-site receptors. The auditor's opinion in relation to the three requirements listed in Section 4.3.3 of the NSW EPA *Auditor Guidelines* are as follows:

- The capping layer was designed by an appropriate qualified environmental/civil (or equivalent) engineer to maximise its long-term stability. Only site derived contaminated material was present AEC-4. Groundwater monitoring over more than a decade has shown there to be only localised impact to groundwater quality and very little migration beyond the boundaries of AEC-4. Potential for volatile and hazardous ground gas accumulation will be monitored via a legally and enforceable LTEMP.
- It is the auditor's understanding that structures to be constructed on the capped area will have to follow the protocols presented in the LTEMP.
- A notification of the presence of the capped and managed area shall be placed on the Planning Certificate issued under Section 10.7 of the Environmental Planning and Assessment Act 1979. The auditor received confirmed via email that Parramatta Council will place this notification on the planning certificate.

8. Stage 2 AA4 remediation and validation implementation

The remediation and validation activities were conducted between December 2023 and June 2024. A summary of these activities is presented in the following sections.

8.1 Validation program

ERM (2024b) stated that overall, the validation program was completed in a manner consistent with the procedures listed in the Stage 2 RAP and in the Technical Specification report. Departures are discussed in **Section 8.2**.

A summary of the environmental monitoring events undertaken during the remediation in accordance with the REMPs are presented in **Table 12.**

Table 12 Summary of environmental monitoring

REMP	Aspect	Description / Frequency	REMP Validation
Air Quality Management Plan (AQMP)	Boundary VOC and odour emissions	Ambient boundary VOC and odour surveys to be conducted to assess VOC and odour control performance during the more intense phases of the Stage 2 works, which normally include soil excavation and screening. Over two to three sampling rounds, nominally when excavation of contaminated material is occurring.	Not Applicable to capping works -Monitoring requirement relevant to excavation of hydrocarbon impacts for on-site treatment (biopiling) which has been previously completed.
AQMP	Excavation Area VOC and odour emissions	PID monitoring to be conducted during soil handling operations. During soil handling operations.	Not Applicable to capping works -Monitoring requirement relevant to excavation of hydrocarbon impacts for on-site treatment (biopiling) which has been previously completed.
AQMP	Dust emissions	Maintain visual awareness of dust and log any observations of dust seen to be leaving the s Stage 2 AA4. At all times.	Soil was constantly watered during excavation works and progressively covered by liner materials.
AQMP	General	Ad hoc visual observations to ensure compliance with air quality management requirements. At all times.	No issues were reported.
AQMP	General	Audits against the requirements of the Stage 2 AQMP and Stage 2 AQMMS. Quarterly	No issues were reported.
Soil and Water Management Plan (SWMP)	Inspection of erosion and sediment controls	Routine inspections to monitor the implementation and integrity of the erosion and sediment control structures At all times	No issues were reported. Erosion and Sediment Controls, including silt fences were maintained around the works perimeter throughout the works.

REMP	Aspect	Description / Frequency	REMP Validation
SWMP	Testing of stockpiled excavated soil	Testing of stockpiled material to enable classification prior to off-site disposal, noting that this is not anticipated to be required as part of the project. As / if required	Not applicable. No material was excavated or disposed off-site.
SWMP	Assessment of capping layer	Verification that capping layer construction has been completed in accordance with the detailed design. On completion of construction.	Completed. Assessment of the Capping Layer is the subject of the AEC-4 Validation Report CQA documentation collected and presented in Section 5 of ERM, 2024b demonstrates overall compliance with the detailed design and associated technical specification for capping construction.
SWMP	Testing of leachate and accumulated water in excavations	Leachate and accumulated water in excavations related to remediation activities will be collected and tested prior to off-site disposal. As required.	Not applicable for AEC-4 as no excavations within the waste were undertaken (apart from the northern perimeter to install the retaining wall, a shallow trench along the perimeter to anchor the capping layer and sumps to install stormwater collection culverts).
SWMP	Inspection of equipment and plant	Regular inspections of remediation equipment and plant to be carried out to ensure the potential for leaks are minimised and identified issues are rectified. At all times	No issues were reported.
SWMP	General	Ad hoc visual observations to ensure compliance with soil and water management requirements. At all times	No issues were reported.
Groundwater Management Plan (GMP)	Groundwater monitoring during remediation (nearby wells)	Groundwater monitoring in line with the GMP. Baseline sampling prior to commencement of remediation works Within 3 months following completion of remediation works	Baseline monitoring event was completed in November 2023. The followed-up monitoring is schedule to occur in August 2024 and will comprise the remaining 13 monitoring wells located down gradient of the Stage 2 AA4 and Duck River. The outcomes of these monitoring will be discussed in a specific audit.
GMP	Groundwater monitoring during remediation - nearby wells)	Groundwater monitoring in line with the GMP. Gauging weekly during excavation and/or dewatering	Not applicable. As per the Stage 2 GWMP, due to shallow nature of landforming works undertaken at AEC-4, no interaction of the works with groundwater was anticipated and therefore requirement for monitoring during remediation of AEC-4 was not applicable.
GMP	Groundwater monitoring during remediation -	Groundwater monitoring in line with the GMP.	Not applicable. As per the Stage 2 GWMP, due to shallow nature of landforming

REMP	Aspect	Description / Frequency	REMP Validation
	Down-gradient boundary	Monthly during active remediation conducted up-gradient	works undertaken at AEC-4, no interaction of the works with groundwater was anticipated and therefore requirement for monitoring during remediation of AEC-4 was not applicable.
GMP	Groundwater monitoring post remediation - Down-gradient boundary	Groundwater monitoring in line with the GMP. Biannually (every 6 months) following completion of post remediation sampling event. Requirement for ongoing sampling is to be reviewed annually	The monitoring will be completed / enforceable as per the LTEMP.
GMP	Excavation water and discharge monitoring	Water removed from excavations and leachate will be collected and tested prior to off-site disposal. As required.	No excavations that intersected groundwater were undertaken, and dewatering was not necessary.
GMP	General	Ad hoc visual observations to ensure compliance with groundwater management requirements. At all times.	Groundwater management was not required.
GMP	General	Audits against the requirements of this GMP and GWMP. Quarterly	No issues were reported.
WMP	Remediation works waste	Waste tracking system will be implemented in accordance with NSW EPA requirements. Documentation (such as receipts) for the transport and disposal of waste and recycling materials from the Western Area. Material tracking records will include types, volumes and management measures for waste and resource arising from/used for the Project. As / if necessary.	Waste material was not disposed off-site. Refer to **Section 8.6**.
WMP	Remediation works waste	Waste tracking system will be audited to confirm system is being implemented in accordance with NSW EPA requirements. 6-monthly.	Waste material was not disposed off-site. Refer to **Section 8.6**.
WMP	Asbestos register	Maintain an asbestos register for all asbestos waste generated during remediation activities. At all times.	Waste material was not disposed off-site. Refer to **Section 8.6**.
WMP	Imported fill	Imported fill material will be stockpiled and tracked separately to the on-site materials and tested/validated to confirm the fill meets the criteria to be reused on the Project Area.	As discussed in **Section 8.5**.

REMP	Aspect	Description / Frequency	REMP Validation
		As / if necessary.	
WMP	General	Ad hoc visual observations to ensure compliance with waste management requirements. At all times.	No issues were reported.
WMP	General	Audits against the requirements of the WMP. Quarterly.	No issues were reported.
TMP	General	Ad hoc visual observations to ensure compliance with traffic management requirements. At all times.	No issues were reported.
TMP	General	Quarterly inspections against the requirements of the TMP and any active Traffic Management Method Statement (TMMS). Quarterly	No issues were reported.

A summary of the remediation, and capping validation information documented in ERM (2024b) is summarised in **Table 13.**

Table 13 Summary of remediation and capping validation

Task	Discussion / validation
Vegetation clearing and grubbing	In December 2023, vegetation clearance within the footprint of AEC-4 was completed to facilitate capping construction and landscaping works. Photolog was presented in Appendix F and inspection forms and field sheets in Appendix D of ERM (2024b).
Monitoring well decommissioning	Groundwater monitoring wells were decommissioned in accordance with the requirements of the Technical Specification. Ten groundwater monitoring wells within the capped extent (BH116, MW12/01, MW20/03, MW20/04, MW20/05, MW20/06, MW20/07, MW20/13, MW20/03 and MW20/04) were decommissioned and sealed using bentonite and concrete. Photolog was presented in Appendix F and inspection forms and field sheets in Appendix D of ERM (2024b).
Land forming and surface grading	Prior to the commencement of earthworks, EPS performed a survey to confirm extent of existing site features. Revisions to the capping design, including the alteration of previous retaining walls to battered sides were necessary for constructability and future site access. The departures from the Stage 2 RAP are discussed in Section 8.2. Landforming and surface grading was undertaken as per CO13919.06-CC40 (ERM, 2024a). Cut to fill earthworks were completed as per the site preparation notes provided in CO13919.06-CC30 (ERM, 2024a). The following steps were undertaken as part of landforming works: - Existing asphalt surface was stripped, temporarily stockpiled and re-used within the Stage 2 AA4. - Complete cut to fill earthworks achieved the required levels as indicated on CO13919.06-CC30 within a tolerance of +0 mm/-10 mm through pavements and +0 mm/-20 mm elsewhere. - Existing levels were matched at the batter interface. - ERM inspected the finished surface of the capped area on 22/03/2024. CQA Inspection Records were provided as Appendix D, and the photolog of the graded surface is presented in Appendix F of ERM (2024b).

Task	Discussion / validation
Subgrade preparation	The subgrade was prepared in accordance with the earthworks plan (CO13919.06.CC30). ERM (2024b) reported that it was the responsibility of the Level 1 Geotechnical consultant to supervise the contractors works and ensure that the final prepared subgrade met geotechnical specifications of the Earthworks Plan and Detailed Design specifications. The Level 1 Geotechnical Report, prepared by Alliance Geotechnical was provided within Appendix I of ERM (2024b).
Anchor/ utility trench excavation	Detailed excavations for anchor trenches, utilities, and stormwater drainage were completed as per CO13919.06-CC40 (ERM, 2024a). These trenches were excavated into contaminated material, followed by the installation of cushion geotextile and geomembrane, adhering to the methods specified in ERM (2024a). Documentation of the excavation process and final trenches is provided in Photolog presented in Appendix F of ERM (2024b). Excavated spoil was used as fill behind retaining walls under the cap. The exact locations of the anchor trenches are documented in Appendix C of ERM (2024b). An inspection by ERM confirmed that the excavation's dimensions, depths, and placements meet the design and technical specifications.
Cushion geotextile – Review of material specifications	MQC results regarding the suitability of the Cushion Geotextile materials for the AEC-4 were provided to ERM by the Remediation Contractor. These results, sourced from Geofabrics Australasia, were included in Appendix E of ERM (2024b). Bidim A94' geotextile materials were utilised as cushion geotextile material on the project. ERM (2024b) documented that the installed cushion geotextile is a non-woven, needle-punched fabric made from virgin polypropylene or polyester fibres, inspected and verified as 'needle free' upon delivery. It is designed for buried applications, offering the necessary strength and durability to withstand installation and covering, and to maintain long-term tensile strength underground.
Cushion geotextile – Storage and handling	ERM (2024b) confirmed that the handling and storage of the Cushion Geotextile rolls was consistent with the requirements of the Technical Specification. All rolls were inspected to ensure that they were in acceptable condition prior to installation at AEC-4.
Pre-placement of cushion geotextile	The installation of the cushion geotextile layers was supervised by an ERM validation consultant throughout. The process met specific requirements, including overlapping the rolls by at least 300 mm, anchoring them progressively with sandbags, ensuring full coverage of the prepared sub-base and LLDPE liner, and being carried out by the same specialist installer as the LLDPE liner (Curtis Barrier). Detailed observations are documented in the CQA inspection field records was provided in Appendix D of ERM (2024b).
LLDPE geomembrane	The LLDPE panel layout was prepared by Curtis Barrier and provided to ERM for the purpose of assessing the suitability of the panel design. A copy was included in Appendix H of ERM (2024b). Further, a revised panel layout plan was provided to ERM by Curtis Barrier dated 18/4/2024. ERM reviewed and approved the layout drawing prior to commencement of placement on Site. The following documents were provided to ERM for the purpose of assessing the quality of the LLDPE geomembrane liner: - LLDPE product information (Appendix H of ERM [2024b]), reviewed and approved prior to order placement by EPS. - LLDPE Manufacturer Quality Assurance Testing Results (Appendix E of ERM [2024b]), reviewed and approved prior to placement of materials on Site. All laboratory certificates were NATA (or international equivalent) accredited. ERM (2024b) documented that the rolls used as in installation of the impermeable LLDPE geomembrane as follows: - A total of 50 panels and 13 separate individual rolls of Smooth Geomembrane.

Task	Discussion / validation
	- A total of 61 panels and 7 separate individual rolls of Single Sided Textured Geomembrane. Each roll was 105 m in length and 8.0 m wide. Samples of the LLDPE liner material were obtained by ERM on 30/04/24, 1/04/24 and 6/05/24 in accordance with the frequencies specified in ERM (2024a). The IQA Samples of LLDPE materials were sent to the laboratory (TRI Australasia) to verify the compliance of the geomembrane materials with the requirements of the Technical Specification.
LLDPE handling and storage	ERM verified that the storage of the LLDPE geomembrane rolls met the Technical Specification requirements. All rolls were inspected and confirmed to be in acceptable condition before installation at AEC-4.
LLDPE panel installation	The ERM (2024b) documented that them were present throughout the installation of the LLDPE geomembrane, confirming it met the Technical Specification requirements. Observations included: - The surface was inspected and cleared of indentations or defects before placing each panel. - The single-sided textured LLDPE geomembrane was installed from the inside of the anchor trench to the retaining wall, with the textured side facing the ground. - The smooth LLDPE geomembrane was placed across the top of the capped area. - Geomembrane rolls were deployed using a telehandler, with care taken to avoid damage. - Panels were overlapped by at least 75 mm before seaming. - Joins were oriented parallel to the maximum slope, minimizing joins in corners and avoiding stress concentration areas. - Sandbags secured the geomembrane layer until the overlying geotextile was installed. The ERM confirmed the installation of the LLDPE geomembrane panels in AEC-4 was consistent with the approved layout plan and Technical Specification requirements.
LLDPE anchoring	ERM (2024b) reported that the LLDPE geomembrane was installed in trenches along the perimeter drains, in contact with the inside edge and base of the anchor trench. The panels were cut to size to prevent folding, and the trenches were at least 1.2 meters wide and 0.6 meters deep. ERM confirmed the installation met design drawings and Technical Specifications, ensuring the panels remain anchored to the top of the sloped edges.
Trial Welds	ERM (2024b) documented that prior to field installation, the contractor provided passing trial welds to ensure the adequacy of equipment, technician, and conditions, as per the Technical Specification: - Trial welds for peel and shear strength were completed for both fusion and extrusion welds on LLDPE panels. - These trials were conducted every 5 hours, after delays over 1 hour, and with weather changes. - The samples were 500 mm long and 300 mm wide, cooled to ambient temperature. - Dual track fusion welds were properly marked. - Four specimens per weld: two for peel and two for shear tests. - Testing used a calibrated tensiometer, with valid certification. - All trial welds met the criteria of the Technical Specification. Trial weld logs were presented in Appendix D of ERM (2024b).
Marker layer and covering layer	ERM (2024b) documented that due to logistical constraints with subdivision works under SSD 10459, the placement of the brightly coloured geotextile marker layer specified in the Technical Specification was not completed at the time of issue of Validation Report. Further discussion and justification for this deviation is

Task	Discussion / validation
	presented in **Section 8.2**. The marker layer and clay covering material will be completed post-validation and are requirements of the Stage 2 AA4 LTEMP.

8.2 Departures from the Stage 2 RAP and Technical Specification

Some departures from the Stage 2 RAP and Technical Specification occurred during the remediation as documented in ERM (2024b) and summarised in **Table 14.**

Table 14 Deviations of the Stage 2 RAP

RAP requirement	Technical pecification description of works to meet	Works completed at validation
A permanent hardstand such as a concrete slab or asphalt pavement is recommended, along with a minimum soil cover thickness of 0.2 metres over areas with exposed impacted soil, which includes a marker layer to warn future site users of the presence of the material below the LLDPE.	Sandstone boulder retaining walls are installed along the northern extent of the capped areas. Landscaped battered slopes are present on the western, southern, and eastern extents of the capped area, necessary due to a portion of the southern slope lying within the riparian corridor for Duck River. The capped area includes a 0.3 metre cover stabilized on the slope using 'Miracell® Geocell' (or an engineer-approved alternative), with the LLDPE liner serving as a 'root guard' and planted with shallow-rooted grass species. Soils placed above the marker geotextile must meet geotechnical requirements for 'General Fill' and be certified as VENM/ENM. The marker geotextile extends above all capped contaminated material and LLDPE. A minimum soil coverage of 0.3 meter overlying the marker layer/LLDPE liner is needed to meet the RAP requirements. After validation, a heavy-duty asphalt pavement will be constructed over most of the capped area, excluding walls and landscaped batters.	Landforming and detailed earthworks within the AEC-4 capped area have finished, including the installation of shared anchor and utility trench, stormwater pits, and stormwater trenches. The capping of AEC-4 involved the application of layers of protective geotextile above and below a 2mm thick LLDPE geomembrane. This liner extends over stormwater pits, trench excavations, and shared service/utility trench, ensuring physical separation between contaminated material and workers involved in future civil works during later stages of construction.
The marker layer will be made from a bright-coloured, knitted HDPE or geofabric with a density greater than 300 g/m^2. This distinctively bright colour is designed to alert future workers conducting excavations to the conditions documented in the LTEMP before they breach this layer.	The marker layer will be made from a polypropylene or polyethylene geotextile, available in prominent yellow, orange, or red colours. It is designed for use in buried applications, with enough strength and durability to withstand installation and covering processes without significant damage, ensuring long-term tensile strength underground.	The entire AEC-4 capping area has been encapsulated with two layers of protective geotextile and an LLDPE geomembrane, ensuring physical separation between the contaminated material and workers involved in future civil works during later construction stages. To reinforce the completion of these protective measures, the installation of the marker layer and clay covering material is mandated in the Long-Term Environmental Management Plan (LTEMP).

RAP requirement	Technical pecification description of works to meet	Works completed at validation
The barrier layer capping material must meet specific criteria: it should have an in-situ saturated permeability of less than 10-9 m/s, be highly plastic without particles larger than 50 mm as confirmed by particle size distribution analysis from the source of the imported material. Additionally, it must be designed with a minimum ground surface slope of 1% to prevent water pooling during rainfall. Finally, it should be overlain by hardstand pavement and subgrade that are geotechnically suitable for vehicle traffic and use as a carpark, ensuring the integrity of the cap is maintained.	Geomembrane replaces compacted clay layer, eliminating particle size concern. Designed cap has >1% gradient for drainage to stormwater drains. Minimum 0.3m clay cover with erosion control added before pavement construction for RAP compliance. Pavement specification engineered to account for heavy vehicle traffic, despite intended light use.	Barrier layer requirements are not applicable due to the use of an LLDPE geomembrane liner. Surface gradient post-liner installation prevents water pooling and interaction with capped materials. Final landform construction, including pavements and drainage, is pending completion in the ongoing civil construction phase.
When alternative capping systems like liners or membranes are chosen, the average infiltration rates must not surpass 5% of annual rainfall, calculated as 48 mm per year.	The proposed 2 mm LLDPE geomembranes are considered impermeable, with in situ permeability rates of less than 10^-9 meters per second, resulting in calculated average infiltration rates of less than 1 mm per year.	The installed geomembrane has been validated to meet technical specifications and requirements for impermeability.

8.3 Asbestos air monitoring

ERM (2024b) reported that airborne asbestos monitoring was undertaken as per the Stage 2 RAP throughout the duration of earth works, prior to the installation of cushion geotextile.

All monitoring and analysis were conducted in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC: 3003(2005)].*

8.4 Asbestos clearance certificate

ERM (2024b) reported that an asbestos clearance for the Stage 2 AA4 was conducted on 22 April 2024. The clearance included inspection of the upper portion of the AEC-4 capped surface, drainage pit excavations and anchor trenches to provide visual confirmation of no ACM throughout the work area. No free visible asbestos was observed. The asbestos clearance certificates are presented in **Appendix C.**

8.5 Validation of imported soil

ERM (2024b) documented that VENM was imported to the Stage 2 AA4 for the landforming, and surface grading was undertaken as per the Proposed Capping Plan (CO1391906-C14). A summary of volumes and sources of material imported for use within the Stage 2 AA4 is provided **Table 15.**

Table 15 Summary of VENM classification and sources

VENM sources	Site address	VENM description	VENM mass tonne
EI Australia	149-163 Milton Street, Ashbury NSW	Clay (VENM)	None. ERM (2024b) reported that *non-conformant material was documented in the first load of source material from the Ashbury site on 26th March 2024. Foreign material and other building waste was identified within materials. The material was subsequently removed and returned to the*

VENM sources	Site address	VENM description	VENM mass tonne
			source site. No further import of material was accepted from this site.
EI Australia	9-19 Second Avenue, Eastwood NSW	Clay and Shale	1568

8.6 Waste management

ERM (2024b) reported that no waste materials were generated as part of Stage 2 AA4 remediation. Excavated materials (when available) were re-used on-site as follows:

– Asphalt was re-compacted in place within the AEC-4 footprint.

– Anchor trench, retaining wall footing material and stormwater pit spoil was utilised to build up battered slopes beneath the cap footprint.

8.7 Auditor discussion – Implementation of Stage 2 RAP for AA4

The auditor reviewed the draft version of the Validation Report, commentary on which was documented in the audit trackingsheet. Subsequently, ERM issued an amended version of the Validation Report, where the auditor considered the comments on the draft had been satisfactorily addressed. A copy of the audit documentation is presented in **Appendix B**.

The auditor considered that remedial works were completed largely in accordance with the Stage 2 RAP and supporting documentation relevant to AEC-4 including the Technical Specification Report. Departures that occurred, mostly associated with minor adjustments to the design, were discussed with the auditor during the remediation and were documented in the Validation Report.

A number of site visit were undertaken by the auditor or the auditor assistant during the remediation to inspect the stages of construction – including surface preparation, landforming, excavation of anchor trenches and foundation for the northern retaining wall and laying of the cushion layer and the LLDPE layer. The site visits are documented in **Appendix G.**

Contaminated soil and/or groundwater within the footprint of the burial area shall be managed in accordance with the Stage 2 AA4 LTEMP to allow the land to be used for commercial/industrial purposes. Permanent buildings that are to be constructed within the capped area shall follow the protocols listed in the LTEMP (which also refer to the requirements of the NSW EPA Hazardous Ground Gas Guidelines for gas protection measures).

The auditor was satisfied that the imported material information presented in the Validation Report demonstrated it was suitable for use on site.

Based on the outcomes of validation activities undertaken by ERM, the auditor considered that Stage 2 AA4 is suitable for ongoing commercial/industrial land uses subject to the implementation of a legally enforceable LTEMP.

The discussion of residual impacts (that do not pose risks to future on-site receptors) is presented in **Section 11**.

9. Evaluation of quality assurance and quality control

This section of the SAR provides an evaluation of the QA/QC procedures relevant to the validation program conducted by ERM with reference to ASC NEPM. The field and laboratory QA/QC measures presented by ERM have also been compared to the relevant requirements listed in the *Consultant Guidelines* to gauge the integrity of the data set used to validate the remedial works.

A copy of the auditor's assessment of QA/QC measures presented by ERM is provided within **Appendix D** of this SAR.

9.1 Auditor discussion – Evaluation of QA/QC

The auditor considered that an adequate level of QA/QC has been adopted by ERM in site characterisation to support the selection of the remedial approach for AEC-4. In considering the dataset, the auditor noted the following:

- Soil and groundwater samples were collected using suitable procedures, and the results of all laboratory blank / spike samples were all considered acceptable.
- While there were minor variations in field duplicate and laboratory control samples results, and omissions of some field documentation, the results were generally consistent (including comparison to previous sampling results) indicating the dataset was representative of site conditions.
- Duplicate samples (where used) were generally within acceptable RPDs. Minor RPD exceedances in soils were attributed to heterogeneity in soils. Primary laboratories provided sufficient information to conclude adequate precision of their methods.
- The auditor considered that the quality of data and their presentation were of an adequate standard to support the conclusions ERM made regarding the suitability of the site.
- The laboratory analyses have been conducted by NATA registered laboratories.
- The most recent data sets (groundwater and soil) contained CoPC concentrations that were similar to those that had been recorded in previous investigations. Ground gas sampling had been conducted on at least two separate occasions, the results of which were comparable.

Overall, the auditor considered that the dataset for the most recent site characterisation programs was sufficiently precise, accurate, representative, complete, and comparable for this audit purpose.

ERM presented sufficient data/information to demonstrate that the capping layer had been installed as per the Technical Specifications. This included field observations in relation to the preparatory earthworks, collection and testing of materials used as the cushion/protective layer and the LLDPE to confirm they had the physical characteristics outlined in the Technical Specifications and confirmation that the layers were appropriately placed and sealed/welded.

10. Stage 2 AA4 conceptual site model post remediation

Based on the outcomes of the placement of the capping layer, the validation program and the most recent results from the assessments ERM updated the CSM for the Stage 2 AA4 as per **Table 16.**

Table 16 Conceptual Site Model – Post remediation

<table>
<tr><th rowspan="2">Identified CoPC</th><th colspan="2">Potentially complete SPR linkages</th></tr>
<tr><th>Human Health</th><th>Ecological</th></tr>
<tr><td><u>SOIL</u>
- LNAPL – visual evidence in unsaturated soils
- TRH C_6-C_{10}
- Benzene
- Asbestos (ACM and fibres within fill)
- Metals (hexavalent chromium)
- Carcinogenic PAHs
- PFAS</td><td><u>SOIL</u>
No potential complete SPR linkage to human health receptors via exposure to CoPCs in soil as follows:
- <u>Indoor inhalation of vapours</u>: Pathway within AEC-4 footprint is limited via LTEMP controls on the design and construction of future buildings with appropriate gas/vapour mitigation.
- <u>Inhalation of dusts or potential asbestos fibres</u>: Pathway mitigated through administrative controls such as work permits, PPE and airborne asbestos monitoring which is to be outlined within the Contractor's Asbestos Management Plan (AMP) to include in the LTEMP.
- <u>Direct contact or ingestion of impacted soils</u>: Pathway mitigated through administrative controls such as work permits, PPE and management controls, which are to be outlined within the Contractor's Occupational Health and Safety Plans and Work Method Statements. Future exposure will be mitigated via restriction of excavation works below a marker layer under the LTEMP.
- <u>Potential for staining and/or odours</u>: The potential for generation of odours and aesthetic impacts from residual TRH impacts outside of the AEC-4 capped extent require consideration within the LTEMP.</td><td><u>SOIL</u>
No potentially complete SPR linkages via soil to ecological receptors identified (limited to off-site - Duck River).</td></tr>
<tr><td><u>GROUNDWATER</u>
- LNAPL (within AEC-4)
- PAHs
- PFAS (PFOS)</td><td><u>GROUNDWATER</u>
No potentially complete SPR linkages were identified for on-site or off-site human health receptors via groundwater exposure under the current and proposed commercial / industrial land-use.</td><td><u>GROUNDWATER</u>
Incomplete exposure pathways for historical exceedances of off-site groundwater criterion:
- <u>PAHs</u> exceeding relevant ecological criteria in groundwater have been identified within the AEC-4 buried waste mound only. However, the extent of the contamination was laterally delineated to below assessment criteria within the Stage 2 AA4 boundary.
- <u>PFAS </u>(including PFOS) exceeding relevant ecological direct toxicity criteria in wells downgradient of AEC-4 are considered consistent with the magnitude of concentrations assessed via mass flux estimates of groundwater at the site boundary for other areas of Stage 2 (ERM, 2018). The report concluded:
o potential direct toxicity risks to offsite receptors were unlikely considering low mass contribution and overall volume of receiving water body.
o Indirect human exposure via consumption of PFAS containing seafood unlikely given existing fishing bans and the volume of untreated stormwater that would discharge into the Duck River from numerous other sources.
Offsite assessment of bio accumulative effects of PFAS in waterways are unlikely to provide meaningful input into site based PFAS management given magnitude of other off-site contributions to these systems.</td></tr>
<tr><td><u>GROUND GASES</u>
- Methane</td><td><u>GROUND GASES</u>
<u>No potential exposure pathways for receptors given a well-ventilated open-air environment and the presence of the LLDPE layer. </u>The LTEMP details controls and management measures to ensure its long term integrity as well as protocols should buildings be constructed. Future monitoring is proposed within the LTEMP to monitor and manage potential for accumulation of ground gas from within AEC-4.
<u>Potential for lateral migration of bulk ground gases is unlikely</u>: from AEC-4 to off-site receptors at present and in the future given the presence of the Duck River down gradient (south) and drainage channel to the west of the AEC-4 buried waste area. These features provide barriers to the off-site lateral migration of ground gas/ vapours via restriction of flow and pore space below the ground surface.</td><td><u>GROUND GASES</u>
No potentially complete SPR linkages via soil to ecological receptors identified (limited to off-site - Duck River).</td></tr>
</table>

10.1 Auditor discussion – Conceptual site model - Post remediation

It is the auditor's opinion that the refined CSM developed by ERM considered site specific attributes (including the site geology, groundwater behaviour and soil and groundwater data), the final capped condition of the area and was largely prepared in accordance with the relevant guidelines and presented sufficient information to assess potential risks within the Stage 2 AA4.

The auditor considered that sufficient data had been gathered in GMEs conducted over the past two decades (refer to **Table 3**) to demonstrate that hydrocarbon impacts to groundwater quality are either localised and have demonstrated little migration potential or are at levels that do not pose an unacceptable risk to human health or the off-site environment (noting that there are no environmental receptors on-site).

Soil within the buried area is known to be contaminated and there are also hydrocarbon saturated soils and LNAPL. Soil will not be accessible to site users and the ground gas monitoring has not demonstrated widespread presence of hazardous ground gases that require specific management. Notwithstanding, the construction of the cap has taken into consideration the need to mitigate vapour intrusion into areas such as service pits and the LTEMP provides steps that are to be implemented to avoid exposure to soil, groundwater and ground gases. The CSM appropriately considered these factors in not identifying any unacceptable risks to site users.

11. Stage 2 AA4 Long Term Environmental Management Plan

Upon completion of the remediation and validation works, management of contamination is required, both within the constructed capped area (i.e., AEC-4) and in areas beyond the cap within the Stage 2 AA4 (proposed Lot 64). ERM developed the Stage 2 AA4 LTEMP to detail the necessary environmental management procedures and controls for the future use of the Stage 2 AA4. Essentially, the Stage 2 AA4 LTEMP outlines passive mitigation measures to maintain exposure controls to human health and the environment as well as monitoring requirements. Notably, ERM (2024c) states that:

"*all work related to excavation, movement, handling, importation and placement of fill and soil materials and / or groundwater within the site should be carried out in accordance with this LTEMP and in compliance with relevant legislation*".

11.1 Objectives

ERM (2024c) summarised the nature and extent of residual contamination following remedial works and stated that the objectives of the Stage 2 AA4 LTEMP were to:

– Specify methodologies and protocols to prevent and/or mitigate potential negative impacts on human health and the environment associated with residual contamination in soil.
– Provide approaches for the proper environmental management of future construction activities that could encounter residual contaminated soil and groundwater, including specifications for reinstating the capping layer.
– Detail ongoing monitoring requirements for groundwater and hazardous ground gases (until cessation of monitoring is possible).
– Outline limitations on potential future land uses of Stage 2 AA4.

11.2 Description of residual contamination following remedial works

Implementation of the capping and containment remediation strategy means that contaminated material remains on-site in a secure and inaccessible manner. ERM (2024c) stated therefore that risks to human health and the environment following remedial works are low and acceptable based on the proposed land use. Residual contaminated material beneath the cap comprises:

– Soils with asbestos (friable and bonded), PAH, Chromium VI, petroleum hydrocarbons and LNAPL/sludge within soils and groundwater (very low to non-mobile).

11.3 Management activities

ERM (2024c) reported the following key management controls are required:

– Non-intrusive works – No management controls
– Temporary periodic monitoring of the capping layer, groundwater and hazardous ground gases.
– Monitoring of the integrity of the capping layer is necessary to verify its ongoing effectiveness in acting as a physical barrier, preventing subsurface residual soil contamination and minimising the risk of surface water infiltration. Moreover, while groundwater contamination

has been demonstrated to be stable, ongoing monitoring of groundwater conditions is necessary to ensure that contamination does not migrate off-site at concentrations that can pose risks to human health or the environment.

– Intrusive excavation works that could potentially affect the capping layer – Implementation of environmental management controls as detailed in the Stage 2 AA4 LTEMP for works including intrusive operations, excavation of fill and natural soil materials to facilitate removal, realignment or construction of any subsurface infrastructure near the boundary of the capping layer; maintenance and/or upgrade of site utility services; temporary stockpiling of excavated material resulting from on-site intrusive works; and off-site disposal of any contaminated soil and/or groundwater waste.

In addition, ERM (2024c) provided guidance for various environmental management activities which include:

– Training, health and safety.
– Environmental monitoring.
– Task specific works plans, including management of excavated materials, stockpiling, handling and disposal, as well as import of fill material and excavation reinstatements.
– Sediment and stormwater run-off controls.
– Management of unexpected finds.
– Biodiversity management measures.
– Contingency measures to identify unexpected situations and outline procedures to manage them effectively to prevent or minimise adverse impacts on human health and the environment.

11.4 Monitoring and review of LTEMP

ERM (2024c) provided details on inspection, reporting and review requirements including:

– Final landform within the AEC-4 inspections and tests
– Capping inspections.
– Post construction gas monitoring event.
– Groundwater monitoring reports.
– Material classification reports.
– Non-conformance reporting.
– LTEMP review and record keeping

ERM (2024c) documented that following installation of the LLDPE to meet remediation requirements for the capped area, the following requirements shall be implemented:

– Material and construction
  - Placement of an additional 300 mm layer of material suitable to construct a trafficable surface. If imported fill is required only construction materials or certified ENM or VENM materials are to be imported for use.
– Inspection and testing
  - To be conducted by the Geotechnical Consultant under Full Time (Level 1) Supervision to meet compaction requirements as per Pavement Design.
  - Engineered fill materials are also subject to the documentation, testing and inspection requirements specified within Section 5.5.3 of the Technical Specification (ERM, 2024a).

- Survey of the final finished surface is to be undertaken by the contractor and subject to final inspection by the Validation Consultant to verify that a minimum slope of 1% is maintained, such that stormwater runoff will not pool on the finished capped area.

11.5 Communications and notifications

ERM (2024c) provided details regarding the implementation of the LTEMP, along with a list of key stakeholders, their respective roles and responsibilities. The identified stakeholders comprised the landowner, the auditor, and qualified environmental specialists. The LTEMP provides guidance on communication and notification protocols among these stakeholders. Notably, ERM stated that the LTEMP should be recognised in future management plans prepared for any intrusive investigations. In cases of minor intrusive operations, a safe work method statement may be sufficient, while larger development and construction projects may require a Construction Environmental Management Plan (CEMP).

11.6 Enforceability and public notification

All long-term management requirements are legally enforceable via conditions B10(a) and (b) of the Development Consent SSD No. 9302, issued under Section 4.38 of the Environmental Planning and Assessment Act 1979 – as outlined below:

B10. Upon completion of the Site Audit Statement and Site Audit Report, the Applicant must: (a) Implement the approved LTEMP (b) Provide evidence to the Planning Secretary that the LTEMP is listed on the relevant planning certificate for the land, issued under section 10.7 of the EP&A Act.

Additionally, as required by condition B10 (b) of the Development Consent, Parramatta Council has been requested to add a notation to the planning certificate for the Stage 2 AA4 under section 10.7(5) of the EP&A Act that the property is subject to the Stage 2 AA4 LTEMP.

11.7 Auditor discussion – Stage 2 AA4 LTEMP

The auditor noted that the Stage 2 AA4 LTEMP appropriately identified the residual contamination and provided an adequate description of the objectives, scope of works, roles and responsibilities of parties involved in the implementation and management of the Stage 2 AA4 LTEMP.

The Stage 2 AA4 LTEMP is applicable to commercial/industrial purposes. Groundwater extraction within the Stage 2 AA4 is prohibited and potential future beneficial reuses of groundwater are not addressed within the LTEMP. Should there be any deviations in land use from the commercial/industrial setting outlined in the Stage 2 AA4 LTEMP, including the construction of basement infrastructure, a review and update of the Stage 2 AA4 LTEMP will be necessary. A copy of the Stage 2 AA4 LTEMP prepared by ERM is presented in **Appendix E**

Section 3.4.6 of the *Auditor guidelines* requires the following conditions to be met for an EMP to be accepted by an auditor as a means of managing site contamination:

a) *The EMP has been reviewed by the auditor*

   Yes. The Stage 2 AA4 LTEMP has been reviewed by the auditor. The auditor considered that the LTEMP had been prepared in a manner consistent with relevant NSW EPA made or approved guidelines.

b) *The EMP can reasonably be made to be legally enforceable, for example because compliance with it is a requirement of a notice under the CLM Act or of development consent conditions issued by the relevant consent authority*

Yes. The Stage 2 AA4 LTEMP is legally enforceable through condition B10(a) of SSD 9302, which states that "*Upon completion of the Site Audit Statement and Site Audit Report, the Applicant must: (a) Implement the approved LTEMP*".

c) *There will be appropriate public notification of any restrictions applying to the land to ensure that potential purchasers or other interested individuals are aware of the restrictions, for example appropriate notations on a planning certificate issued under s.149(2) of the Environmental Planning and Assessment Act or a covenant registered on the title to land under s.88B of the Conveyancing Act 1919.*

Yes. The Stage 2 AA4 LTEMP will be noted on the planning certificate under section 10.7 of the EP&A Act. The auditor informed Parramatta Council that notation needed to be made on the Section 10.7. A copy of Council's response (along with that provided by the NSW EPA) is presented in Appendix   of this report.

d) *There is no off-site migration of contamination from the site which is the subject of the site audit, or where there is off-site migration or its potential, that contamination within the site is managed or monitored so it does not present an unacceptable risk to either the on-site or off-site environments*

Based on the data presented in the Stage 2 AA4 Validation report (ERM, 2024a) and groundwater results (ERM, 2023c), the auditor agreed with ERM's conclusions that there was no evidence of off-site migration of contamination from the Stage 2 AA4 that could constitute an unacceptable risk to off-site receptors. Based on the refined CSM post-remediation prepared by ERM (ERM, 2024), the potential risks associated with the residual impacts are low and acceptable for either human (commercial/industrial) and ecological (Duck River) receptors.

12. Other considerations

12.1 Ecological considerations

Based on the historical reports, the off-site migration of residual LNAPL in groundwater or dissolved phase petroleum hydrocarbons has not been demonstrated to be at levels that could potentially cause risk to the identified environmental/ecological receptors. As previously discussed in the PFAS CSM and mass flux assessment prepared by ERM, testing for PFAS from soil leachate and groundwater in the WARP had demonstrated that PFAS in groundwater does not represent an unacceptable risk to on- and off-site receptors.

12.2 Aesthetic impacts

Given that AEC-4 is covered with a layer comprising LLDPE and there is no exposed soils, there are no aesthetic impacts. Additionally, there is a LTEMP prepared for the site..

12.3 Chemical mixtures

ERM did not specifically examine potential additive or synergistic effects of chemical mixtures in the Stage 2 AA4 Validation report. However, due to the types of CoPC identified in soil and groundwater within the buried waste in AEC-4, chemical mixtures are not considered to be relevant to the site.

12.4 Potential migration

Previous groundwater investigations had demonstrated that there was very limited to migration of CoPC from the WARP to the nearest receptor (Duck River).

The findings of the GME undertaken in November 2023 (ERM, 2024a) at AEC-4 and the immediate surrounding area demonstrated there was no potential off-site migration from Stage 2 AA4 to the nearest off-site ecological receptor (Duck River). This was consistent with previous GMEs conducted in AEC-4.

12.5 Auditor discussion – Other considerations

Ecological considerations – The proposed land use is commercial / industrial, and the Stage 2 AA4 will be hardstand covered. Therefore, it would not be expected that the presence or protection of on-site ecological receptors would be relevant at such facilities. The riparian zone is located more than 30 metres from the Stage 2 AA4 boundary. During numerous site visits undertaken since 2018 (the site visits are documented in **Appendix G**), the off-site vegetation did not show signs of stress such as yellowish leaves, dead trees etc.

Aesthetic considerations – Aesthetic impacts should not be encountered during routine use of Stage 2 AA4 unless the capping is damaged. The LTEMP outlines protocols that should be implemented if the capping is breached.

Chemical mixtures – The auditor did not consider that chemical mixtures were an issue for Stage 2 AA4.

Potential contamination migration – In relation to the potential off-site migration of contaminants, ERM reported groundwater concentrations of CoPC within adopted trigger levels for ecological receptors at wells down-gradient of Stage 2 AA4 and adjacent to the Duck River.

13. Compliance with regulatory requirements

In evaluating the adequacy of the remedial and validation works and whether the site is suitable for commercial/industrial land use, the decision-making process for assessing urban redevelopment sites (Appendix A of the *Auditor Guidelines*) has been followed. In using this process, the auditor has considered the information presented earlier in the SAR. **Table 17** presents this assessment.

Table 17 Decision making process for assessing urban redevelopment sites

EPA's requirements	Auditor 's comments
All site assessment, remediation and validation reports follow the applicable guidelines.	The Stage 2 AA4 Validation report, as well as all other reports listed in **Sections 1.6** and **1.7** contained the key elements required by the *Consultant Guidelines* for such reports. All reports have been reviewed by the auditor as part of this audit as documented in the audit trackingsheet and/or IAAs. The audited documentation is presented in **Appendix B**.
Any aesthetic issues relating to soils have been adequately addressed.	The auditor noted that residual contaminated soils, if encountered, could have a hydrocarbon odour. However, exposure to odorous soils would only occur if the cap was breached which will not occur under general use of the site. Any intrusive works are to be implemented as per the requirements of the LTEMP.
Soils have been assessed against health-based investigation levels and potential migration of contamination from soils to groundwater has been considered.	Soil sampling data was compared to validation criteria (based on NSW EPA endorsed guideline values or SSTLs derived as part of the HHERA) or ASC NEPM Management Limits.
Groundwater (where relevant) has been assessed against health-based investigation levels and, if required, any potential impacts to buildings and structures from the presence of contaminants considered.	A baseline groundwater monitoring was undertaken in November 2023 as required by Condition of Consent B22 (SSD9302). The data from the GME indicated that the remedial activities neither influenced the groundwater quality nor promoted LNAPL mobilisation. Additionally, groundwater is not potable given the salinity and there is not likely to be any beneficial use of groundwater.
Hazard ground gases (where relevant) have been assessed against relevant health-based investigation levels and screening values.	Hazardous ground gases associated with hydrocarbon contamination were assessed as part of the remedial planning and execution (ERM, 2023a). Given one CSV 4 within the capping area, as a precaution, additional soi vapour sampling within the pits surrounding the capped area will be completed as per the Stage 2 AA4 LTEMP.
Any issues relating to local area background soil concentrations that exceed relevant investigation levels have been adequately addressed in the site assessment reports.	Not applicable.
The impacts of chemical mixtures have been assessed.	Risks associated with chemical mixtures were not explicitly commented upon by ERM. However, due to the types of CoPC identified in soil and groundwater within the buried waste in AEC-4, chemical mixtures are not considered to be relevant to the site.
Any potential ecological risks have been assessed.	Ecological risks had previously been evaluated in the groundwater monitoring programs that had been completed leading up to the remedial works. No ecological risks were identified to the key receptor, Duck River to the south of the WARP.

EPA's requirements	Auditor 's comments
Any evidence of, or potential for, migration of contaminants from the site has been appropriately addressed, including potential risks to off-site receptors, and reported to the site owner or occupier.	The potential migration of contaminants has been assessed (principally via groundwater monitoring) and the risks of exposure deemed to be low and acceptable.
The site management strategy (where relevant) is appropriate including post-remediation environmental plans.	Site management protocols were presented and discussed in **Section 11** of this SAR. The auditor considered that the LTEMP is suitable for the proposed industrial/commercial land uses and that there is appropriate public notification and legal enforceability.

14. Audit conclusions

14.1 Consultant conclusions

The following conclusions were presented by ERM in the Stage 2 AA4 Validation report:

Following completion of capping works summarised within this Validation Report, it is considered that the completed works have met the objectives of the Stage 2 RAP, and therefore conditions relating to

completion of remediation under SSD 9302 have been met.

The proposed Lot 64, (which includes AEC-4) is suitable for ongoing Commercial Industrial Land-use subject to the implementation of a legally enforceable LTEMP.

14.2 Auditor conclusions

Remediation of AEC-4 was necessary to address the presence of soil (and groundwater) contamination that could present an unacceptable exposure risk to site users. The capping approach to remediate the Stage 2 AA4 prevents (subject to implementation of the LTEMP) exposure to the contamination.

It is the auditor's opinion that based on the remedial and validation results discussed in this SAR, the Stage 2 AA4 is suitable for commercial/industrial land uses subject to implementation of the Stage 2 AA4 LTEMP. A copy of the Stage 2 AA4 LTEMP is presented in **Appendix E**. The auditor notes that as discussed in this SAR permanent buildings shall only be constructed above the capping area as per the protocols outlined in the LTEMP.

The Stage 2 AA4 LTEMP is considered to have been prepared in a manner consistent with NSW EPA made or endorsed guidelines. The auditor confirms that the four key requirements of an EMP (as listed in Section 3.4.6 of the *Auditor Guidelines*) have been met. This SAR also confirms, as required by condition B7 of the Development Consent, that:

– the remedial works approved under the Development Consent have been completed in accordance with the remediation objectives listed in the Stage 2 RAP; and
– potential risks to human health and the environment have been addressed in accordance with the objectives of the Stage 2 RAP.

15. Disclaimer

This SAR and accompanying SAS have been prepared in accordance with relevant provisions of the Contaminated Land Management Act 1997.

This Report:

– Has been prepared the auditor and his support team as indicated in the appropriate sections of this SAR (“GHD”) for Viva Energy.
– May be used and relied on by Viva Energy.
– May be used by and provided to the NSW EPA and the relevant planning authority for the purpose of meeting statutory obligations in accordance with the relevant sections of the.
– May be provided to other third parties but such third parties use of or reliance on the SAR is at their sole risk, as this SAR must not be relied on by any person other than those listed above without the prior written consent of GHD.
– May only be used for the purpose as stated in **Section 1.4** of the SAR (and must not be used for any other purpose).

GHD and its servants, employees and officers (including the auditor) otherwise expressly disclaim responsibility to any person other than Viva Energy arising from or in co4nection with this SAR.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the SAR are excluded unless they are expressly stated to apply in this Report.

The services undertaken by the auditor, his team and GHD in connection with preparing this SAR:

– Were undertaken in accordance with current profession practice and by reference to relevant guidelines made or approved by the NSW EPA.
– The opinions, conclusions and any recommendations in this SAR are based on assumptions made by the auditor, his team and GHD when undertaking services and preparing the SAR (“Assumptions”), as specified throughout this SAR.
– GHD and the auditor expressly disclaim responsibility for any error in, or omission from, this SAR arising from or in connection with any of the Assumptions being incorrect.
– Subject to the paragraphs in this section of the SAR, the opinions, conclusions and any recommendations in this SAR are based on conditions encountered and information reviewed at the time of preparation of this SAR and are relevant until relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this SAR arising from or in connection with those opinions, conclusions and any recommendations.

The auditor and GHD have prepared this SAR on the basis of information provided by Viva Energy and others who provided information to GHD (including Government authorities), which the auditor and GHD have not independently verified or checked (“Unverified Information”) beyond the agreed scope of work.

The auditor and GHD expressly disclaim responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the SAR, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

This SAR and SAS should be read in full, and no excerpts are taken to be representative of the findings of this SAR.

The opinions, conclusions and any recommendations in this SAR are based on information obtained from, and testing (if undertaken as specified in this SAR) undertaken at or in connection with previous reports.

Although reasonable care has been used to assess the extent to which the data collected from site is representative of the overall site condition and its beneficial uses, investigations undertaken in respect of this SAR are constrained by the particular conditions as discussed in this SAR.

Site conditions may change after the date of this SAR. The auditor and GHD expressly disclaim responsibility:

- Arising from, or in connection with, any change to the site conditions.
- To update this SAR if the site conditions change.

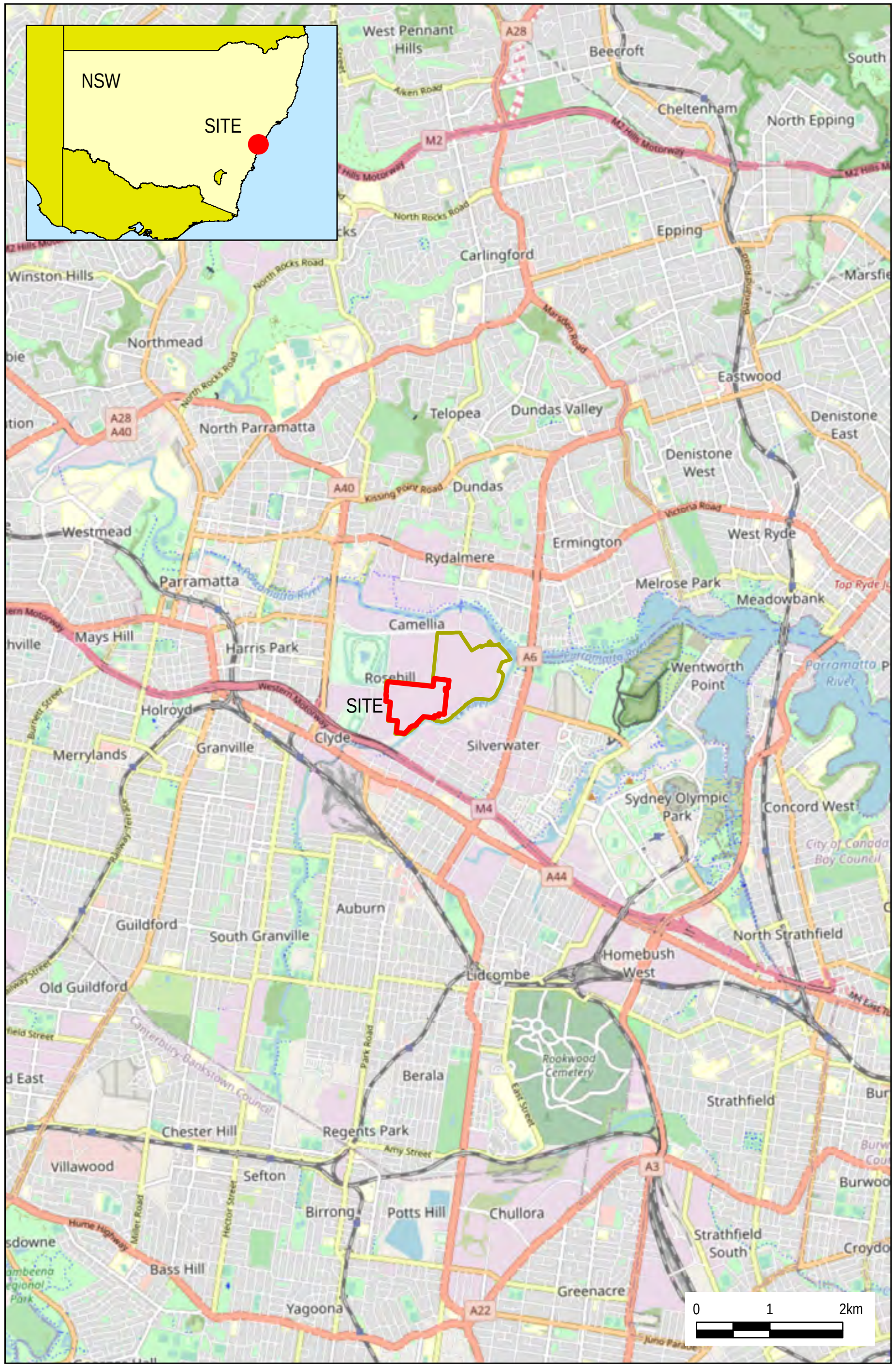
These Disclaimers should be read in conjunction with the entire SAR and no excerpts are taken to be representative of the findings of this SAR.

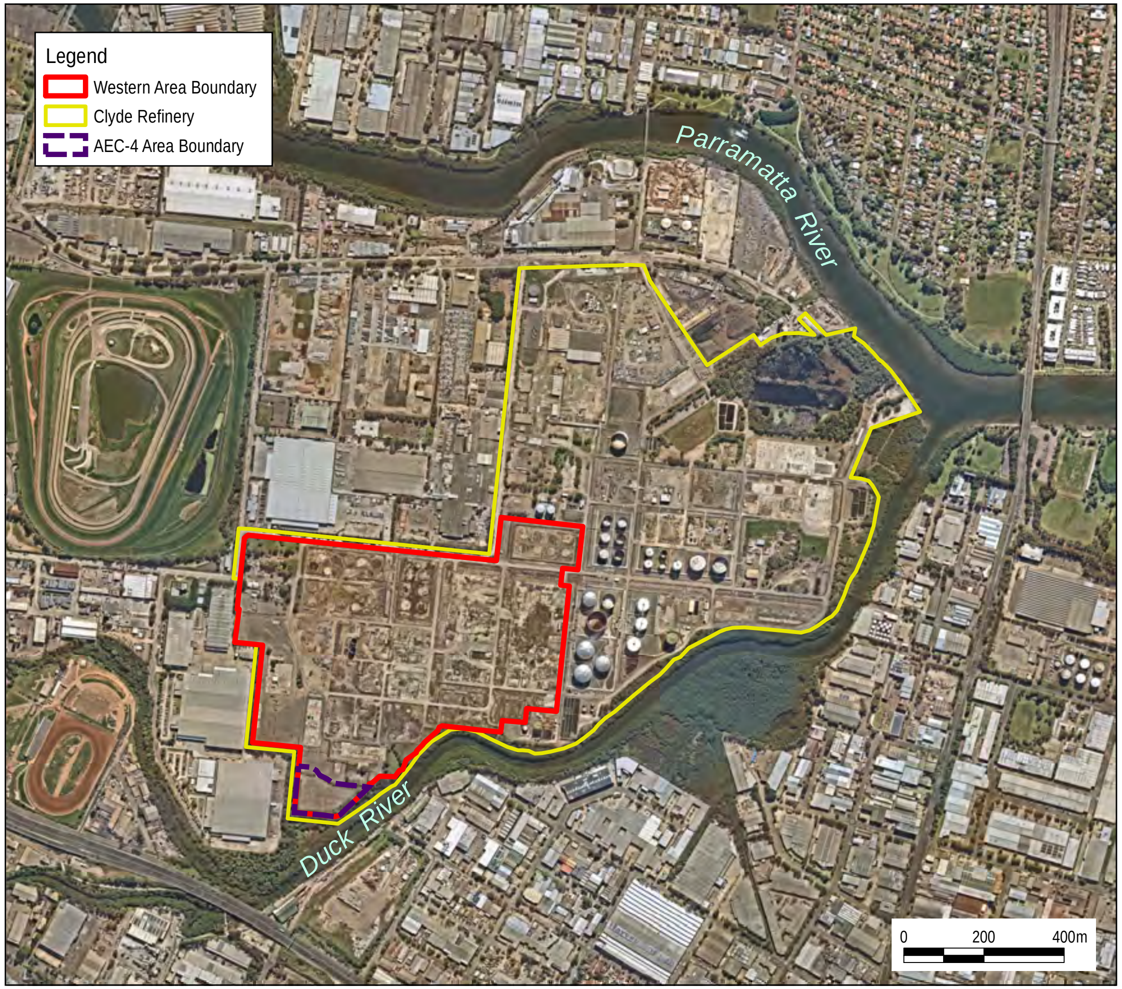
Appendices

Appendix A

Figures

Appendix A-1 Figures from the AEC-4 Supplementary Assessment





General Area Land Use:
Industrial
General Hydrogeology of Locality:
1. Soil Type:
Residual clay with minor silt and sand
2. Depth to aquifer:
0.5-2.5m bgs

Aquifer Usage:
Not known beneficial onsite extraction
Potentially Sensitive Receptors:
- Parramatta River (north eastern boundary)
- Duck River (southern boundary)

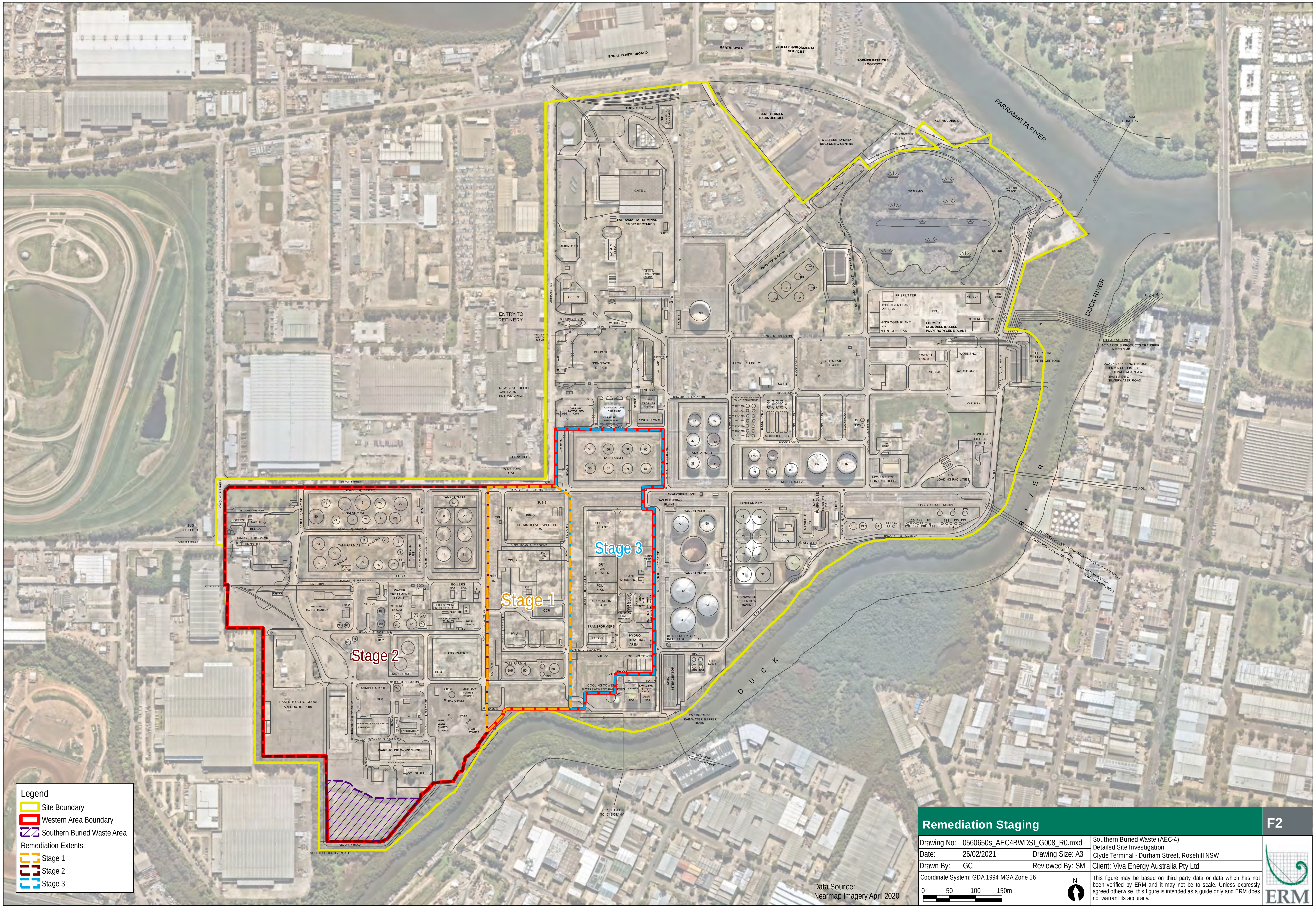
Source:
Nearmap Imagery April 2020
Locality: Esri, OpenStreetMap 2019

Site Location

F1

Drawing No: 0560650s_AEC4BWDSI_G001_R0.mxd		Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date: 28/08/2020	Drawing Size: A4	
Drawn By: KV	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Remediation Staging

F2

Drawing No:	0560650s_AEC4BWDSI_G008_R0.mxd		
Date:	26/02/2021	Drawing Size:	A3
Drawn By:	GC	Reviewed By:	SM

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

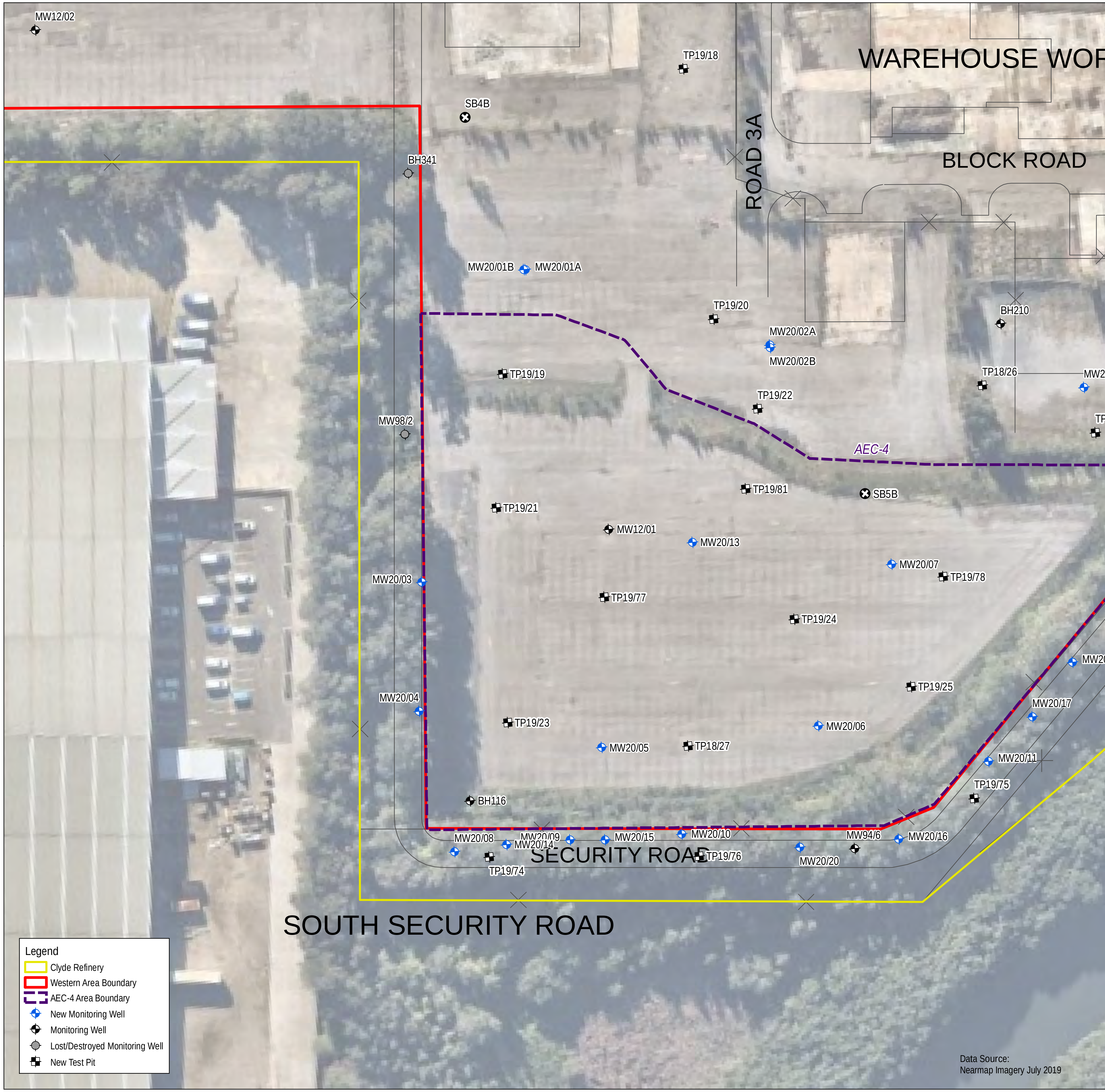
Southern Buried Waste (AEC-4)
Detailed Site Investigation
Clyde Terminal - Durham Street, Rosehill NSW

Client: Viva Energy Australia Pty Ltd

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM


WAREHOUSE WORK SHOPS
BLOCK ROAD
ROAD 3A
AMENITIES
AEC-4
Asphalt Sealed
Mounded Area
SECURITY ROAD
SOUTH SECURITY ROAD
DUCK RIVER
Legend
Site Boundary
Western Area Boundary
AEC-4 Area Boundary
Topographic Contours (0.1m interval)
Unsealed Stormwater Channel
Data Source:
Nearmap Imagery July 2019
Site Features
F3
Drawing No: 0560650s_AEC4BWDSI_G002_R0.mxd
Date: 26/02/2021
Drawing Size: A3
Drawn By: GC
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 10 20 30m
N
Southern Buried Waste (AEC-4)
Detailed Site Investigation
Clyde Terminal - Durham Street, Rosehill NSW
Client: Viva Energy Australia Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

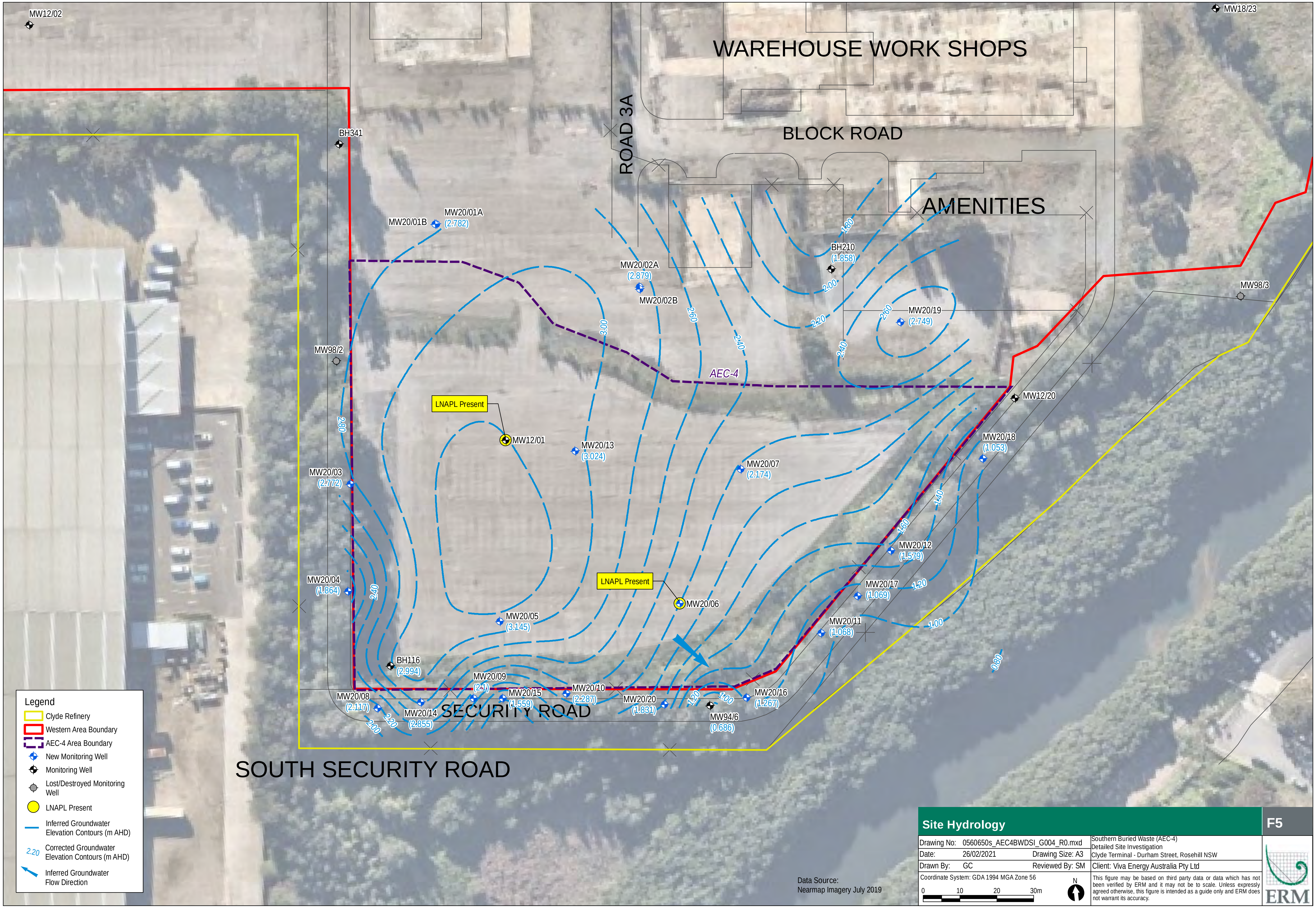


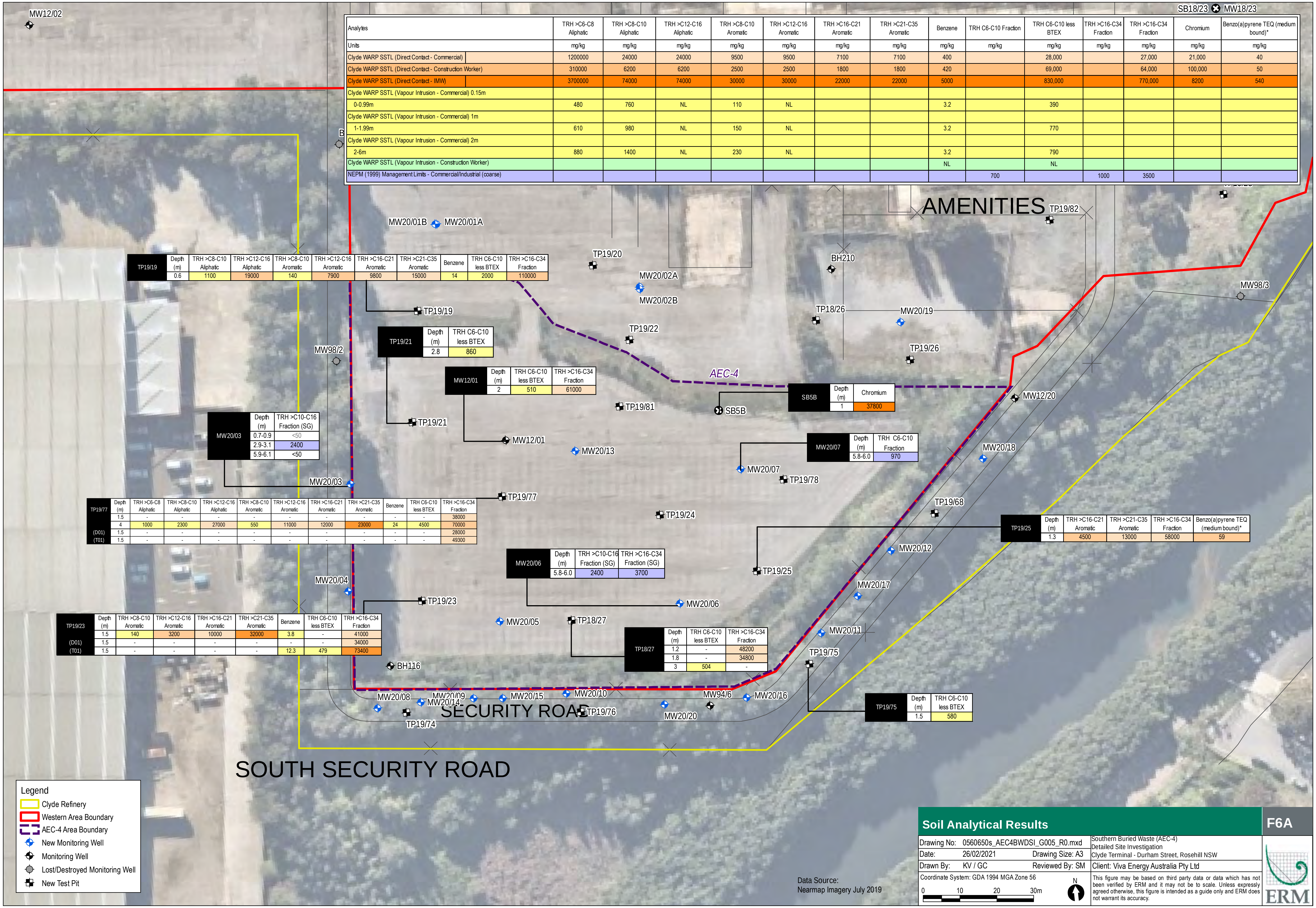
Investigation Locations F4

Drawing No:	0560650s_AEC4BWDSI_G003_R0.mxd		Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date:	26/02/2021	Drawing Size: A3	
Drawn By:	GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM


WAREHOUSE WORK SHOPS
BLOCK ROAD
ROAD 3A
AMENITIES
SECURITY ROAD
SOUTH SECURITY ROAD
AEC-4
MW12/02
MW18/23
BH341
MW20/01B
MW20/01A (2.782)
MW20/02A (2.879)
MW20/02B
BH210 (1.858)
MW20/19 (2.749)
MW98/3
MW98/2
MW12/20
LNAPL Present
MW12/01
MW20/13 (3.024)
MW20/07 (2.174)
MW20/18 (1.053)
MW20/03 (2.772)
MW20/12 (1.579)
MW20/04 (1.864)
LNAPL Present
MW20/06
MW20/17 (1.069)
MW20/05 (3.145)
MW20/11 (1.068)
BH116 (2.994)
MW20/09 (2.1)
MW20/08 (2.117)
MW20/15 (1.559)
MW20/10 (2.287)
MW20/16 (1.267)
MW20/14 (2.855)
MW20/20 (1.831)
MW94/6 (0.686)
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
Legend
Clyde Refinery
Western Area Boundary
AEC-4 Area Boundary
New Monitoring Well
Monitoring Well
Lost/Destroyed Monitoring Well
LNAPL Present
Inferred Groundwater Elevation Contours (m AHD)
2.20 Corrected Groundwater Elevation Contours (m AHD)
Inferred Groundwater Flow Direction
Data Source:
Nearmap Imagery July 2019
Site Hydrology
F5
Drawing No: 0560650s_AEC4BWDSI_G004_R0.mxd
Date: 26/02/2021
Drawing Size: A3
Drawn By: GC
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 10 20 30m
N
Southern Buried Waste (AEC-4)
Detailed Site Investigation
Clyde Terminal - Durham Street, Rosehill NSW
Client: Viva Energy Australia Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Analytes	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction	TRH >C16-C34 Fraction	Chromium	Benzo(a)pyrene TEQ (medium bound)*
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	9500	9500	7100	7100	400		28,000		27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420		69,000		64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000		830,000		770,000	8200	540
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m														
0-0.99m	480	760	NL	110	NL			3.2		390				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m														
1-1.99m	610	980	NL	150	NL			3.2		770				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m														
2-6m	880	1400	NL	230	NL			3.2		790				
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)								NL		NL				
NEPM (1999) Management Limits - Commercial/Industrial (coarse)									700		1000	3500		

TP19/19	Depth (m)	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	0.6	1100	19000	140	7900	9800	15000	14	2000	110000

TP19/21	Depth (m)	TRH C6-C10 less BTEX
	2.8	860

MW12/01	Depth (m)	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	2	510	61000

SB5B	Depth (m)	Chromium
	1	37800

MW20/03	Depth (m)	TRH >C10-C16 Fraction (SG)
	0.7-0.9	<50
	2.9-3.1	2400
	5.9-6.1	<50

MW20/07	Depth (m)	TRH C6-C10 Fraction
	5.8-6.0	970

TP19/77	Depth (m)	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.5	-	-	-	-	-	-	-	-	-	38000
	4	1000	2300	27000	550	11000	12000	23000	24	4500	70000
(D01)	1.5	-	-	-	-	-	-	-	-	-	28000
(T01)	1.5	-	-	-	-	-	-	-	-	-	49300

TP19/25	Depth (m)	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	TRH >C16-C34 Fraction	Benzo(a)pyrene TEQ (medium bound)*
	1.3	4500	13000	58000	59

MW20/06	Depth (m)	TRH >C10-C16 Fraction (SG)	TRH >C16-C34 Fraction (SG)
	5.8-6.0	2400	3700

TP19/23	Depth (m)	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.5	140	3200	10000	32000	3.8	-	41000
(D01)	1.5	-	-	-	-	-	-	34000
(T01)	1.5	-	-	-	-	12.3	479	73400

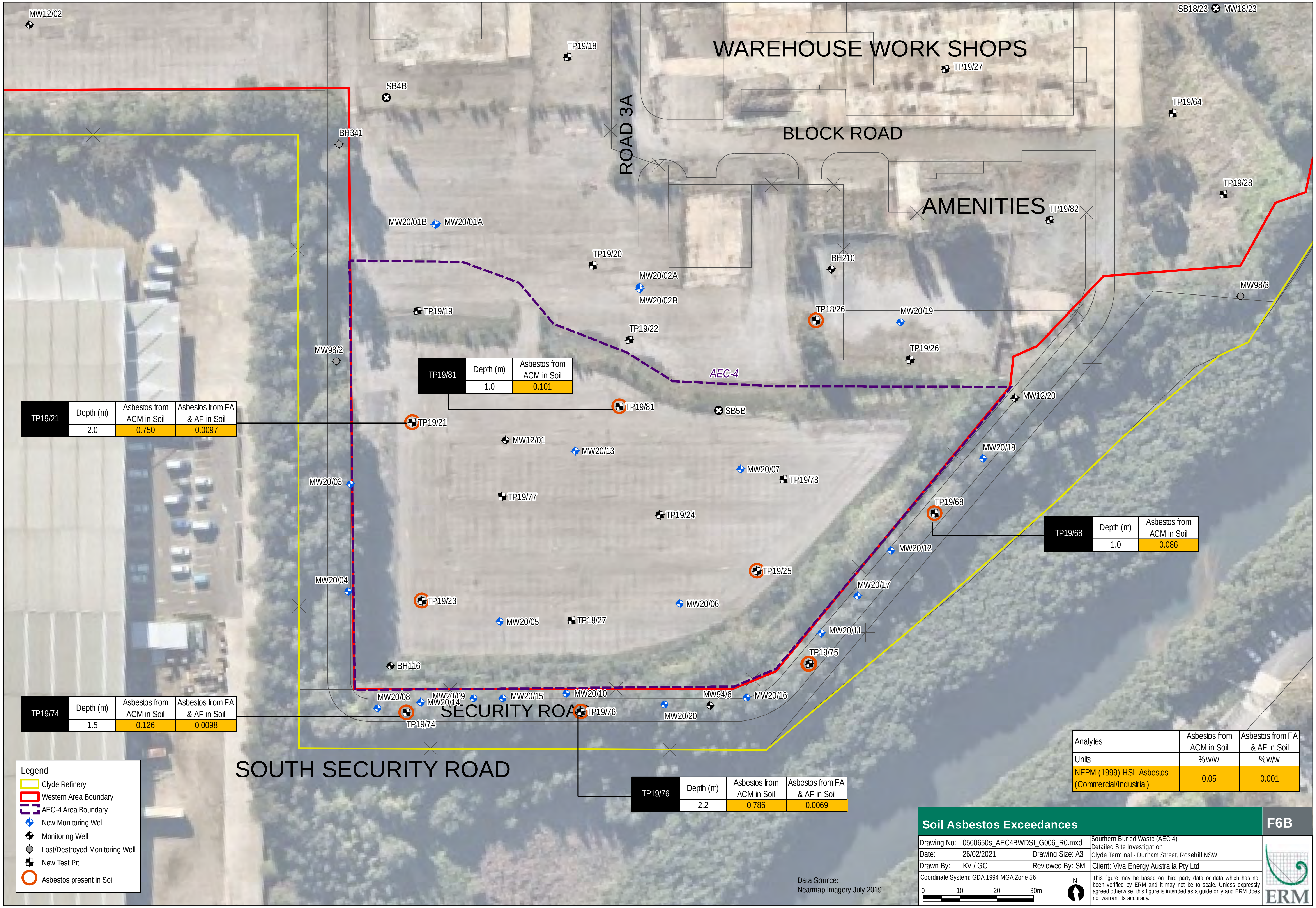
TP18/27	Depth (m)	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.2	-	48200
	1.8	-	34800
	3	504	-

TP19/75	Depth (m)	TRH C6-C10 less BTEX
	1.5	580

Soil Analytical Results

F6A

Drawing No: 0560650s_AEC4BWDSI_G005_R0.mxd	Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date: 26/02/2021 Drawing Size: A3	
Drawn By: KV / GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



TP19/81	Depth (m)	Asbestos from ACM in Soil
	1.0	0.101

TP19/21	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	2.0	0.750	0.0097

TP19/68	Depth (m)	Asbestos from ACM in Soil
	1.0	0.086

TP19/74	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	1.5	0.126	0.0098

TP19/76	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	2.2	0.786	0.0069

Analytes	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
Units	%w/w	%w/w
NEPM (1999) HSL Asbestos (Commercial/Industrial)	0.05	0.001

Soil Asbestos Exceedances

F6B

Drawing No:	0560650s_AEC4BWDSI_G006_R0.mxd		Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date:	26/02/2021	Drawing Size: A3	
Drawn By:	KV / GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

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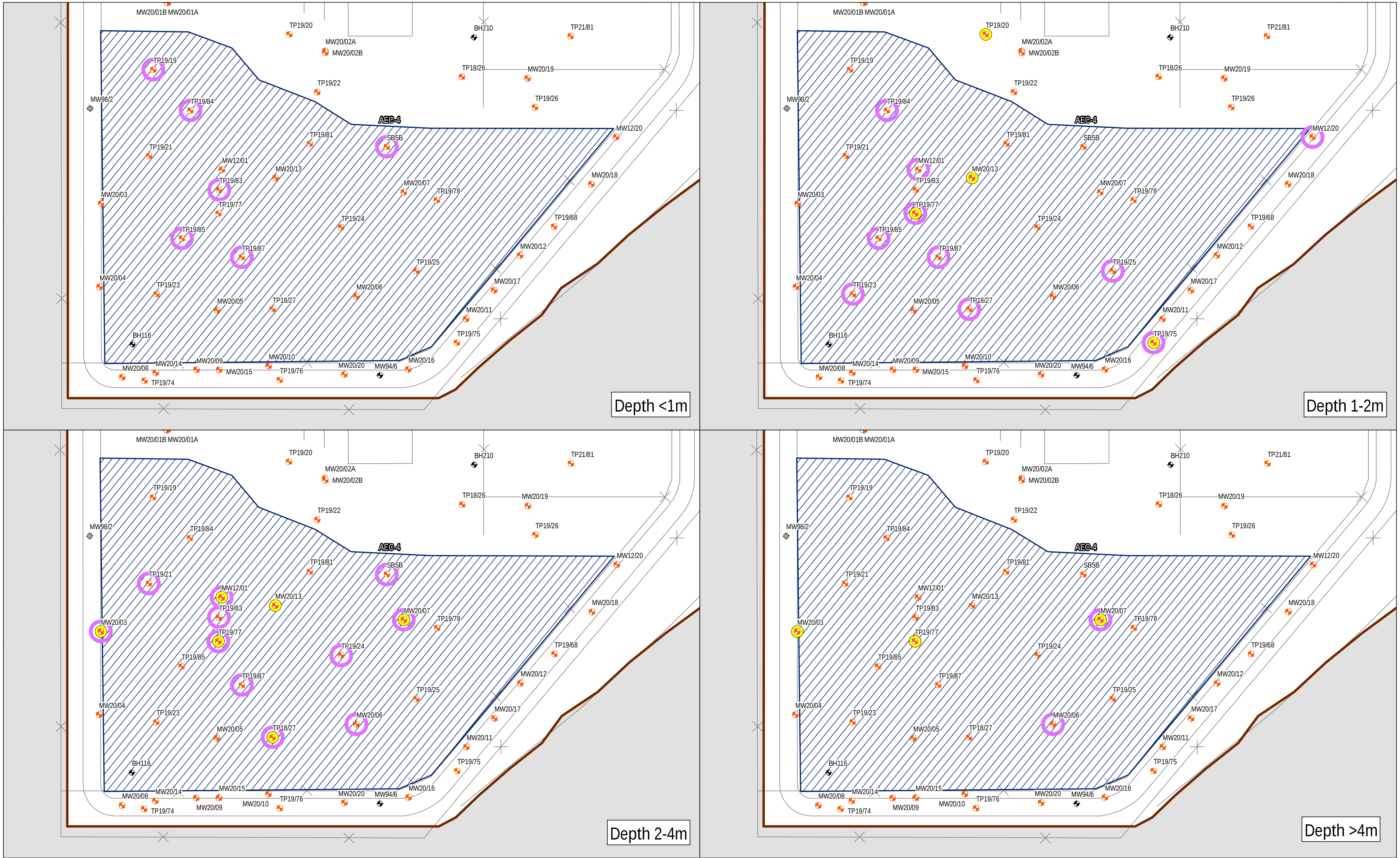

Legend

- AEC-4 Extent
- Stage 2
- Western Area Boundary
- Clyde Refinery
- Monitoring Well
- Lost/Destroyed Monitoring Well
- Soil Sampling
- LNAPL Present
- TRH Management Limit

LNAPL in Soils

F6C

Drawing No:	0560650s_AEC4BWDSI_G009_R1.mxd	Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date:	07/06/2021 Drawing Size: A3	
Drawn By:	GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 10 20 30m

N

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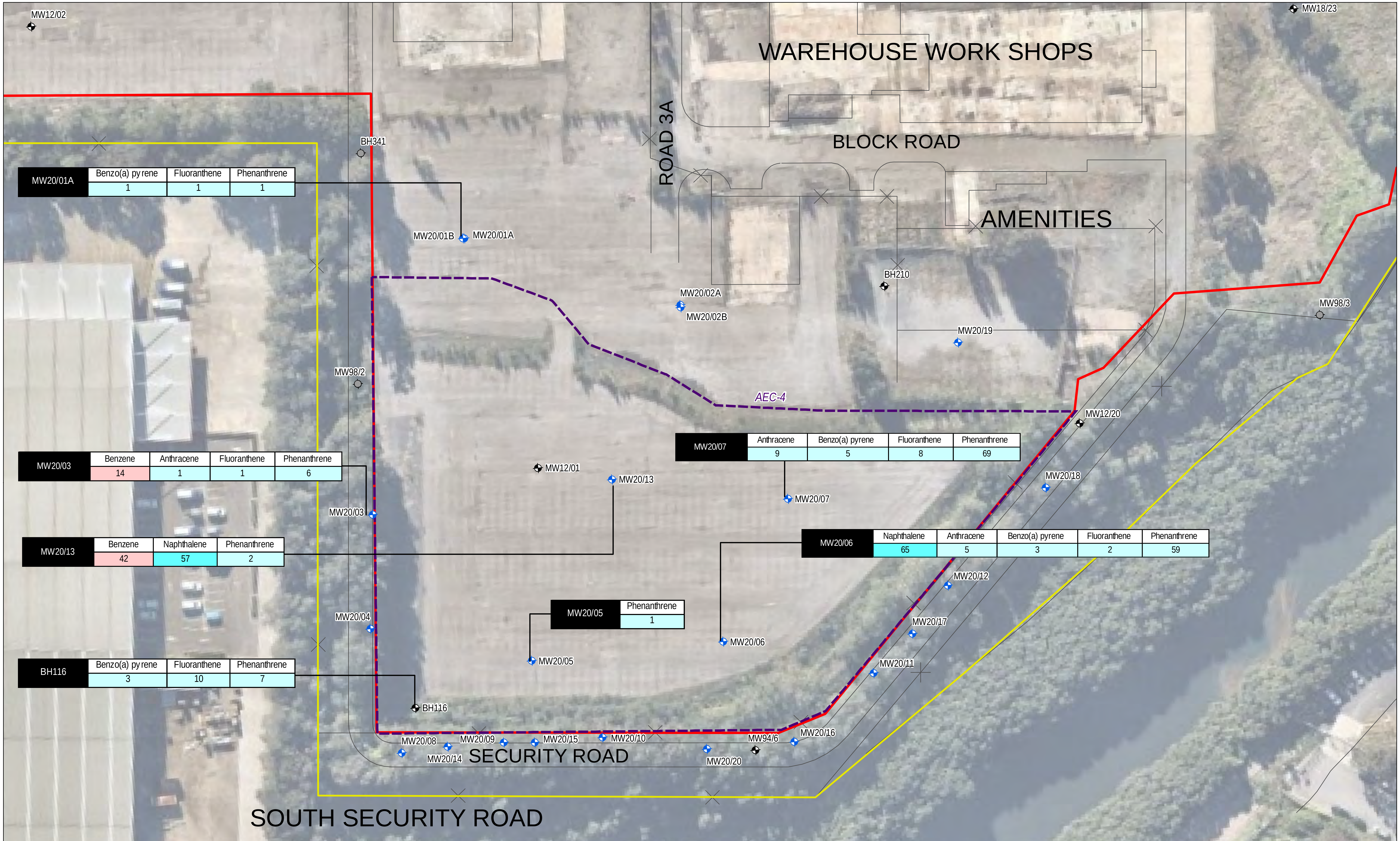
ERM



MW20/01A	Benzo(a) pyrene	Fluoranthene	Phenanthrene
	1	1	1

MW20/03	Benzene	Anthracene	Fluoranthene	Phenanthrene
	14	1	1	6

MW20/13	Benzene	Naphthalene	Phenanthrene
	42	57	2

BH116	Benzo(a) pyrene	Fluoranthene	Phenanthrene
	3	10	7

MW20/07	Anthracene	Benzo(a) pyrene	Fluoranthene	Phenanthrene
	9	5	8	69

MW20/06	Naphthalene	Anthracene	Benzo(a) pyrene	Fluoranthene	Phenanthrene
	65	5	3	2	59

MW20/05	Phenanthrene
	1

Legend

- Clyde Refinery
- Western Area Boundary
- AEC-4 Area Boundary
- New Monitoring Well
- Monitoring Well
- Lost/Destroyed Monitoring Well

Analytes	BTEX	Naphthalene	PAH/Phenols			
	Benzene	Naphthalene	Anthracene	Benzo(a) pyrene	Fluoranthene	Phenanthrene
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZG (2018) TV - Marine water (95%)	700	70	0.1	0.1	1	0.6
NEPM (2013) - Marine Water	500	50	-	-	-	-
NEPM (2013) - Recreational	10	-	-	-	-	-
NHMRC (2008) Recreational Water - Health	10	-	-	0.1	-	-

Data Source:
Nearmap Imagery July 2019

Groundwater Analytical Results (Exceedances)

F7

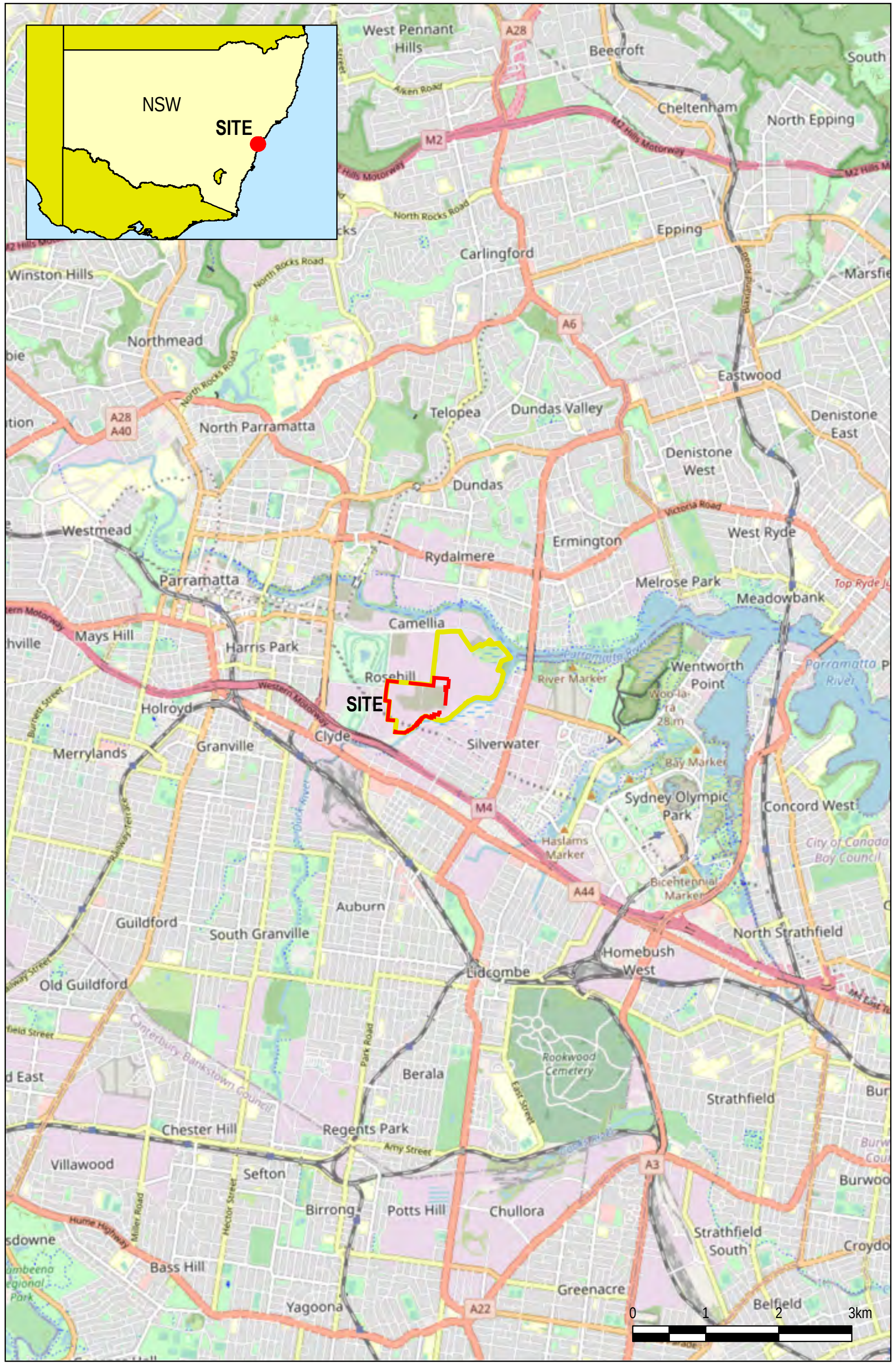
Drawing No:	0560650s_AEC4BWDSI_G007_R0.mxd		Southern Buried Waste (AEC-4) Detailed Site Investigation Clyde Terminal - Durham Street, Rosehill NSW
Date:	26/02/2021	Drawing Size: A3	
Drawn By:	GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56			This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

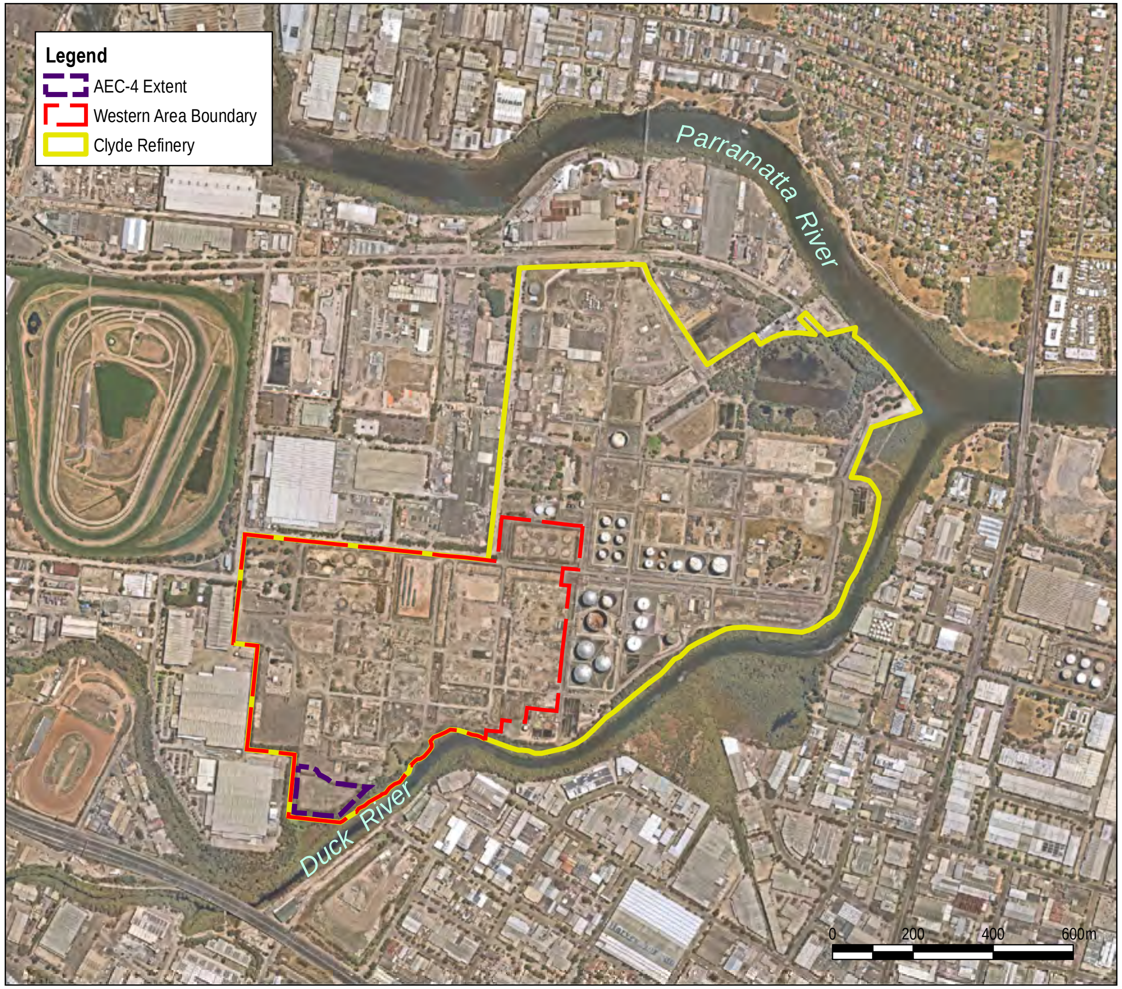
0 10 20 30m

N

ERM

Appendix A-2 Figures from the AEC-4 ROA





General Area Land Use:
Industrial
General Hydrogeology of Locality:
1. Soil Type:
Residual clay with minor silt and sand
2. Depth to aquifer:
0.5-2.5m bgs

Aquifer Usage:
Not known beneficial onsite extraction
Potentially Sensitive Receptors:
- Parramatta River (north eastern boundary)
- Duck River (southern boundary)

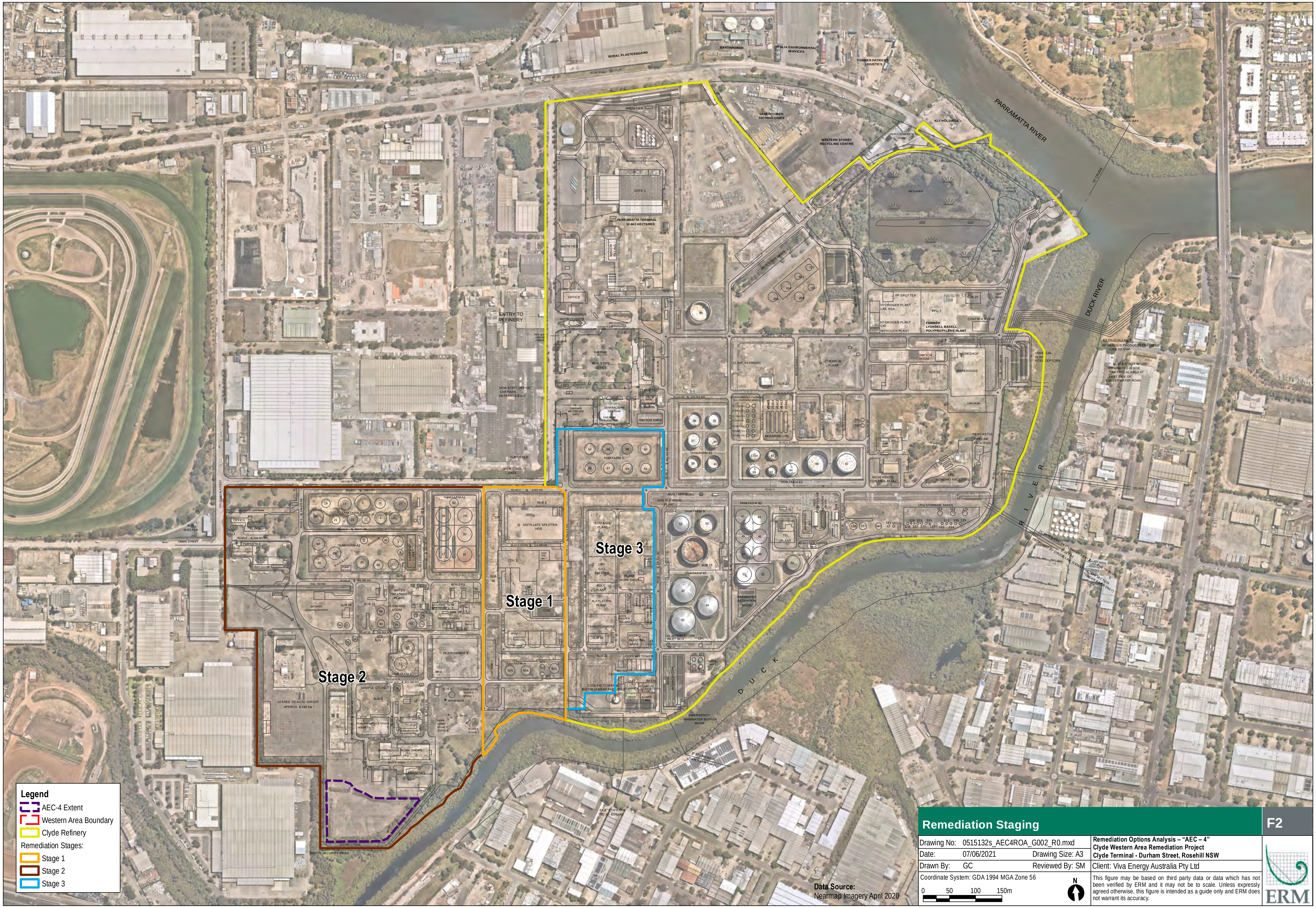
Source:
Nearmap Imagery January 2021
Locality: Esri, OpenStreetMap 2021

Site Location

F1

Drawing No: 0515132s_AEC4ROA_G001_R0.mxd		**Remediation Options Analysis – "AEC – 4"** **Clyde Western Area Remediation Project** **Clyde Terminal - Durham Street, Rosehill NSW**
Date: 07/06/2021	Drawing Size: A4	
Drawn By: GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Remediation Staging

F2

Drawing No:	0515132s_AEC4ROA_G002_R0.mxd		
Date:	07/06/2021	Drawing Size: A3	
Drawn By:	GC	Reviewed By: SM	

Remediation Options Analysis – "AEC – 4"
Clyde Western Area Remediation Project
Clyde Terminal - Durham Street, Rosehill NSW

Client: Viva Energy Australia Pty Ltd

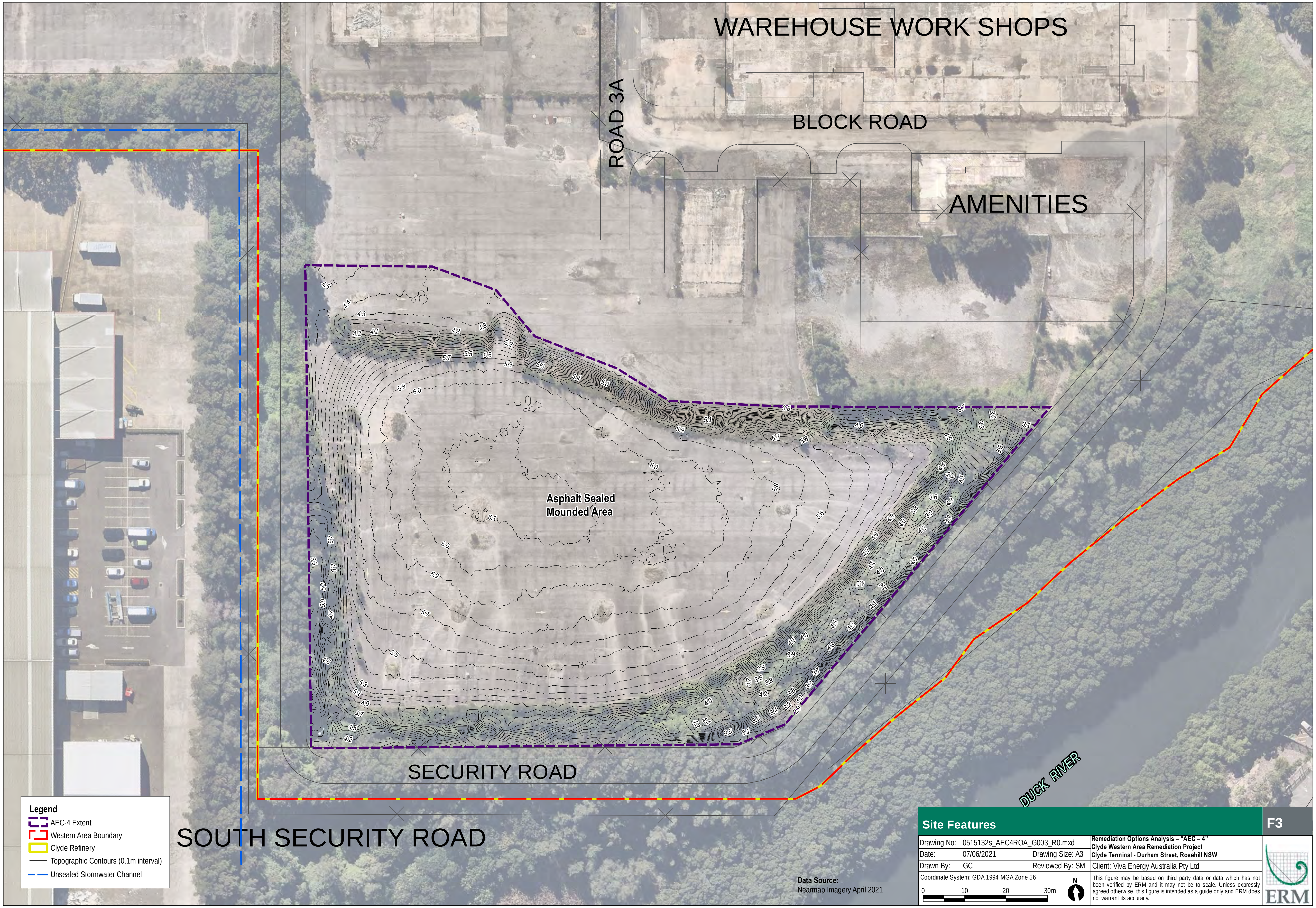
Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

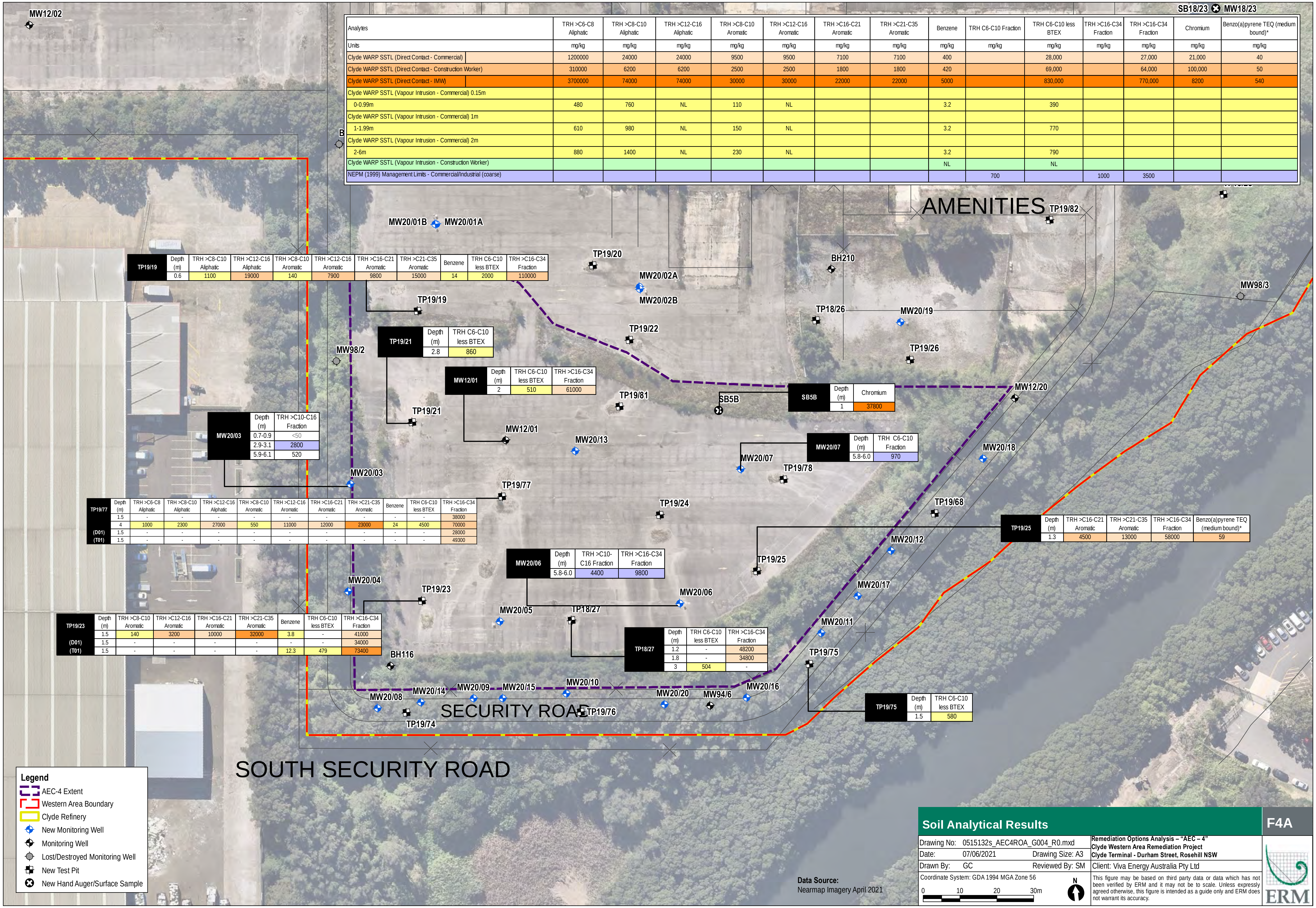


Site Features

F3

Drawing No: 0515132s_AEC4ROA_G003_R0.mxd	**Remediation Options Analysis – "AEC – 4"** **Clyde Western Area Remediation Project** **Clyde Terminal - Durham Street, Rosehill NSW**
Date: 07/06/2021 Drawing Size: A3	
Drawn By: GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



Analytes	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction	TRH >C16-C34 Fraction	Chromium	Benzo(a)pyrene TEQ (medium bound)*
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	9500	9500	7100	7100	400		28,000		27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420		69,000		64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000		830,000		770,000	8200	540
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m														
0-0.99m	480	760	NL	110	NL			3.2		390				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m														
1-1.99m	610	980	NL	150	NL			3.2		770				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m														
2-6m	880	1400	NL	230	NL			3.2		790				
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)								NL		NL				
NEPM (1999) Management Limits - Commercial/Industrial (coarse)									700		1000	3500		

TP19/19	Depth (m)	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	0.6	1100	19000	140	7900	9800	15000	14	2000	110000

TP19/21	Depth (m)	TRH C6-C10 less BTEX
	2.8	860

MW12/01	Depth (m)	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	2	510	61000

MW20/03	Depth (m)	TRH >C10-C16 Fraction
	0.7-0.9	<50
	2.9-3.1	2800
	5.9-6.1	520

SB5B	Depth (m)	Chromium
	1	37800

MW20/07	Depth (m)	TRH C6-C10 Fraction
	5.8-6.0	970

TP19/77	Depth (m)	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.5	-	-	-	-	-	-	-	-	-	38000
	4	1000	2300	27000	550	11000	12000	23000	24	4500	70000
(D01)	1.5	-	-	-	-	-	-	-	-	-	28000
(T01)	1.5	-	-	-	-	-	-	-	-	-	49300

TP19/25	Depth (m)	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	TRH >C16-C34 Fraction	Benzo(a)pyrene TEQ (medium bound)*
	1.3	4500	13000	58000	59

MW20/06	Depth (m)	TRH >C10-C16 Fraction	TRH >C16-C34 Fraction
	5.8-6.0	4400	9800

TP19/23	Depth (m)	TRH >C8-C10 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	Benzene	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.5	140	3200	10000	32000	3.8	-	41000
(D01)	1.5	-	-	-	-	-	-	34000
(T01)	1.5	-	-	-	-	12.3	479	73400

TP18/27	Depth (m)	TRH C6-C10 less BTEX	TRH >C16-C34 Fraction
	1.2	-	48200
	1.8	-	34800
	3	504	-

TP19/75	Depth (m)	TRH C6-C10 less BTEX
	1.5	580

Soil Analytical Results

F4A

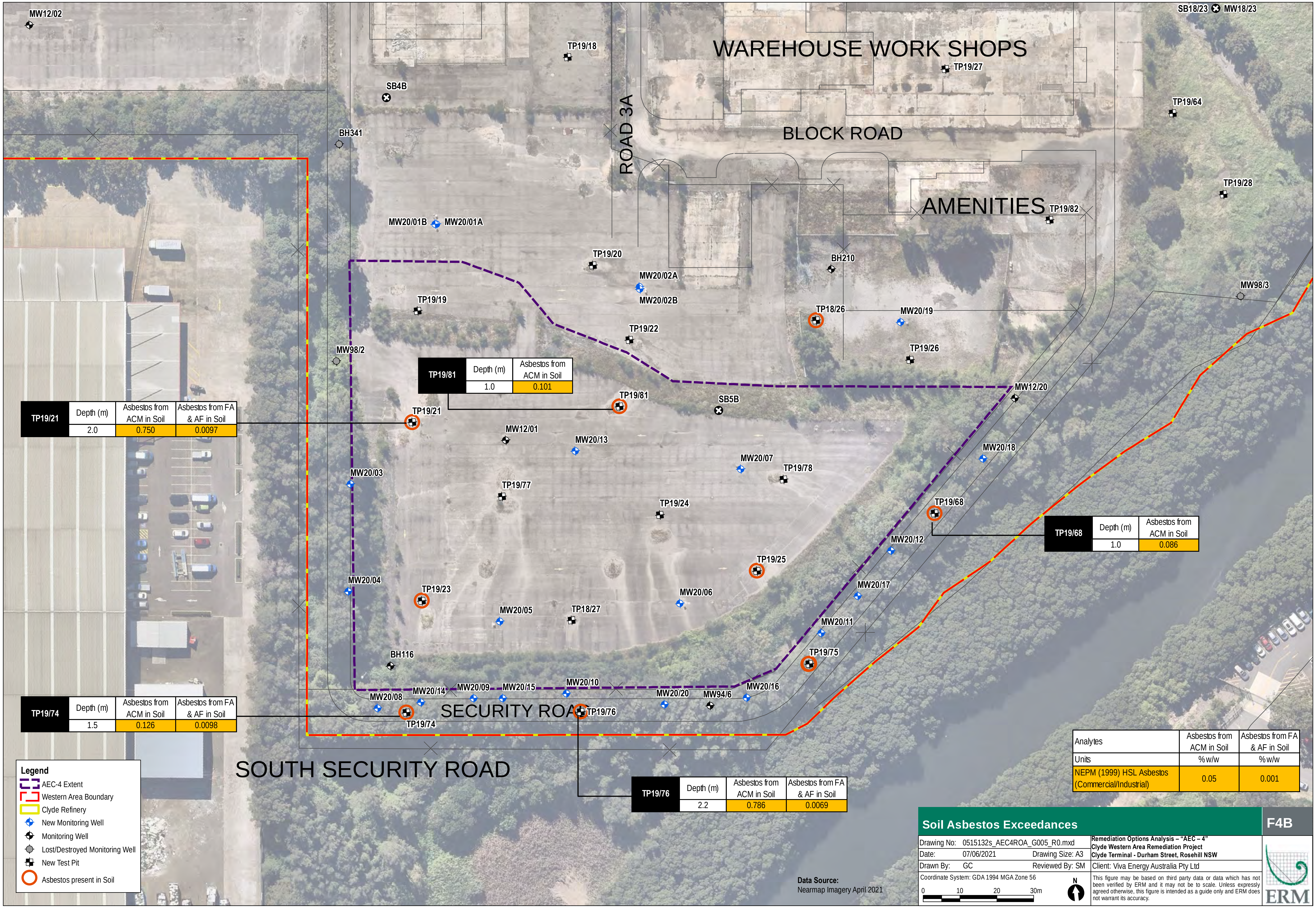
Drawing No: 0515132s_AEC4ROA_G004_R0.mxd
Date: 07/06/2021 Drawing Size: A3
Drawn By: GC Reviewed By: SM

Remediation Options Analysis – "AEC – 4"
Clyde Western Area Remediation Project
Clyde Terminal - Durham Street, Rosehill NSW

Client: Viva Energy Australia Pty Ltd

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



TP19/81	Depth (m)	Asbestos from ACM in Soil
	1.0	0.101

TP19/21	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	2.0	0.750	0.0097

TP19/68	Depth (m)	Asbestos from ACM in Soil
	1.0	0.086

TP19/74	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	1.5	0.126	0.0098

TP19/76	Depth (m)	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
	2.2	0.786	0.0069

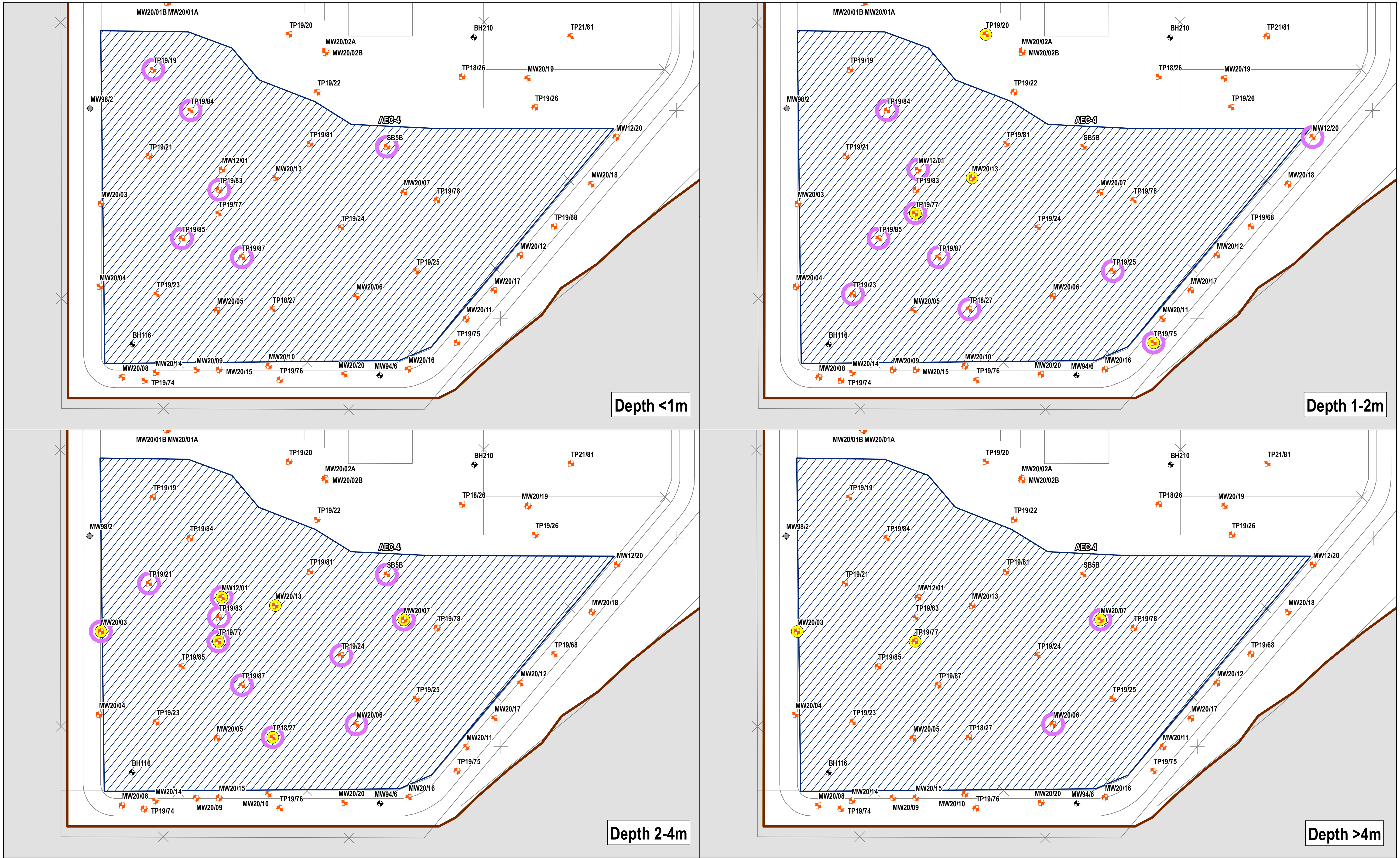
Analytes	Asbestos from ACM in Soil	Asbestos from FA & AF in Soil
Units	%w/w	%w/w
NEPM (1999) HSL Asbestos (Commercial/Industrial)	0.05	0.001

Soil Asbestos Exceedances

F4B

Drawing No: 0515132s_AEC4ROA_G005_R0.mxd	Remediation Options Analysis – "AEC – 4" Clyde Western Area Remediation Project Clyde Terminal - Durham Street, Rosehill NSW
Date: 07/06/2021 Drawing Size: A3	
Drawn By: GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Legend

- Stage 2
- Western Area Boundary
- Clyde Refinery
- AEC-4 Extent
- Monitoring Well
- Lost/Destroyed Monitoring Well
- Soil Sampling Location
- LNAPL Present
- TRH Management Limit

LNAPL in Soils

F4C

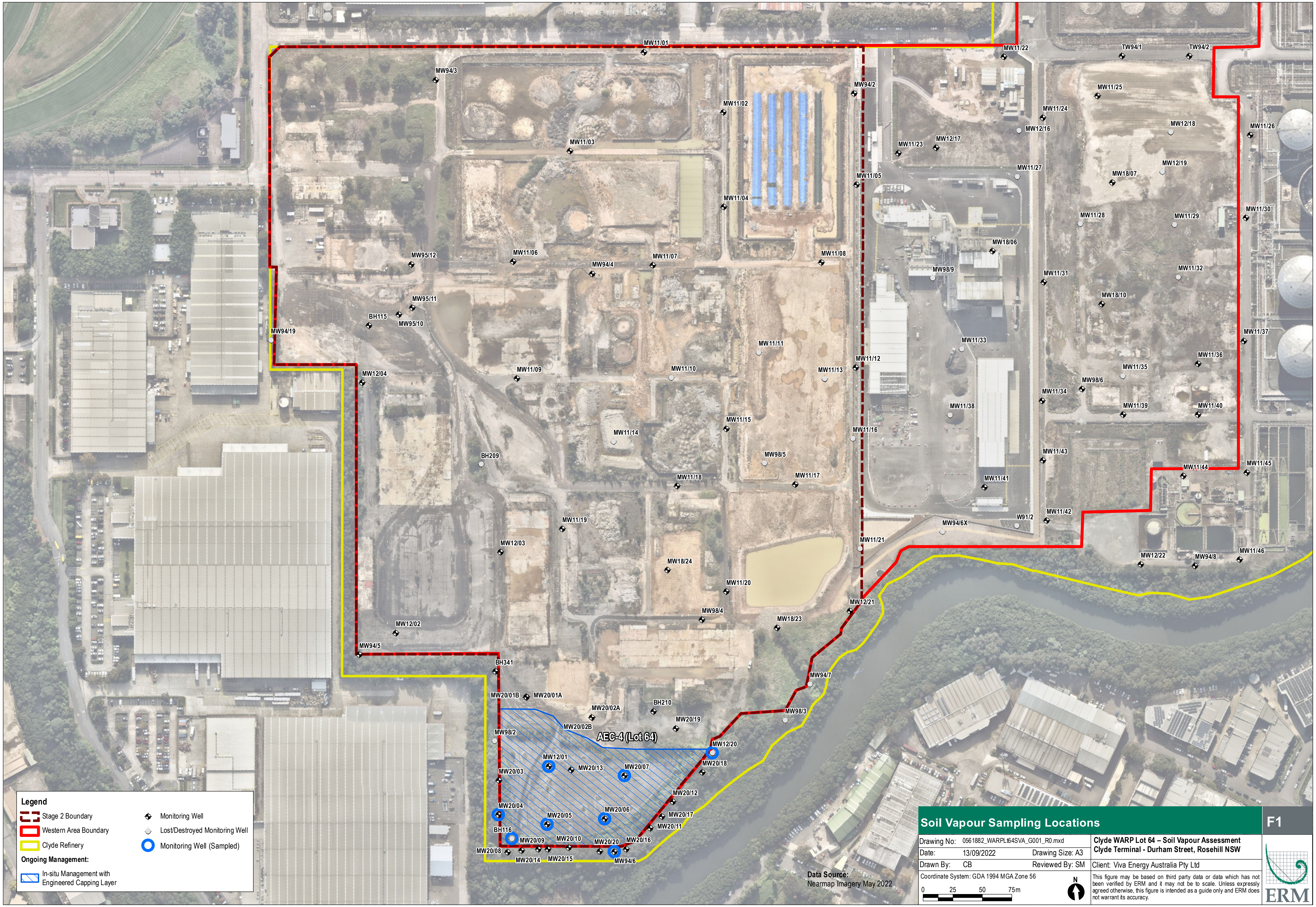
Drawing No: 0515132s_AEC4ROA_G006_R0.mxd	Remediation Options Analysis – "AEC – 4" Clyde Western Area Remediation Project Clyde Terminal - Durham Street, Rosehill NSW
Date: 07/06/2021 Drawing Size: A3	
Drawn By: GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

0 10 20 30m

N

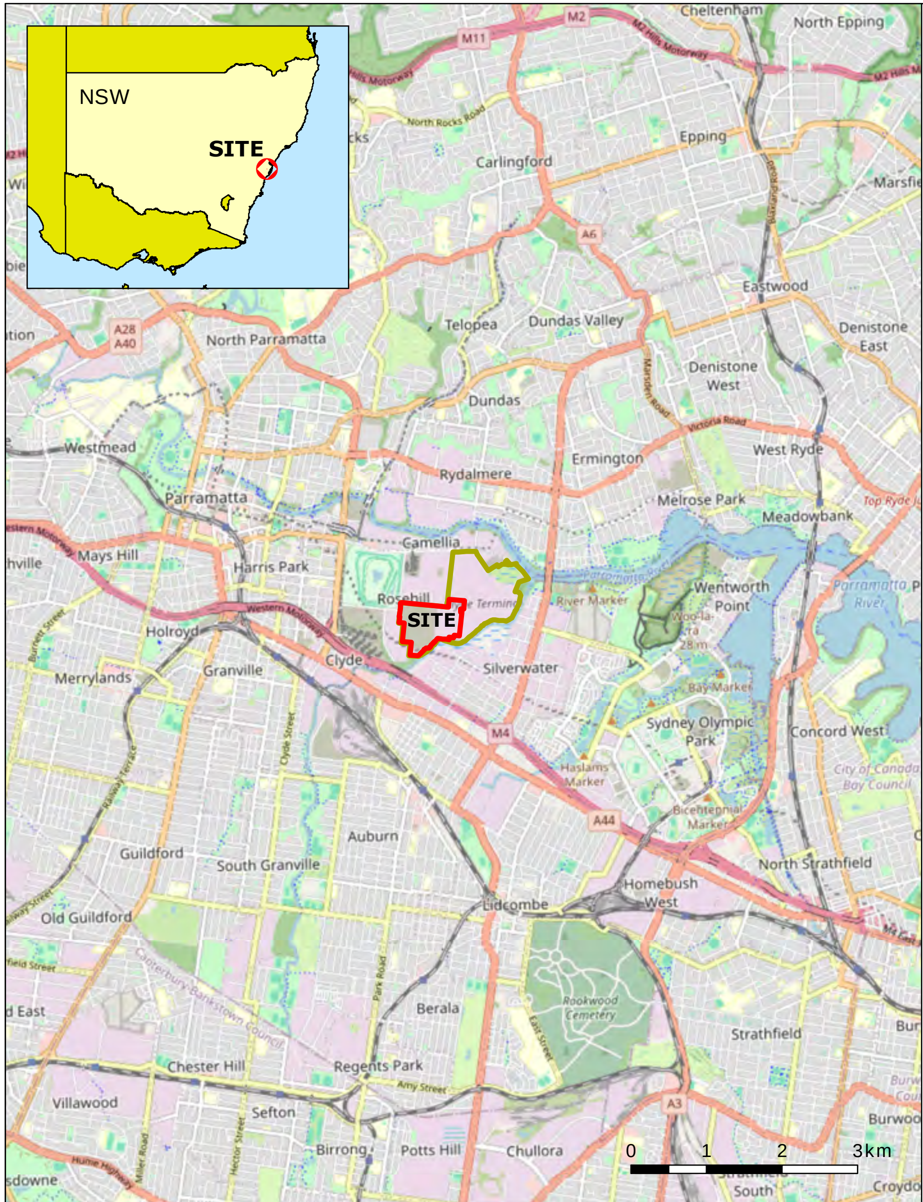
ERM

Appendix A-3 Figures from the Ground Gases Assessment



AEC-4 (Lot 64)
MW11/01
MW94/3
MW11/02
MW94/2
MW11/03
MW11/05
MW11/04
MW95/12
MW11/06
MW94/4
MW11/07
MW11/08
MW95/11
BH115
MW95/10
MW94/19
MW11/11
MW12/04
MW11/09
MW11/10
MW11/13
MW11/12
MW11/15
MW11/14
MW11/16
BH209
MW98/5
MW11/18
MW11/17
MW11/19
MW12/03
MW18/24
MW11/21
MW11/20
MW12/21
MW98/4
MW18/23
MW12/02
MW94/5
BH341
MW94/7
MW20/01B
MW20/01A
BH210
MW20/02A
MW98/3
MW20/19
MW20/02B
MW98/2
MW12/20
MW12/01
MW20/13
MW20/07
MW20/18
MW20/03
MW20/12
MW20/04
MW20/06
MW20/05
MW20/17
MW20/11
BH116
MW20/09
MW20/10
MW20/20
MW20/16
MW20/08
MW20/14
MW20/15
MW94/6
MW11/22
TW94/1
TW94/2
MW11/25
MW11/24
MW12/16
MW12/18
MW11/26
MW11/23
MW12/17
MW11/27
MW12/19
MW18/07
MW11/28
MW11/29
MW11/30
MW18/06
MW98/9
MW11/31
MW11/32
MW18/10
MW11/33
MW11/37
MW11/36
MW11/35
MW98/6
MW11/34
MW11/39
MW11/38
MW11/40
MW11/43
MW11/44
MW11/45
MW11/41
MW91/2
MW11/42
MW94/6X
MW12/22
MW94/8
MW11/46
Legend
Stage 2 Boundary
Western Area Boundary
Clyde Refinery
Ongoing Management:
In-situ Management with Engineered Capping Layer
Monitoring Well
Lost/Destroyed Monitoring Well
Monitoring Well (Sampled)
Data Source:
Nearmap Imagery May 2022
Soil Vapour Sampling Locations
F1
Drawing No: 0561882_WARPLt64SVA_G001_R0.mxd
Date: 13/09/2022
Drawing Size: A3
Drawn By: CB
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 25 50 75m
N
Clyde WARP Lot 64 – Soil Vapour Assessment
Clyde Terminal - Durham Street, Rosehill NSW
Client: Viva Energy Australia Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Appendix A-4 Figures from the Baseline GME



General Area Land Use:
Industrial
General Hydrogeology of Locality:
1. Soil Type:
Residual clay with minor silt and sand
2. Depth to aquifer:
0.5-2.5m bgs

Aquifer Usage:
Not known beneficial onsite extraction
Potentially Sensitive Receptors:
- Parramatta River (north eastern boundary)
- Duck River (southern boundary)

Legend
- Stage 2 Boundary
- Former Clyde Refinery
- Western Area Boundary

Data Source:
Nearmap Imagery January 2024
Locality: Esri, OpenStreetMap 2023

Coordinate System:
GDA 1994 MGA Zone 56

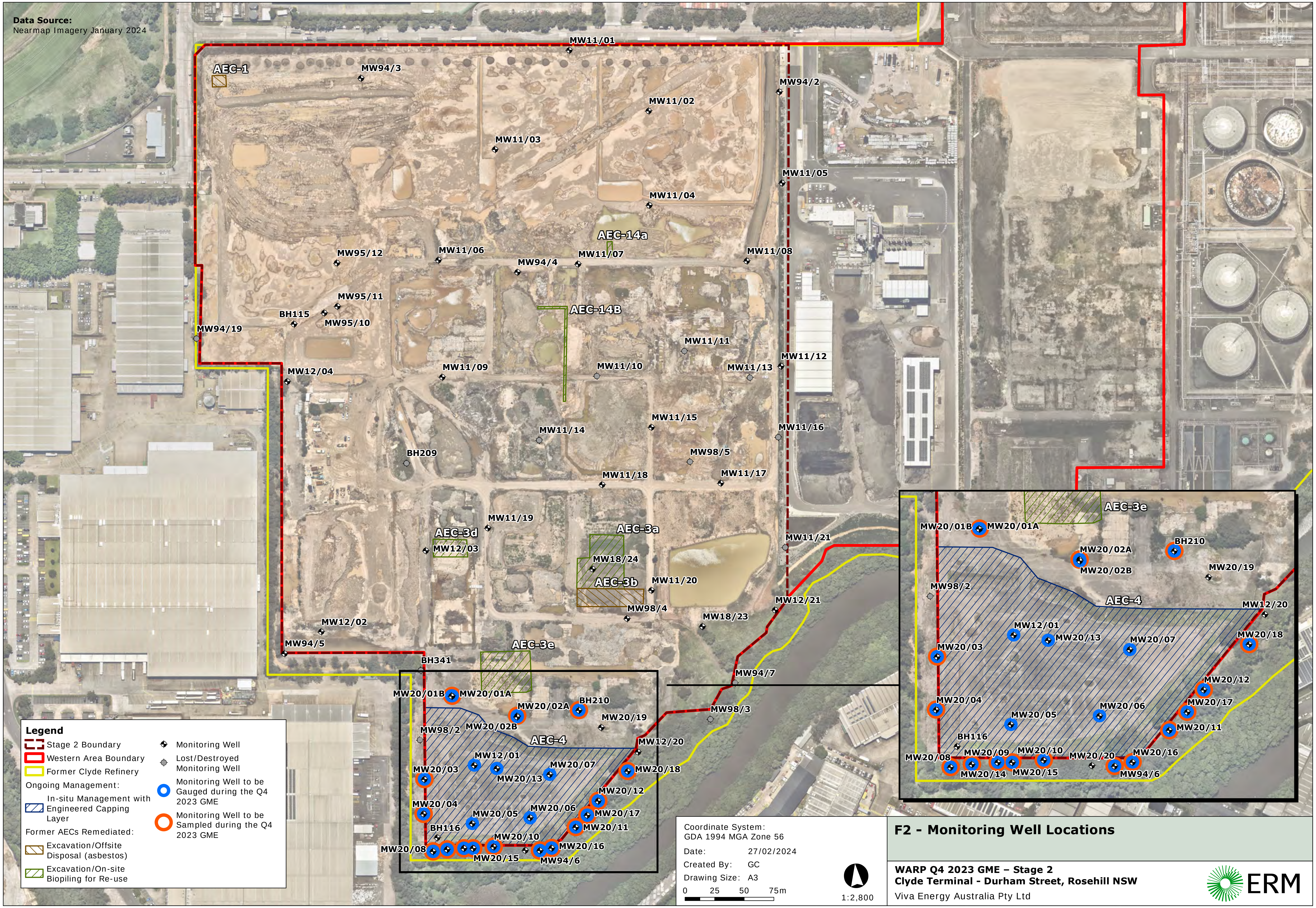
Date: 27/02/2024
Created By: GC
Drawing Size: A4

F1 - Site Location

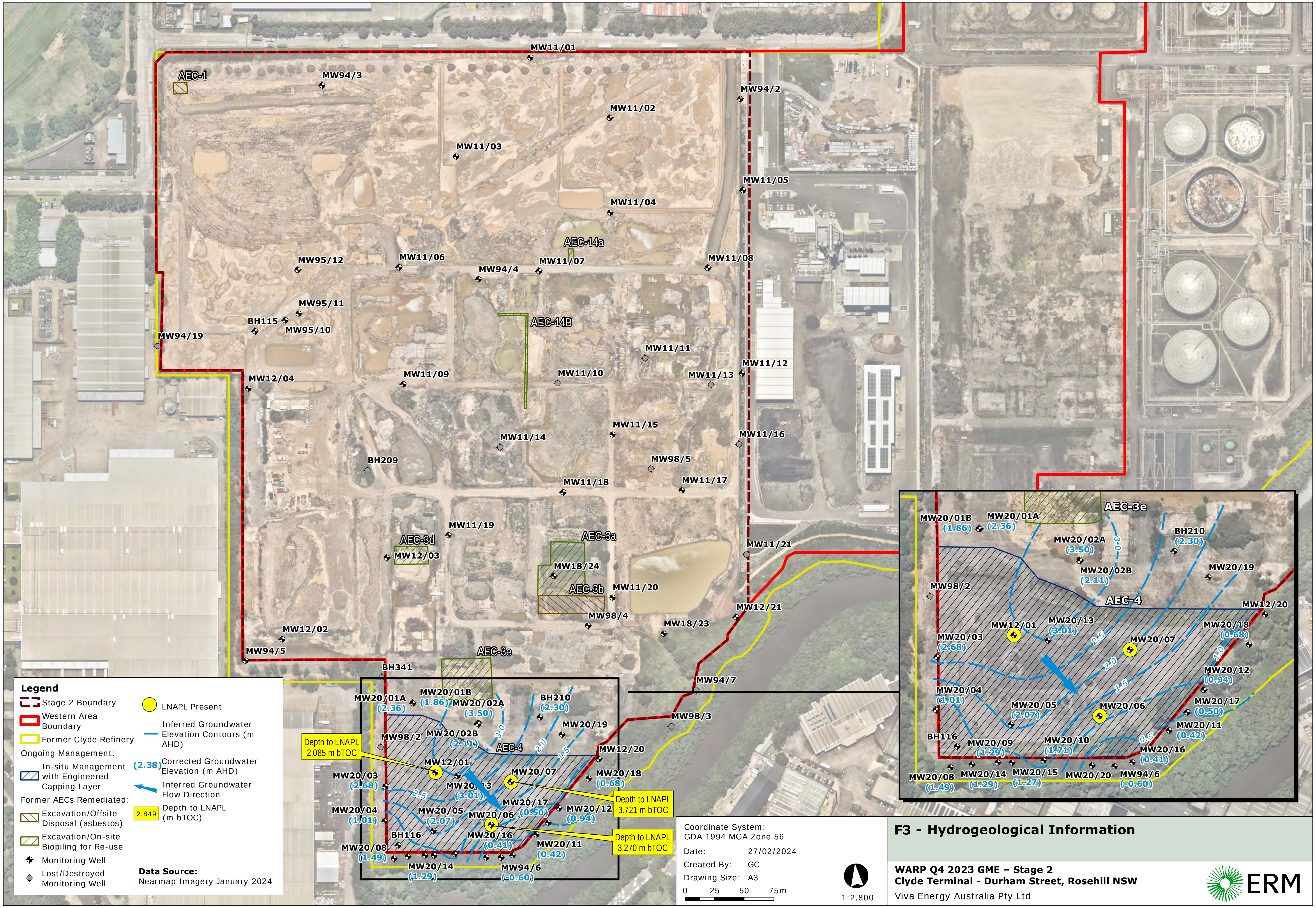
WARP Q4 2023 GME – Stage 2
Clyde Terminal - Durham Street, Rosehill NSW
Viva Energy Australia Pty Ltd

ERM

0712976_WARPSt2Q423GME_G001_R0.mxd



0712976_WARPSt2Q423GME_G002_R0.mxd



Coordinate System:
GDA 1994 MGA Zone 56

Date: 27/02/2024

Created By: GC

Drawing Size: A3

0 25 50 75m

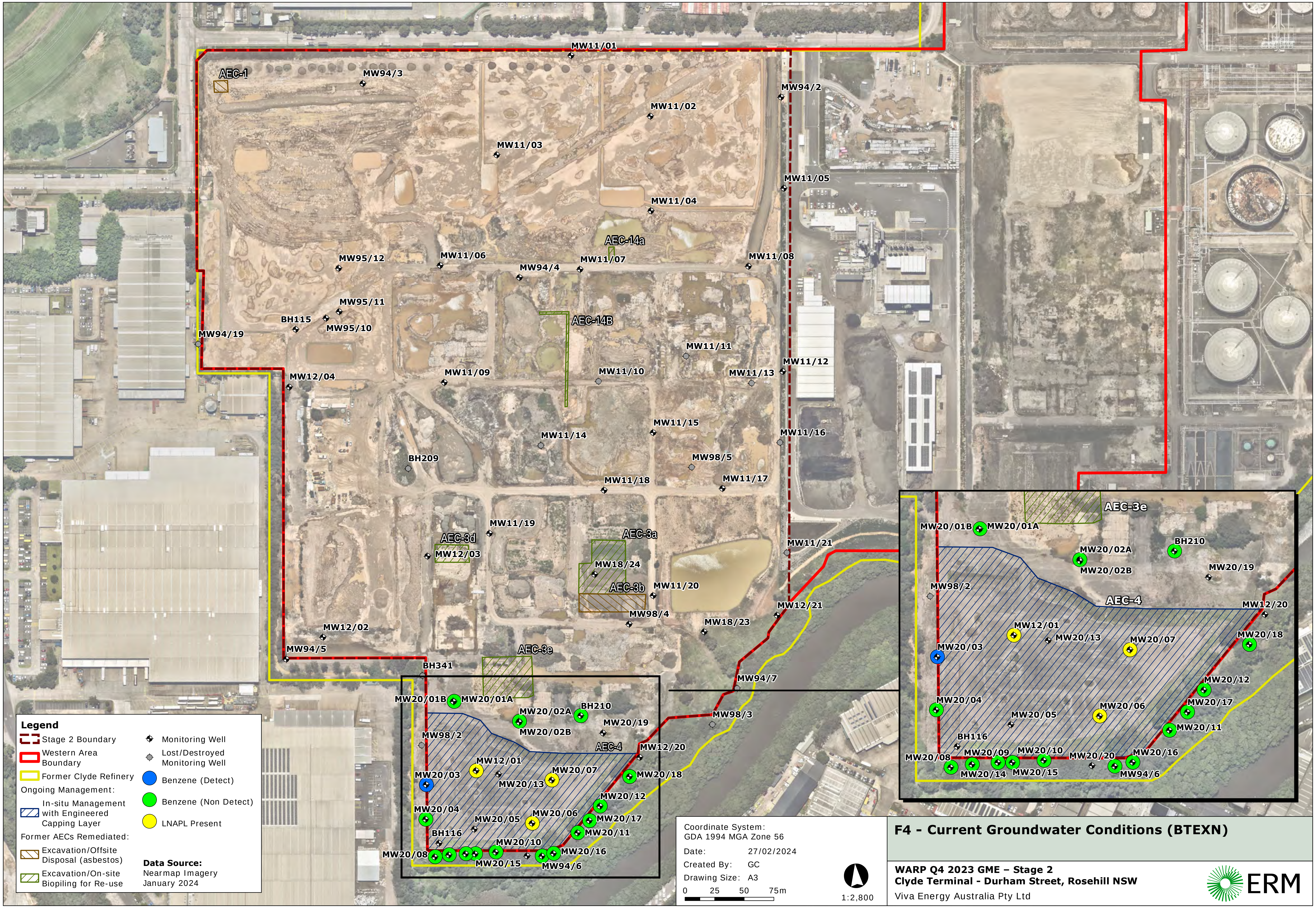
1:2,800

F3 - Hydrogeological Information

WARP Q4 2023 GME – Stage 2
Clyde Terminal - Durham Street, Rosehill NSW

Viva Energy Australia Pty Ltd

ERM



Coordinate System: GDA 1994 MGA Zone 56

Date: 27/02/2024

Created By: GC

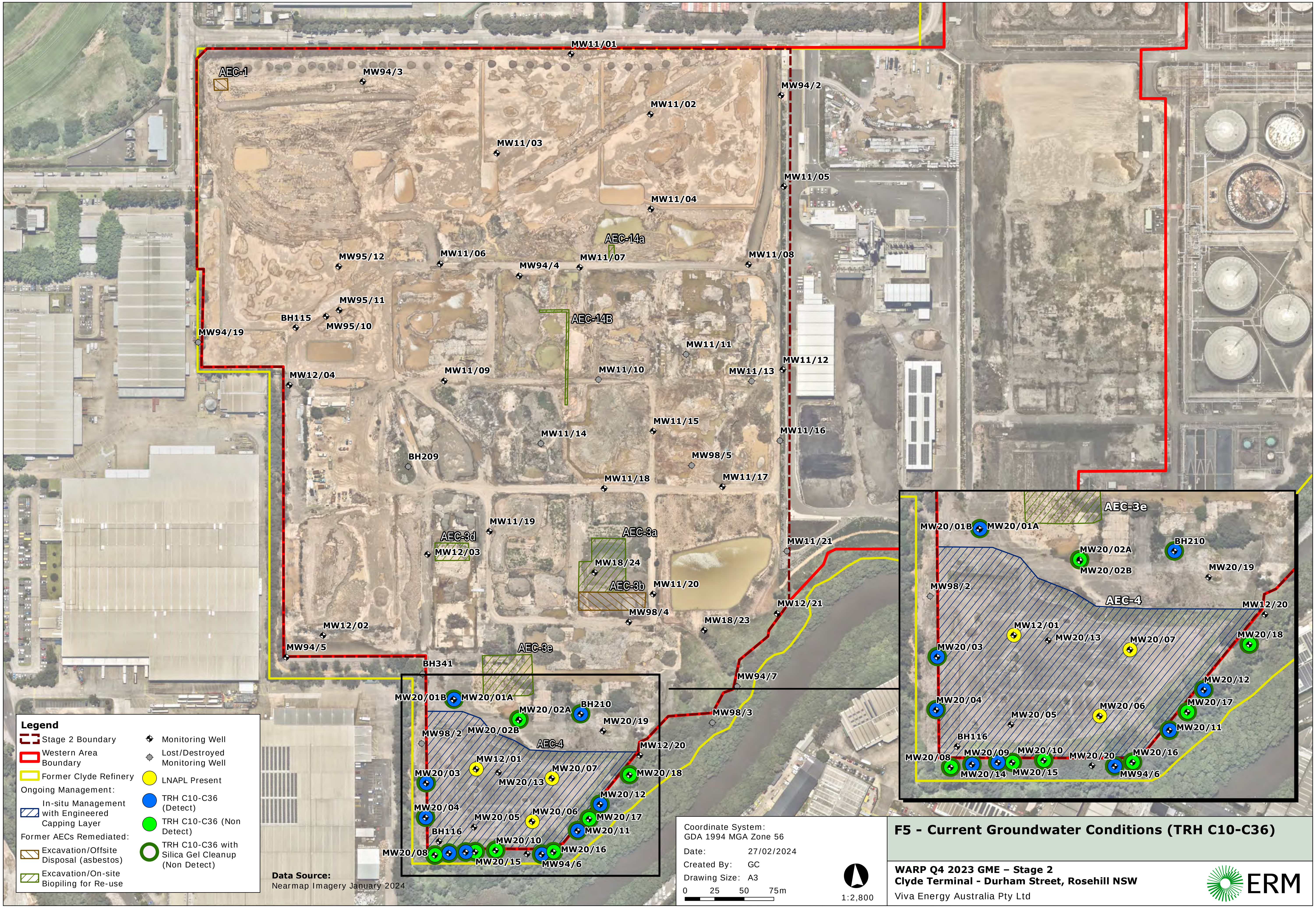
Drawing Size: A3

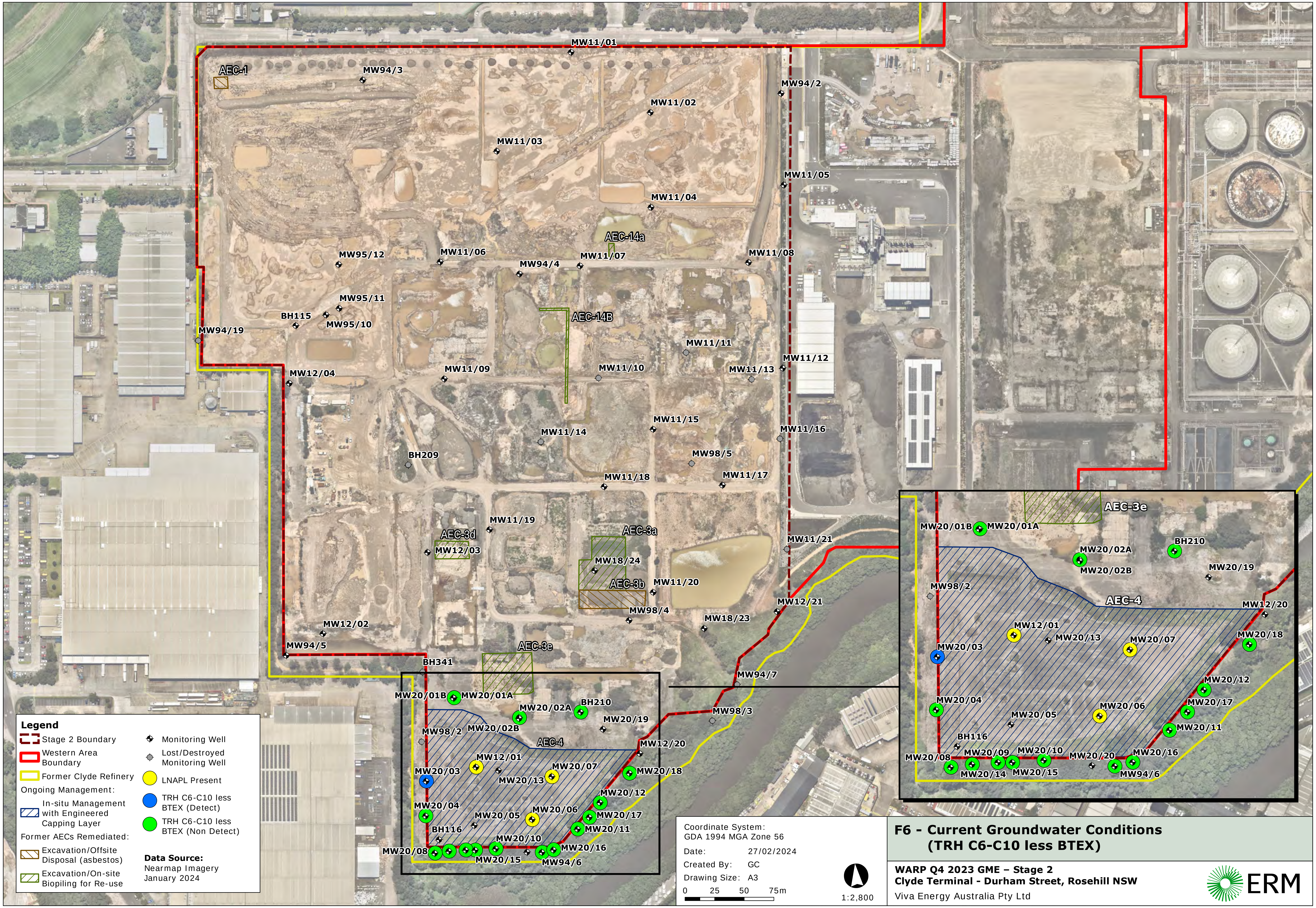
F4 - Current Groundwater Conditions (BTEXN)

WARP Q4 2023 GME – Stage 2
Clyde Terminal - Durham Street, Rosehill NSW

Viva Energy Australia Pty Ltd

ERM


AEC-1
AEC-14a
AEC-14B
AEC-3d
AEC-3a
AEC-3b
AEC-3e
AEC-4
MW11/01
MW94/3
MW94/2
MW11/02
MW11/03
MW11/05
MW11/04
MW95/12
MW11/06
MW94/4
MW11/07
MW11/08
MW95/11
BH115
MW95/10
MW94/19
MW11/11
MW11/12
MW11/13
MW12/04
MW11/09
MW11/10
MW11/15
MW11/16
MW11/14
BH209
MW98/5
MW11/18
MW11/17
MW11/19
MW12/03
MW11/21
MW18/24
MW11/20
MW12/21
MW98/4
MW18/23
MW12/02
MW94/5
BH341
MW94/7
MW98/3
MW20/01B
MW20/01A
MW20/02A
MW20/02B
BH210
MW20/19
MW98/2
MW12/20
MW12/01
MW20/13
MW20/07
MW20/18
MW20/03
MW20/04
MW20/05
MW20/06
MW20/12
MW20/17
MW20/11
BH116
MW20/10
MW20/08
MW20/15
MW20/16
MW94/6
MW20/09
MW20/14
MW20/20
Legend
Stage 2 Boundary
Western Area Boundary
Former Clyde Refinery
Ongoing Management:
In-situ Management with Engineered Capping Layer
Former AECs Remediated:
Excavation/Offsite Disposal (asbestos)
Excavation/On-site Biopiling for Re-use
Monitoring Well
Lost/Destroyed Monitoring Well
LNAPL Present
TRH C10-C36 (Detect)
TRH C10-C36 (Non Detect)
TRH C10-C36 with Silica Gel Cleanup (Non Detect)
Data Source:
Nearmap Imagery January 2024
Coordinate System:
GDA 1994 MGA Zone 56
Date: 27/02/2024
Created By: GC
Drawing Size: A3
0 25 50 75m
1:2,800
F5 - Current Groundwater Conditions (TRH C10-C36)
WARP Q4 2023 GME – Stage 2
Clyde Terminal - Durham Street, Rosehill NSW
Viva Energy Australia Pty Ltd
ERM



Coordinate System:
GDA 1994 MGA Zone 56

Date: 27/02/2024

Created By: GC

Drawing Size: A3

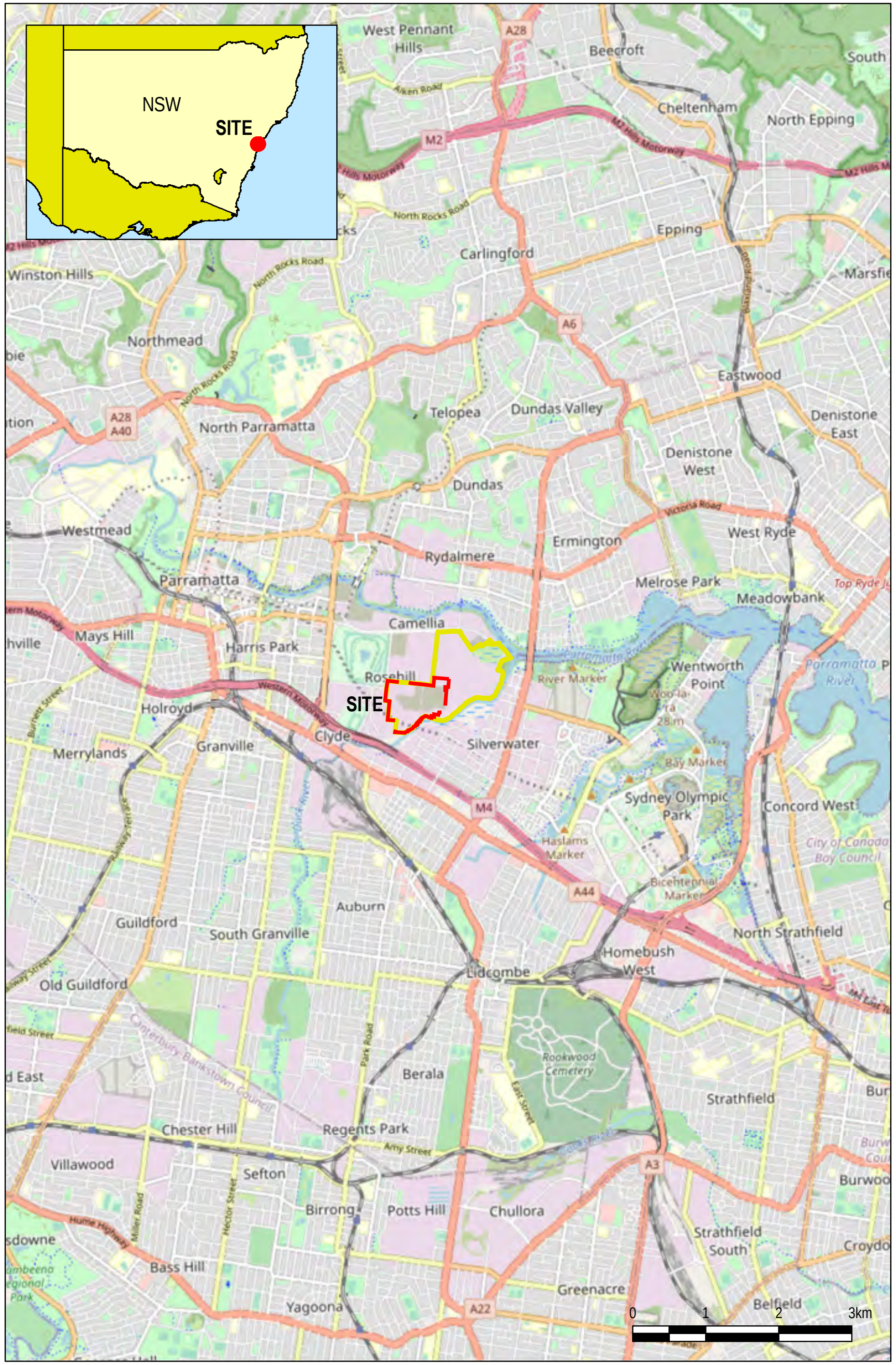
F6 - Current Groundwater Conditions (TRH C6-C10 less BTEX)

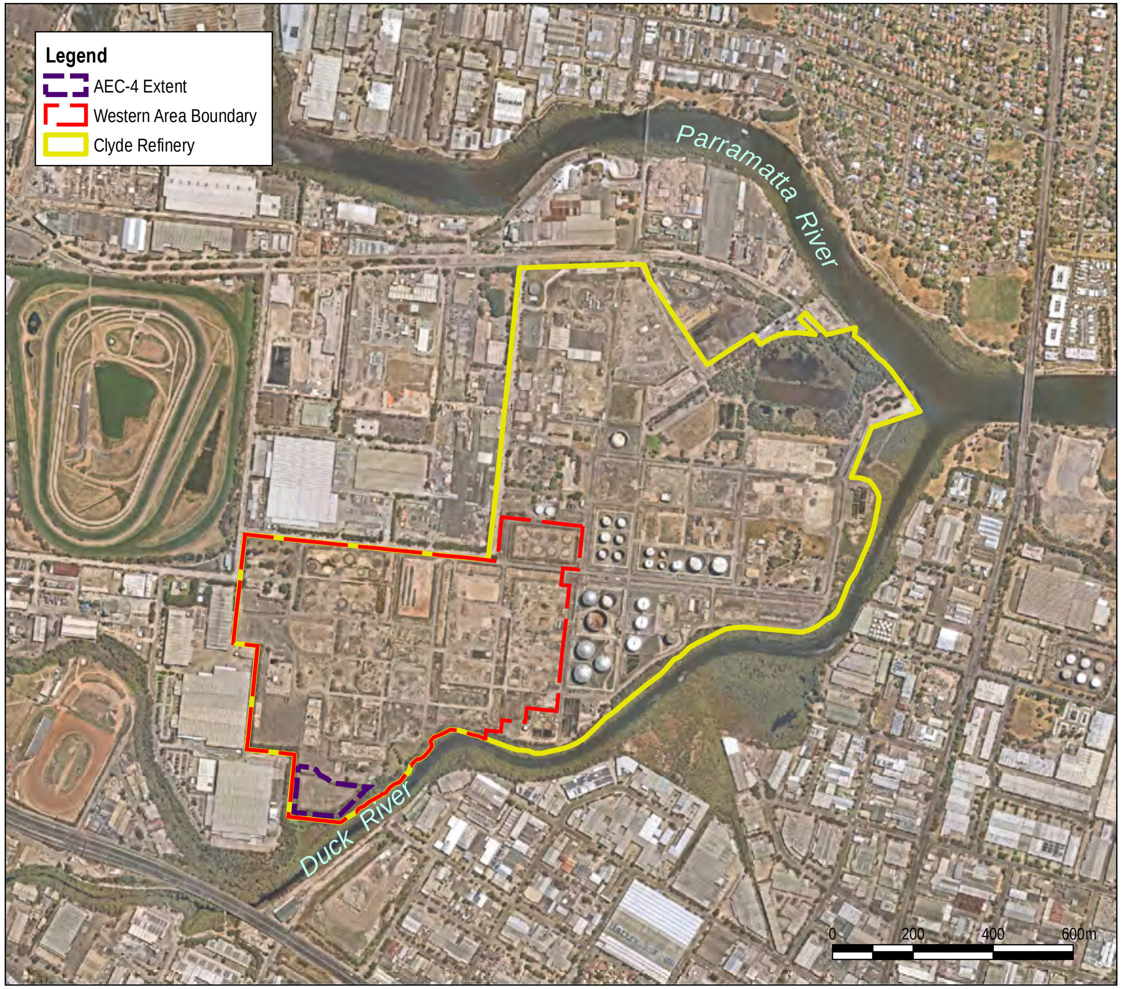
WARP Q4 2023 GME – Stage 2
Clyde Terminal - Durham Street, Rosehill NSW

Viva Energy Australia Pty Ltd

ERM

Appendix A-5 Figures from the Technical Specification





General Area Land Use:
Industrial
General Hydrogeology of Locality:
1. Soil Type:
Residual clay with minor silt and sand
2. Depth to aquifer:
0.5-2.5m bgs

Aquifer Usage:
Not known beneficial onsite extraction
Potentially Sensitive Receptors:
- Parramatta River (north eastern boundary)
- Duck River (southern boundary)

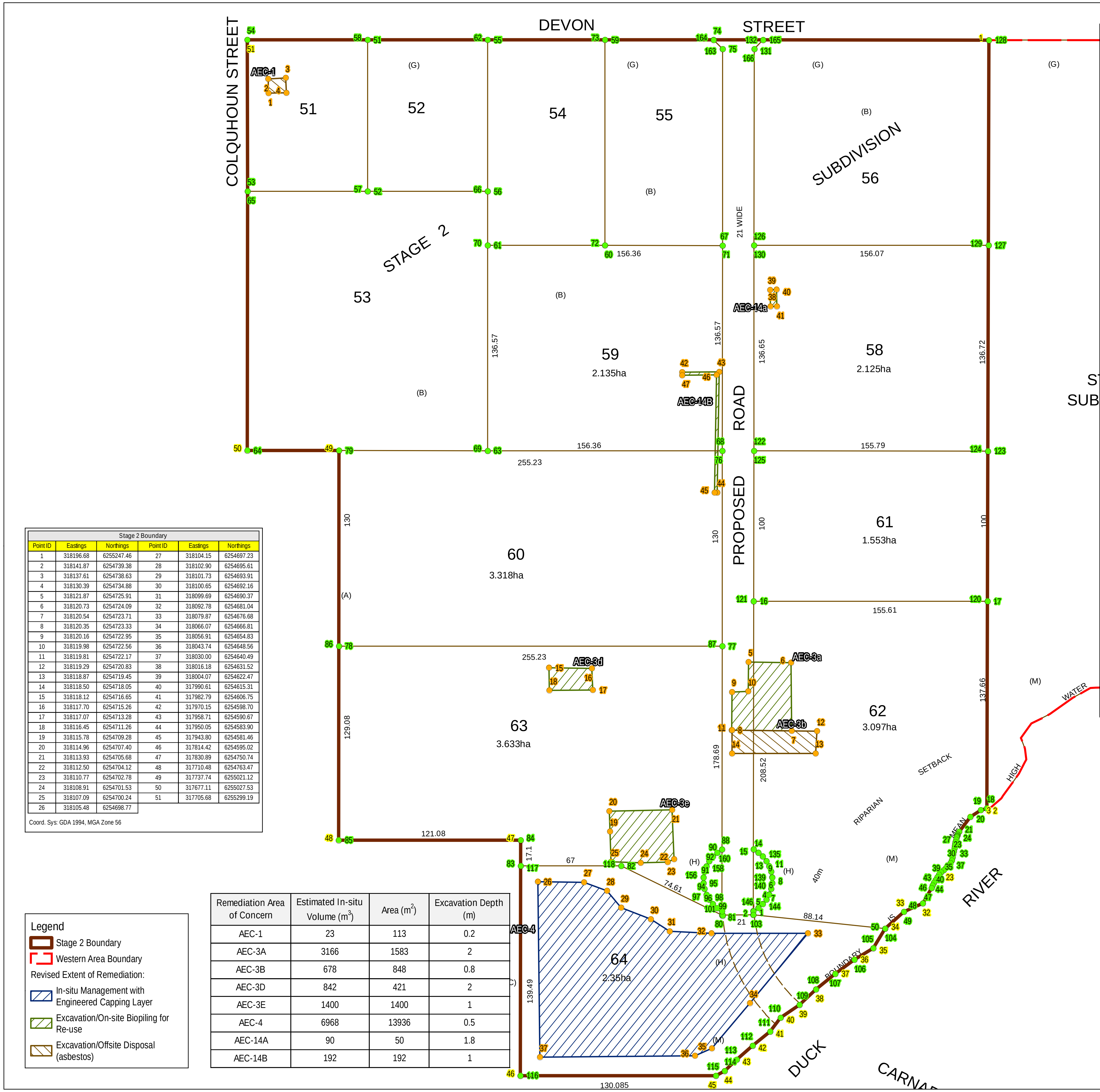
Source:
Nearmap Imagery January 2021
Locality: Esri, OpenStreetMap 2021

Site Location

F1

Drawing No: 0515132s_AEC4ROA_G001_R0.mxd		**Remediation Options Analysis – "AEC – 4"** **Clyde Western Area Remediation Project** **Clyde Terminal - Durham Street, Rosehill NSW**
Date: 07/06/2021	Drawing Size: A4	
Drawn By: GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



Proposed Lot Boundaries											
Lot	Point ID	Eastings	Northings	Lot	Point ID	Eastings	Northings	Lot	Point ID	Eastings	Northings
51	51	317785.2456	6255290.808	62	1	317979.8816	6254685.258	64	102	317959.4539	6254687.25
	52	317774.7825	6255190.556		2	317980.1351	6254687.647		103	317979.8816	6254685.258
	53	317695.2218	6255198.976		3	317983.6248	6254689.35		104	318066.0658	6254666.807
	54	317705.6809	6255299.19		4	317986.7795	6254691.614		105	318056.9076	6254654.825
52	55	317864.805	6255282.426		5	317989.5098	6254694.375		106	318043.7362	6254648.563
	56	317854.1977	6255182.15		6	317991.7383	6254697.554		107	318030.0003	6254640.491
	57	317774.7825	6255190.556		7	317993.4019	6254701.063		108	318016.1837	6254631.515
	58	317785.2456	6255290.808		8	317994.4535	6254704.801		109	318004.0673	6254622.474
53	63	317836.0633	6255010.716		9	317994.8632	6254708.662		110	317990.6137	6254615.306
	64	317677.1142	6255027.53		10	317994.6194	6254712.537		111	317982.7877	6254606.751
	65	317695.2218	6255198.976		11	317993.7291	6254716.317		112	317970.1503	6254598.7
	66	317854.155	6255182.155		12	317992.2175	6254719.894		113	317958.7133	6254590.672
54	59	317942.4951	6255274.242		13	317990.1274	6254723.166		114	317950.0516	6254583.9
	60	317928.1162	6255138.311		14	317987.518	6254726.041		115	317943.7984	6254581.462
	61	317850.4296	6255146.528		15	317984.4633	6254728.439		116	317814.4204	6254595.015
	62	317864.805	6255282.426		16	318001.8836	6254892.618		117	317829.0942	6254733.735
55	71	318005.9178	6255130.081		17	318156.6336	6254876.248		118	317895.7224	6254726.687
	72	317928.1162	6255138.311		18	318141.8687	6254739.385		119	317959.4072	6254686.8
	73	317942.4951	6255274.242		19	318137.6116	6254738.625	Proposed Road	133	317984.4633	6254728.439
	74	318014.3333	6255266.674		20	318130.3873	6254734.881		134	317987.5236	6254726.045
	75	318019.6691	6255260.078		21	318121.8694	6254725.912		135	317990.1384	6254723.17
56	128	318196.6807	6255247.464		22	318120.7307	6254724.088		136	317992.2332	6254719.898
	129	318182.0238	6255111.602		23	318120.5363	6254723.71		137	317993.7485	6254716.32
	130	318026.8082	6255127.953		24	318120.346	6254723.329		138	317994.6413	6254712.539
	131	318040.5501	6255257.879		25	318120.1608	6254722.946		139	317994.8862	6254708.661
	132	318047.1482	6255263.217		26	318119.9815	6254722.56		140	317994.4762	6254704.797
58	124	318167.3595	6254975.671		27	318119.8071	6254722.173		141	317993.423	6254701.057
	125	318012.435	6254992.059		28	318119.2925	6254720.831		142	317991.7565	6254697.547
	126	318026.8082	6255127.953		29	318118.8732	6254719.451		143	317989.5242	6254694.367
	127	318182.0238	6255111.602		30	318118.5	6254718.047		144	317986.7893	6254691.607
59	67	318005.9178	6255130.081		31	318118.1242	6254716.646		145	317983.6296	6254689.346
	68	317991.5515	6254994.268		32	318117.6992	6254715.262		146	317980.1351	6254687.647
	69	317836.0633	6255010.716		33	318117.069	6254713.278		147	317979.8816	6254685.258
	70	317850.4296	6255146.528		34	318116.4536	6254711.264		148	317959.4539	6254687.25
60	76	317991.5515	6254994.268		35	318115.776	6254709.284		149	317959.3547	6254689.896
	77	317977.8763	6254864.99		36	318114.9588	6254707.4		150	317956.3018	6254692.284
	78	317724.0609	6254891.839		37	318113.9278	6254705.676		151	317953.6933	6254695.151
	79	317737.736	6255021.117		38	318112.4953	6254704.118		152	317951.6032	6254698.415
61	120	318156.6336	6254876.248		39	318110.7673	6254702.779		153	317950.091	6254701.984
	121	318001.8836	6254892.618		40	318108.9106	6254701.528		154	317949.1995	6254705.756
	122	318012.435	6254992.059		41	318107.0912	6254700.235		155	317948.9542	6254709.625
	123	318167.3595	6254975.671		42	318105.4776	6254698.77		156	317949.3619	6254713.479
63	80	317959.4539	6254687.25		43	318104.1492	6254697.232		157	317950.4112	6254717.211
	81	317959.0788	6254687.287		44	318102.8956	6254695.607		158	317952.0721	6254720.713
	82	317895.7224	6254726.687		45	318101.7271	6254693.913		159	317954.2975	6254723.886
	83	317829.0942	6254733.735		46	318100.6534	6254692.164		160	317957.0243	6254726.641
	84	317830.8927	6254750.738		47	318099.6867	6254690.375		161	317960.1749	6254728.899
	85	317710.4825	6254763.475		48	318092.7751	6254681.039		162	317963.66	6254730.595
	86	317724.0609	6254891.839		49	318079.8653	6254676.681		163	318019.6691	6255260.078
	87	317977.8763	6254864.99		50	318066.0658	6254666.807		164	318014.3333	6255266.674
	88	317963.66	6254730.595						165	318047.1482	6255263.217
	89	317960.1749	6254728.899						166	318040.5501	6255257.879
	90	317957.0243	6254726.641								
	91	317954.2975	6254723.886								
	92	317952.0721	6254720.713								
	93	317950.4112	6254717.211								
	94	317949.3619	6254713.479								
	95	317948.9542	6254709.625								
	96	317949.1995	6254705.756								
	97	317950.091	6254701.984								
	98	317951.6032	6254698.415								
	99	317953.6933	6254695.151								
	100	317956.3018	6254692.284								
	101	317959.3547	6254689.896								

Coord. Sys.: GDA 1994, MGA Zone 56

Stage 2 Boundary					
Point ID	Eastings	Northings	Point ID	Eastings	Northings
1	318196.68	6255247.46	27	318104.15	6254697.23
2	318141.87	6254739.38	28	318102.90	6254695.61
3	318137.61	6254738.63	29	318101.73	6254693.91
4	318130.39	6254734.88	30	318100.65	6254692.16
5	318121.87	6254725.91	31	318099.69	6254690.37
6	318120.73	6254724.09	32	318092.78	6254681.04
7	318120.54	6254723.71	33	318079.87	6254676.68
8	318120.35	6254723.33	34	318066.07	6254666.81
9	318120.16	6254722.95	35	318056.91	6254654.83
10	318119.98	6254722.56	36	318043.74	6254648.56
11	318119.81	6254722.17	37	318030.00	6254640.49
12	318119.29	6254720.83	38	318016.18	6254631.52
13	318118.87	6254719.45	39	318004.07	6254622.47
14	318118.50	6254718.05	40	317990.61	6254615.31
15	318118.12	6254716.65	41	317982.79	6254606.75
16	318117.70	6254715.26	42	317970.15	6254598.70
17	318117.07	6254713.28	43	317958.71	6254590.67
18	318116.45	6254711.26	44	317950.05	6254583.90
19	318115.78	6254709.28	45	317943.80	6254581.46
20	318114.96	6254707.40	46	317814.42	6254595.02
21	318113.93	6254705.68	47	317830.89	6254750.74
22	318112.50	6254704.12	48	317710.48	6254763.47
23	318110.77	6254702.78	49	317737.74	6255021.12
24	318108.91	6254701.53	50	317677.11	6255027.53
25	318107.09	6254700.24	51	317705.68	6255299.19
26	318105.48	6254698.77			

Coord. Sys: GDA 1994, MGA Zone 56

Remediation Extents							
Area	Point ID	Eastings	Northings	Area	Point ID	Eastings	Northings
AEC-1	1	317716.05	6255262.49	AEC-4	26	317839.39	6254721.99
	2	317716.65	6255271.91		27	317869.92	6254718.42
	3	317728.34	6255271.26		28	317884.58	6254711.20
	4	317727.75	6255261.49		29	317892.79	6254699.08
AEC-3a	5	317994.13	6254852.79		30	317911.60	6254689.39
	6	318022.23	6254849.27		31	317923.38	6254680.21
	7	318018.09	6254804.18		32	317950.80	6254675.96
	8	317978.32	6254808.77		33	318014.71	6254669.06
	9	317981.30	6254834.07		34	317971.37	6254626.91
	10	317991.89	6254833.28		35	317943.14	6254599.61
AEC-3b	11	317978.56	6254808.77		36	317931.37	6254595.99
	12	318034.65	6254802.17		37	317828.60	6254605.82
	13	318032.22	6254787.63	AEC-14a	38	318033.37	6255086.54
	14	317976.91	6254793.31		39	318034.30	6255097.41
AEC-3d	15	317861.71	6254862.73		40	318038.68	6255097.10
	16	317889.90	6254859.37		41	318037.75	6255086.06
	17	317889.20	6254844.95		42	317970.39	6255049.05
	18	317860.45	6254847.77		43	317995.05	6255046.71
AEC-3e	19	317890.65	6254750.25		44	317985.35	6254967.01
	20	317891.71	6254763.79		45	317983.46	6254967.15
	21	317933.24	6254760.33		46	317993.02	6255045.00
	22	317931.22	6254727.52		47	317970.24	6255047.18
	23	317926.69	6254726.06				
	24	317908.95	6254727.44				
	25	317889.20	6254730.13				

Coord. Sys.: GDA 1994, MGA Zone 56

Remediation Area of Concern	Estimated In-situ Volume (m^3)	Area (m^2)	Excavation Depth (m)
AEC-1	23	113	0.2
AEC-3A	3166	1583	2
AEC-3B	678	848	0.8
AEC-3D	842	421	2
AEC-3E	1400	1400	1
AEC-4	6968	13936	0.5
AEC-14A	90	50	1.8
AEC-14B	192	192	1

Legend
- Stage 2 Boundary
- Western Area Boundary

Revised Extent of Remediation:
- In-situ Management with Engineered Capping Layer
- Excavation/On-site Biopiling for Re-use
- Excavation/Offsite Disposal (asbestos)

Proposed Lot Boundaries

F2

Drawing No: 0561882s_S2RAP_G017_R0.mxd	Clyde WARP - Detailed Remediation Action Plan (Stage 2) Durham Street, Rosehill NSW
Date: 07/07/2021 Drawing Size: A3	
Drawn By: GC Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

0 25 50 75m

N

ERM

APPENDIX A CIVIL AND CAPPING DESIGN DRAWINGS (COSTIN ROE)

CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE NSW 2142
PART LOT 100 DP1168951
PROPOSED LOT 64 CAPPING WORKS

DRAWING LIST:

DRAWING NO.	DRAWING TITLE
CO13919.06-CC10	DRAWING LIST & GENERAL NOTES
CO13919.06-CC11	GENERAL ARRANGEMENT PLAN
CO13919.06-CC12	EXISTING SITE LEVELS & FEATURES
CO13919.06-CC30	PROPOSED EARTHWORKS PLAN
CO13919.06-CC35	PROPOSED EARTHWORKS SECTIONS
CO13919.06-CC40	PROPOSED CAPPING & GRADING PLAN
CO13919.06-CC45	STORMWATER DRAINAGE DETAILS AND LONGSECTIONS
CO13919.06-CC55	TYPICAL DETAILS - SHEET 1
CO13919.06-CC56	TYPICAL DETAILS - SHEET 2

LOCALITY PLAN
SCALE 1:2000

GENERAL NOTES:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
2. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
3. ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE.
   ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS.
   ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT.
   REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.
4. DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
5. UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
6. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

ELECTRONIC INFORMATION NOTES:

1. THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
2. THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
4. THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.

20m 0 50 100 150 200m
SCALE 1:2000 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC10

CONSULT AUSTRALIA

Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
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e: mail@costinroe.com.au w: costinroe.com.au
COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
DRAWING LIST & GENERAL NOTES

DRAWING No: CO13919.06-CC10
ISSUE: A

GENERAL ARRANGEMENT PLAN
SCALE 1:1000

FOR CONSTRUCTION CERTIFICATE

10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

CLIENT: VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC11

CONSULT AUSTRALIA

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CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
GENERAL ARRANGEMENT PLAN

DRAWING No C013919.06-CC11
ISSUE A

EXISTING SITE LEVELS AND FEATURES
SCALE 1:250

EXISTING SERVICES NOTES:

1. DURING THE EXECUTION OF WORKS, THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF EXISTING SERVICES. THE CONTRACTOR SHALL REPAIR ANY DAMAGE CAUSED TO THE EXISTING SERVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE RELEVANT SERVICE AUTHORITY, AT NO COST TO THE PRINCIPAL.
2. WHERE IT IS NECESSARY TO REMOVE, DIVERT OR CUT INTO ANY EXISTING SERVICE, THE CONTRACTOR SHALL GIVE AT LEAST THREE (3) DAYS NOTICE OF ITS REQUIREMENTS TO THE SUPERINTENDENT, WHO WILL ADVISE WHAT ARRANGEMENTS SHOULD BE MADE FOR THE ALTERATION OF SUCH EXISTING WORKS.
3. EXISTING SERVICES HAVE BEEN PLOTTED FROM SUPPLIED DATA. THE ACCURACY IS NOT GUARANTEED. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO COMMENCING WORK. ALL CLEARANCES AND APPROVALS SHALL ALSO BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY PRIOR TO THE COMMENCEMENT OF WORK.
4. ALL NEW AND EXHUMED SERVICES THAT CROSS EXISTING AND FUTURE ROADS/PAVEMENTS WITHIN THE SITE SHALL BE BACKFILLED WITH DGB20 MATERIAL TO SUBGRADE LEVEL AND COMPACTED TO 98% STANDARD DENSITY RATIO. SUBJECT TO PRIOR APPROVAL FROM RELEVANT AUTHORITY.
5. ON COMPLETION OF SERVICES INSTALLATION. ALL DISTURBED AREAS SHALL BE RESTORED TO ORIGINAL, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AREAS, GRASSED AREAS AND ROAD PAVEMENTS.
6. CARE TO BE TAKEN WHEN EXCAVATING NEAR UTILITY SERVICES. NO MECHANICAL EXCAVATION TO BE UNDERTAKEN OVER SERVICES. LIAISE WITH RELEVANT AUTHORITY.
7. THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL IF REQUIRED OF ALL EXISTING SERVICES IN AREAS AFFECTED BY THE WORKS WITHIN THE CONTRACT AREA AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT. ALL TO REGULATORY AUTHORITY STANDARDS AND APPROVAL.
8. THE CONTRACTOR IS TO MAINTAIN EXISTING STORMWATER DRAINAGE FLOWS THROUGH THE ROADS AT ALL TIMES. MAKE DUE ALLOWANCE FOR ALL SUCH FLOWS AT ALL TIMES.
9. PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL OBTAIN THE SUPERINTENDENT'S APPROVAL OF THE PROGRAM FOR THE RELOCATION/CONSTRUCTION OF TEMPORARY SERVICES.
10. CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES AS REQUIRED TO MAINTAIN EXISTING SUPPLY TO BUILDINGS REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.
11. INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE OR DAMAGE TO THE ADJACENT RESIDENCES. CONTRACTOR TO GAIN APPROVAL OF THE SUPERINTENDENT FOR TIME OF INTERRUPTION.
12. THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG (DBYD 1100) SERVICES SEARCH BEFORE THE COMMENCEMENT OF ANY WORKS.

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA EnergyAustralia
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC12

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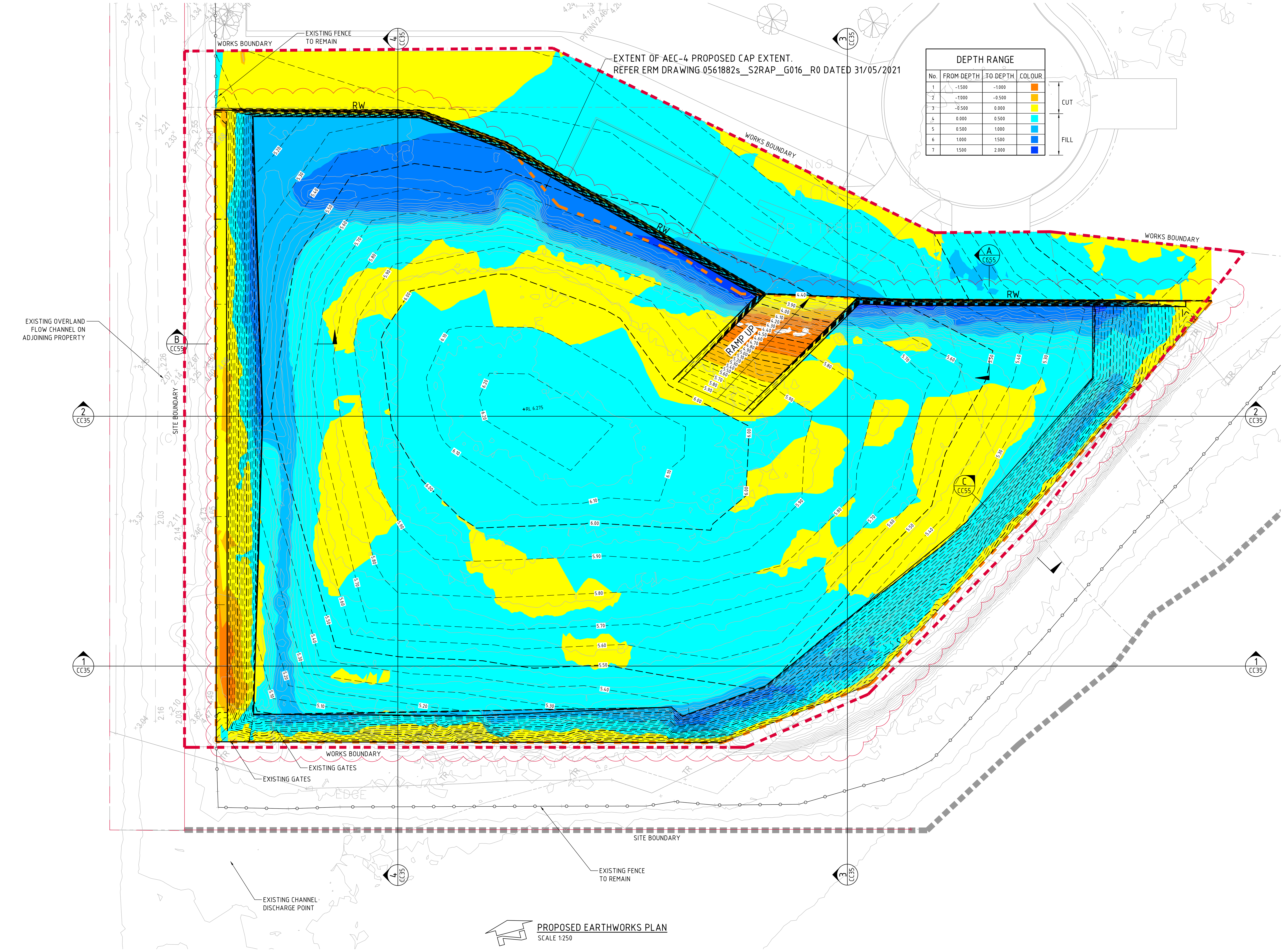
CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE: EXISTING SITE LEVELS & FEATURES
DRAWING No: C013919.06-CC12
ISSUE: A



DEPTH RANGE				
No.	FROM DEPTH	TO DEPTH	COLOUR	
1	-1.500	-1.000		CUT
2	-1.000	-0.500		
3	-0.500	0.000		
4	0.000	0.500		FILL
5	0.500	1.000		
6	1.000	1.500		
7	1.500	2.000		

PROPOSED EARTHWORKS PLAN
SCALE 1:250

SITE PREPARATION NOTES:

1. ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT SYDGE289002-AB PROVIDED BY TETRA TECH COFFEY DATED 17 AUGUST 2021.
2. EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY ERM TITLED 0561882s_S2RAP_G016_R0 DATED 31 MAY 2021..
3. STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
4. COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
5. PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
6. AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
7. SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
8. IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
9. ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE LAYER. FURTHER, LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (AS1289.5.4.1) OR HILF TEST METHOD (AS1289.5.7.1). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS SHOULD BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION
10. ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS [IN THE STATED PERIOD] ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION.
11. PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
12. EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
13. MATCH EXISTING LEVELS AT BATTER INTERFACE.
14. CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
15. DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

ALLOWANCES FOR STRUCTURE

	DEPTH OF PAVEMENT
PAVEMENT	725mm
LANDSCAPING	300mm

EARTHWORK ESTIMATES

SITE AREA = 1.65 Ha

CUT = - 700m³
FILL = +3,400m³

ALLOWANCES
RETAINING WALLS = -1,000m³ (APPROX. TBC)
STORMWATER = - 100m³ (APPROX. TBC)
SERVICES TRENCH = - 600m³ (APPROX. TBC)

DIFFERENCE = +1,000m³ (i.e. FILL OVER CUT)

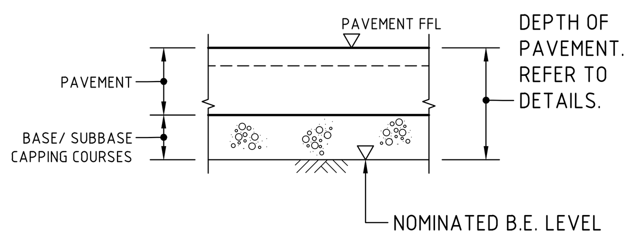
NOTE:
VOLUMES BASED ON NO TOPSOIL/ PAVEMENT STRIP OVER THE NOMINATED AREA. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED EXCAVATION RELATED TO CONSTRUCTION ACTIVITIES. DETAILED EXCAVATION ALLOWANCE IS APPROXIMATE ONLY AND ACCOUNTS FOR RETAINING WALL CONSTRUCTION. THE ALLOWANCES VOLUMES ARE TO BE CONFIRMED BY THE CONTRACTOR. REFER ANY CONCERNS TO ENGINEER.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ERM DATED 31 MAY 2021.

50.00 - EXISTING CONTOUR
50.00 - B.E.L. CONTOUR (MAJOR 0.5m)
50.10 - B.E.L. CONTOUR (MINOR 0.1m)
50.000 - B.E.L. SPOT LEVEL
- CAPPING BOUNDARY
- WORKS BOUNDARY



NOMINATED B.E.L. DETAIL
NTS

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED	05.03.24	C
REVISED AS CLOUDED	16.02.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC30

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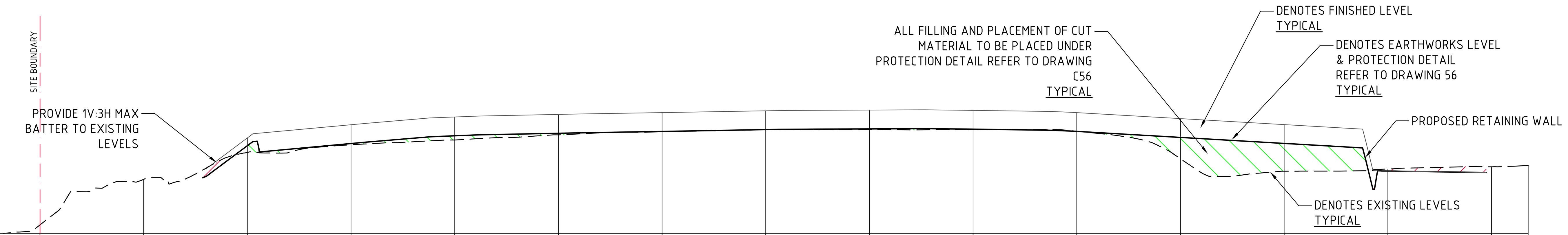
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
PROPOSED EARTHWORKS PLAN
DRAWING No CO13919.06-CC30
ISSUE C

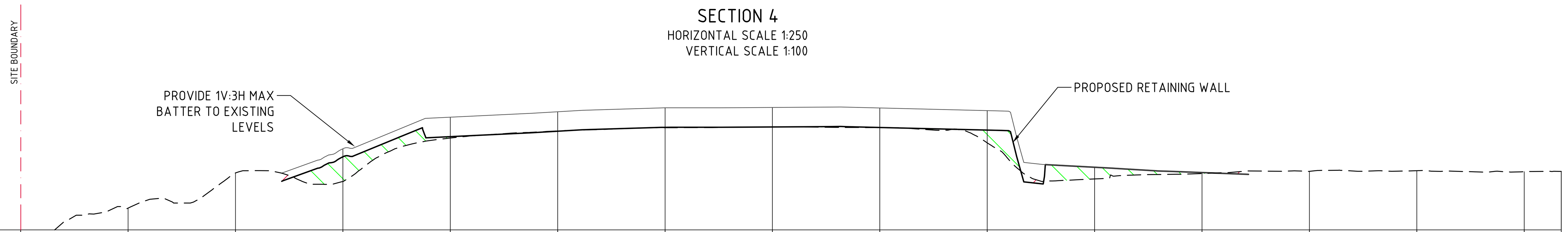
LEGEND:

- DENOTES FINISHED LEVELS PROFILE
- DENOTES EARTHWORKS PROFILE
- DENOTES EXISTING PROFILE
- DENOTES AREA IN CUT
- DENOTES AREA IN FILL



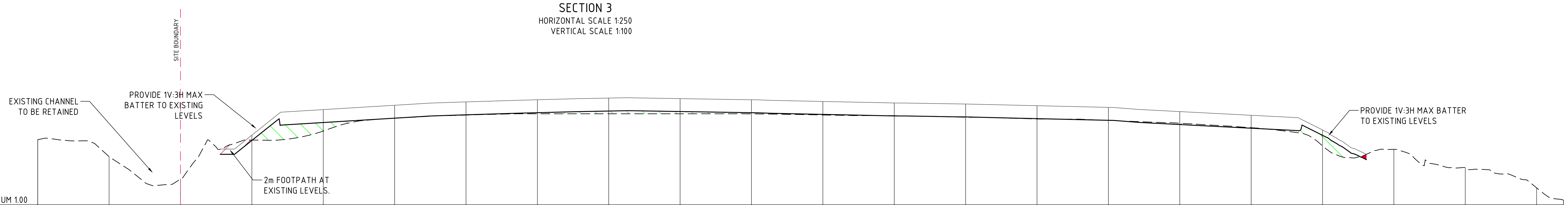
FINISHED SURFACE LEVEL				5.679	6.188	6.487	6.586	6.656	6.725	6.753	6.742	6.657	6.426	6.195	4.405		
BULK EARTHWORKS LEVEL				5.379	5.463	5.762	5.861	5.931	6.000	6.028	6.017	5.932	5.701	5.470	4.405		
CUT/FILL DEPTH				0.256	0.047	0.162	0.061	0.014	0.002	0.028	0.018	-0.006	0.827	1.071	-0.077		
EXISTING SURFACE LEVEL	1.82	2.327	4.085	5.123	5.415	5.600	5.800	5.917	5.999	6.000	5.999	5.938	4.874	4.399	4.481	4.567	4.62
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	153.538

SECTION 4
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



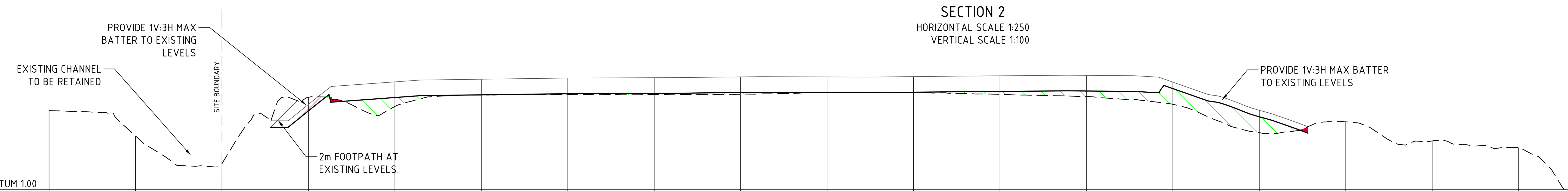
FINISHED SURFACE LEVEL					5.018	6.191	6.395	6.540	6.555	6.534	6.436	4.331	4.132				
BULK EARTHWORKS LEVEL					4.718	5.466	5.670	5.815	5.830	5.809	5.711	4.331	4.132				
CUT/FILL DEPTH					0.920	0.050	-0.011	0.015	0.000	0.005	0.474	0.436	0.036				
EXISTING SURFACE LEVEL	0.79	1.306	2.809	4.118	3.798	5.416	5.681	5.800	5.830	5.804	5.237	3.895	4.096	4.179	4.203	4.165	4.18
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	153.457

SECTION 3
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



FINISHED SURFACE LEVEL				4.903	6.333	6.576	6.766	6.885	6.979	6.951	6.886	6.790	6.705	6.647	6.552	6.458	6.223	6.017	5.192				
BULK EARTHWORKS LEVEL				4.603	5.608	5.851	6.041	6.160	6.254	6.226	6.161	6.065	5.980	5.922	5.827	5.733	5.498	5.292	4.892				
CUT/FILL DEPTH				-0.023	0.475	-0.010	0.016	0.060	0.154	0.126	0.066	0.032	-0.016	0.018	0.019	0.005	-0.076	-0.028	0.592				
EXISTING SURFACE LEVEL	4.65	3.692	2.434	4.626	5.132	5.861	6.025	6.100	6.100	6.100	6.096	6.033	5.995	5.903	5.808	5.727	5.574	5.321	4.300	4.104	3.085	1.946	1.26
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	213.750

SECTION 2
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



FINISHED SURFACE LEVEL				4.951	5.994	6.118	6.171	6.187	6.226	6.226	6.240	6.277	6.297	5.983	4.677							
BULK EARTHWORKS LEVEL				4.651	5.269	5.393	5.446	5.462	5.501	5.501	5.515	5.552	5.572	5.683	4.377							
CUT/FILL DEPTH				-0.628	0.413	0.012	0.042	0.052	0.078	0.010	0.017	0.134	0.258	0.730	0.733							
EXISTING SURFACE LEVEL	4.66	3.486	2.201	5.279	4.856	5.381	5.404	5.410	5.422	5.491	5.498	5.419	5.313	4.953	3.643	4.145	3.256	2.941	0.551	0.546	0.543	0.475	0.46
CHAINAGE		10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	

SECTION 1
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100

1m 0 1 2 3 4 5 6 7 8 9 10m
SCALE 1:100 AT A0 SIZE SHEET

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ALL PAVEMENT AND SUBGRADE LEVELS RAISED 300mm	05.03.24	C
REVISED AS CLOUDED	16.02.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

CLIENT: VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC35

CONSULT AUSTRALIA

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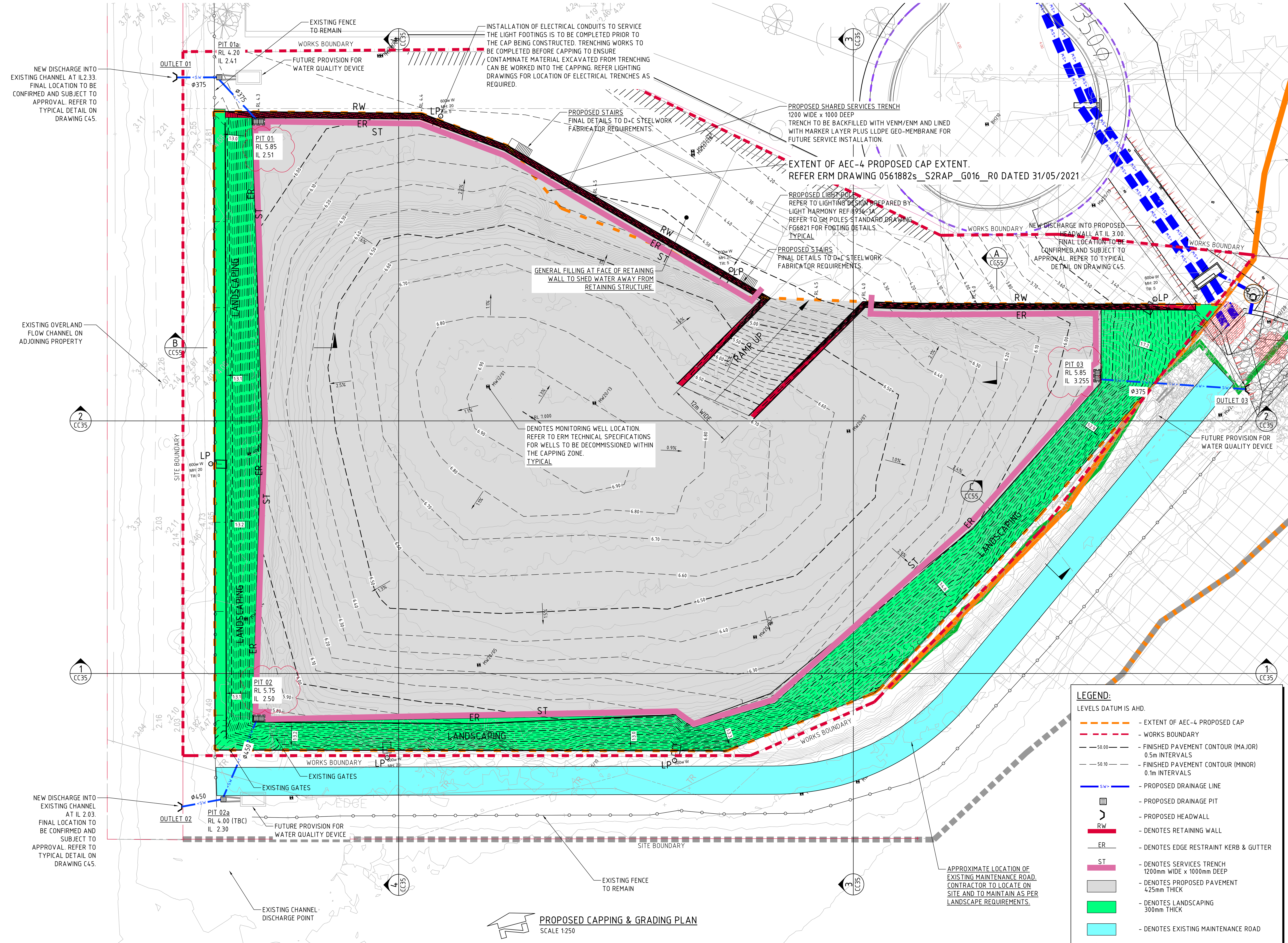
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE: PROPOSED EARTHWORKS SECTIONS

DRAWING No: C013919.06-CC35

ISSUE: C



LEGEND:

LEVELS DATUM IS AHD.

- EXTENT OF AEC-4 PROPOSED CAP
- WORKS BOUNDARY
- 50.00 FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- SW PROPOSED DRAINAGE LINE
- PROPOSED DRAINAGE PIT
- PROPOSED HEADWALL
- RW DENOTES RETAINING WALL
- ER DENOTES EDGE RESTRAINT KERB & GUTTER
- ST DENOTES SERVICES TRENCH 1200mm WIDE x 1000mm DEEP
- DENOTES PROPOSED PAVEMENT
- DENOTES LANDSCAPING 425mm THICK
- DENOTES EXISTING MAINTENANCE ROAD
- LP DENOTES LIGHT POLE

FINISHED LEVELS PLAN NOTES:

1. LEVELS DATUM IS AUSTRALIAN HEIGHT DATUM (A.H.D.).
2. GRADING REQUIREMENTS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS2890.1, AS2890.2 AND AS2890.6.
3. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
4. CONTOUR INTERVALS
   - THE MINOR CONTOUR INTERVAL IS 0.1m.
   - THE MAJOR CONTOUR INTERVAL IS 0.5m.
5. HARDSTAND GRADING
   - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
   - GRADING OF ON-GRADE DOCKS TO BE 1:100 (1%) FALL AWAY FROM THE DOCK FACE FOR A LENGTH OF 15m U.N.O.
   - GRADING OF TRUCK CIRCULATION ZONES TO BE MINIMUM AS NOTED ABOVE, 3-4% NOMINAL AND MAX. 5%.
6. CAR PARKING AREA GRADES
   - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%), DESIRABLE MINIMUM GRADE 1:50 (2%).
   - MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) N CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
   - DISABLED ACCESS PARKING ZONES AND SHARED SPACE TO BE MAXIMUM OF 1:33 (3%) IN ASPHALT PAVEMENT AND MAXIMUM OF 1:40 (2.5%) IN CONCRETE PAVEMENT.
   - CARPARK RAMP GRADES TO BE MAX 1:5 WITH 2.5m SMOOTH TRANSITION AT TOP AND BOTTOM U.N.O.
7. TRUCK RAMP GRADES
   - MAXIMUM B-DOUBLE OR 19.0m AV RAMP GRADES ARE TO BE 1:8.3 (12%) U.N.O. ON PLAN
   - PROVIDE MINIMUM 4.0m LONG TRANSITION WHERE CHANGES OF GRADE EXCEED 1:20 (5%) AT A CREST U.N.O.
   - PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGE OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
   - TRANSITIONS ARE TO PROVIDE A SMOOTH CONTINOUS CIRCULAR AND TANGENTIAL CHANGE IN GRADE TO ENSURE NO SHARP OR ACUTE CHANGES IN GRADE ARE PRESENT.
8. WHERE FIRE BRIGADE ACCESS IS REQUIRED, MAXIMUM RAMP GRADIENTS ARE TO BE 1:6 (16.6%), DESIRABLE RAMP GRADIENTS ARE TO BE 1:8 (12.5%) WITH 7m TRANSITION TOP AND BOTTOM U.N.O. ON PLAN.
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O. BASED ON GEOTECHNICAL ASSESSMENT. PROVIDE MINIMUM 0.5m BERM BETWEEN THE BACK OF KERB OR PAVEMENT EDGES AND THE TOP OR TOE OF A BATTER.
10. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
12. ALL PAVEMENTS ARE TO BE SET AT 30mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS. PROVIDE LOCAL FEATHERING AT DOORWAYS OR ROLLER SHUTTERS TO PROVIDE FLUSH FINISH AS REQUIRED.
13. WHERE NEW AND EXISTING INTERFACING IS REQUIRED, MATCH EXISTING LEVELS AND PROVIDE SMOOTH INTERFACE BETWEEN NEW AND EXISTING GRADIENTS. REFER ANY CONCERNS TO THE ENGINEER.

STORMWATER DRAINAGE NOTES:

1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
3. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
4. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
5. ALL STORMWATER PIPES Ø375 OR GREATER SHALL BE CLASS 2 (WITH HS2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
6. ALL PIPES UP TO AND INCLUDING Ø300 TO BE uPVC GRADE SN8 UNO.
7. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
8. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c=25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
9. IN ADDITION TO ITEM 9 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
10. PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
11. CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING HS2 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
12. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 uPVC TO EACH SIDE OF PIPE.
13. ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
14. WHERE SUBSOIL DRAINAGE PASSES UNDER A PAVEMENT OR A SLAB, UNSLOTTED UPVC ARE TO BE PROVIDED UNLESS NOTED OTHERWISE.
15. ALL PIPE GRADES 1 IN 200 MINIMUM UNO.
16. PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
17. MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
18. PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY', THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' U.N.O.
19. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
20. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
21. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.
22. WHERE CONNECTION TO EXISTING INGROUND DRAINAGE SYSTEMS, OPEN SWALES, CHANNELS OR ANY OTHER EXISTING SYSTEM, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND INVERT ON SITE AT THE BEGINNING OF THE CONSTRUCTION PERIOD. REFER ANY VARIANCE FROM DOCUMENTATION OR SURVEYS TO THE ENGINEER FOR CLARIFICATION.

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
PAVEMENT LEVELS RAISED 300mm AND PIT SURFACE LEVEL REVISED	05.03.24	D
REVISED AS CLOUDED	16.02.24	C
REVISED FOR INVERTS AND OUTLET 3 AS CLOUDED	03.08.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC40

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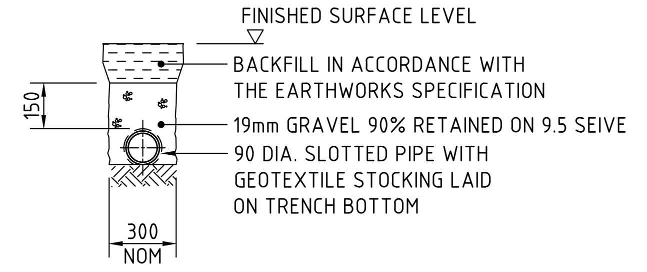
CIVIL & STRUCTURAL ENGINEERS

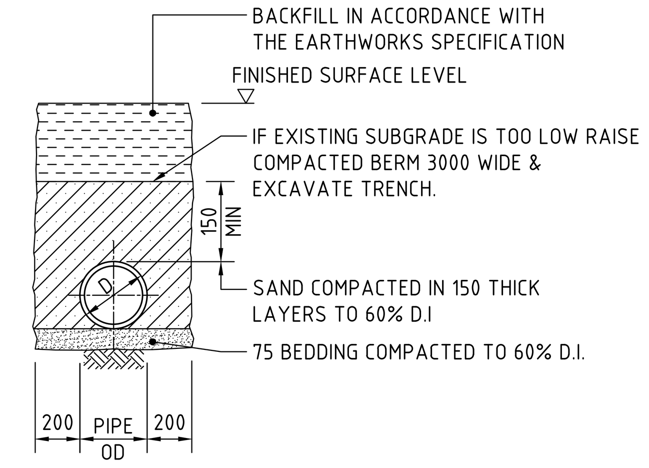
DRAWING TITLE: PROPOSED CAPPING & GRADING PLAN
DRAWING No: C013919.06-CC40
ISSUE: D



SUPPORT TO AGRICULTURAL DRAIN

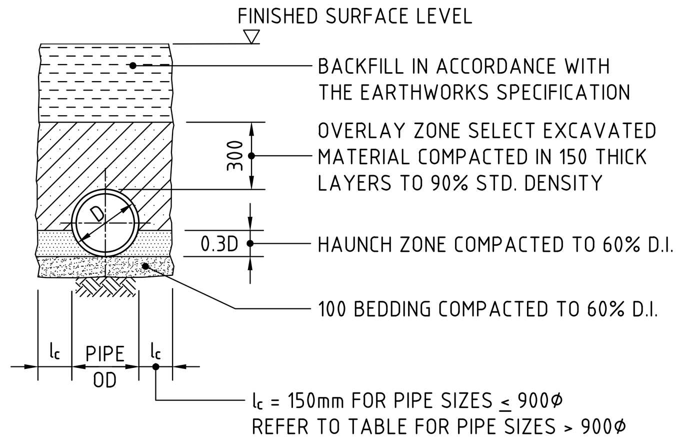
SCALE 1:20

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0



SUPPORT TO uPVC PIPES

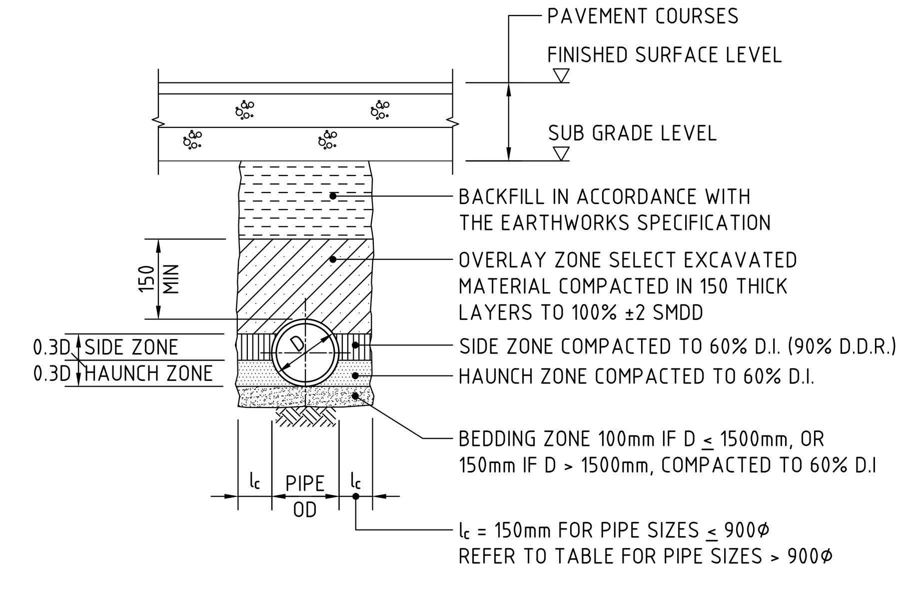
SCALE 1:20



TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS

SCALE 1:20

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	20 TO 0



TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT

SCALE 1:20

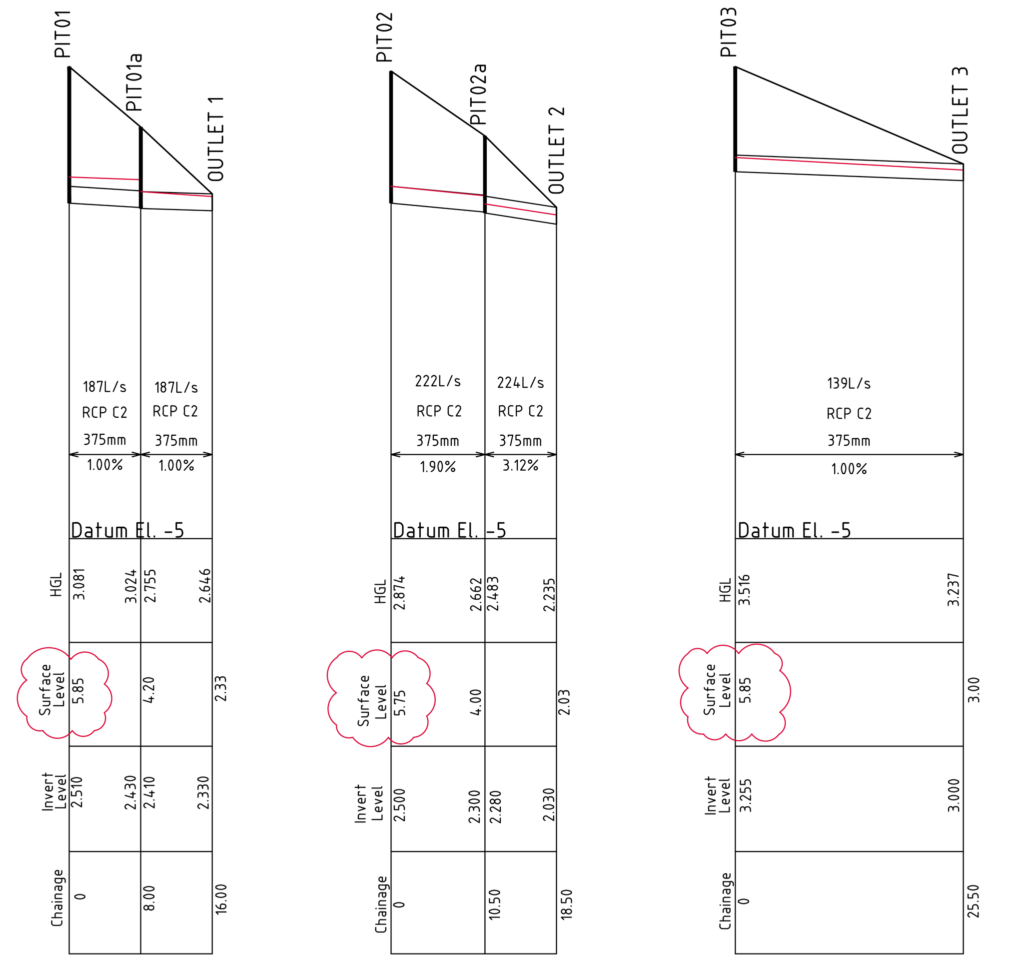
D ≤ 1350, MAX FILL = 4.0m

D > 1350, MAX FILL = 3.0m

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE WIDTH	
PIPE SIZE (mm)	lc (mm)
≤ 900Ø	150
1050Ø	175
1200Ø	200
1350Ø	225
1500Ø	250
1650Ø	275
1800Ø	300
ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800Ø	

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0
SELECT FILL MATERIAL IN ACCORDANCE WITH TABLE 7 AS 3725:2007	



PIT 01 TO OUTLET 1

SCALE 1:500 HORIZONTAL

SCALE 1:100 VERTICAL

PIT 02 TO OUTLET 2

SCALE 1:500 HORIZONTAL

SCALE 1:100 VERTICAL

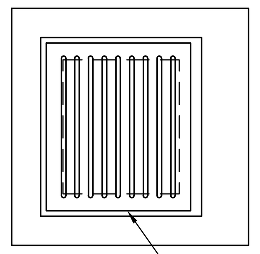
PIT 03 TO OUTLET 3

SCALE 1:500 HORIZONTAL

SCALE 1:100 VERTICAL

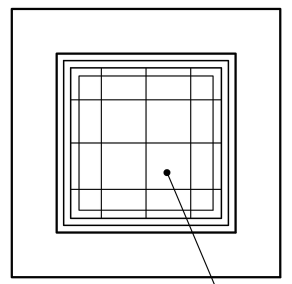
NOTE:

H.G.L & FLOWRATE SHOWN FOR Q20 A.R.I STORM EVENT



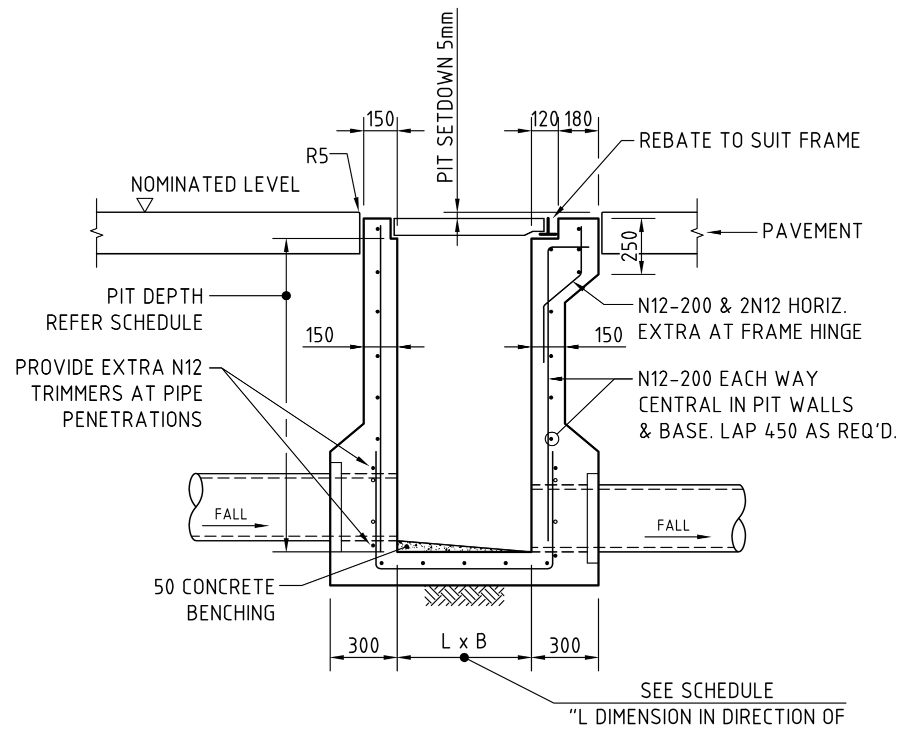
PLAN

SCALE 1:20



PLAN

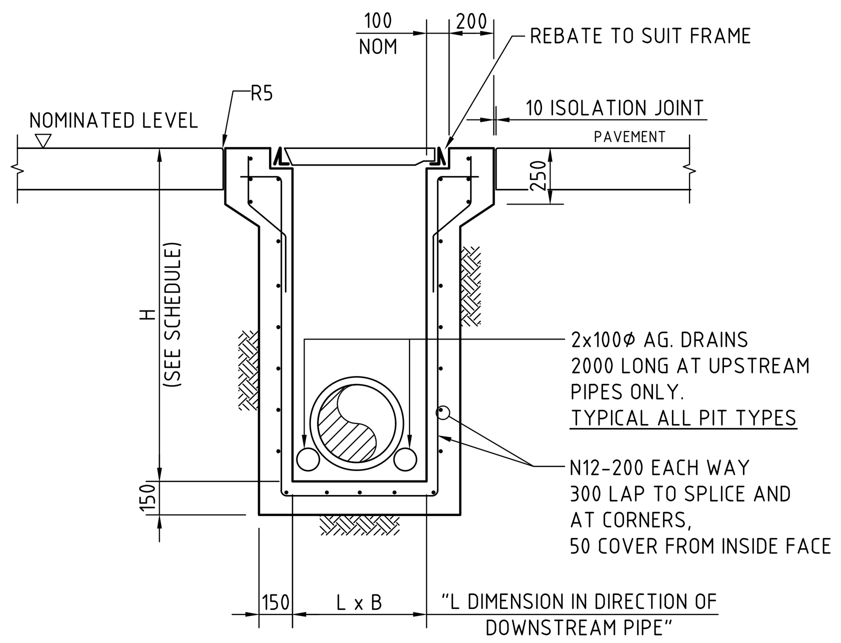
SCALE 1:20



SECTION

SCALE 1:20

SINGLE GRATED GULLY PIT - SGGP



SECTION

SCALE 1:20

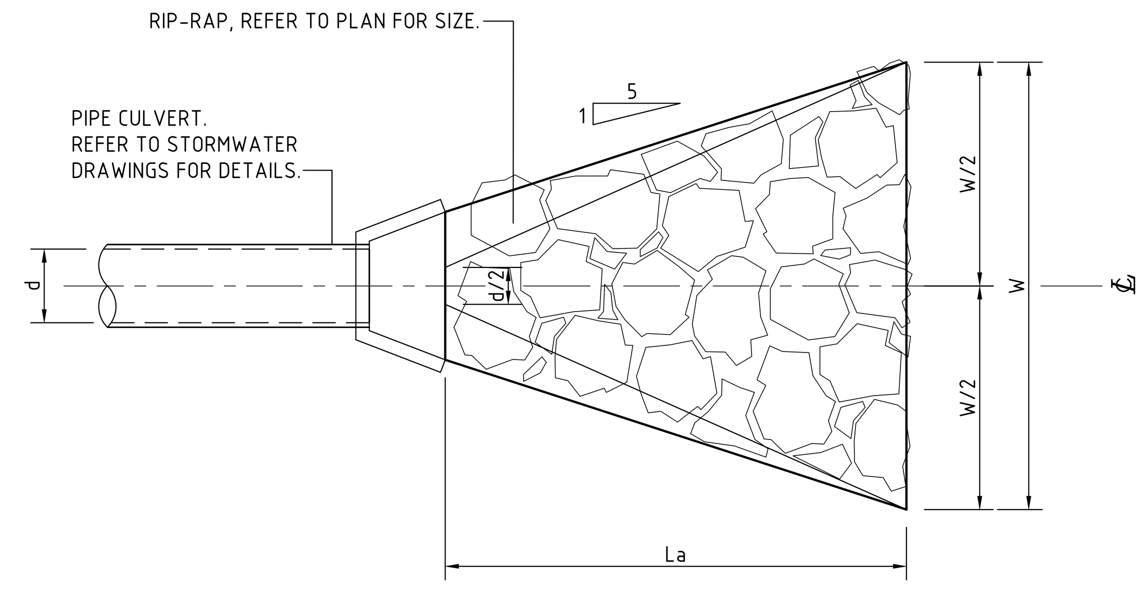
SEALED JUNCTION PIT - SJP

DISSIPATER NOTES :

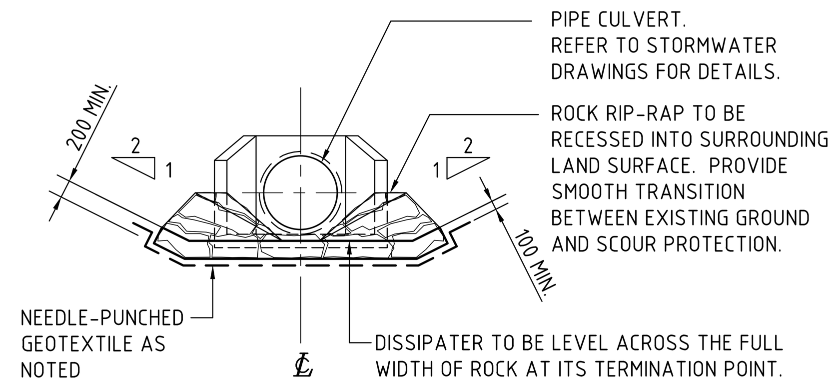
1. ALIGN STRUCTURE EVENLY WITH BANK.
2. LOCATE STRUCTURE AT INVERT LEVEL OF STREAM AND POINT IN A DOWNSTREAM DIRECTION.
3. PIPE TO REST ON, AND BE PACKED IN, BY RIP-RAP (SIZE AS NOTED).
4. DISCHARGE INTO STREAM WHERE BEDROCK IS PRESENT, OTHERWISE SCOUR PROTECT AS REQUIRED.
5. SCOUR PROTECT THE OPPOSITE BANK AS REQUIRED. SCOUR PROTECTION TO BE PROVIDED WHERE OPPOSITE BANK IS WITHIN 12-14 TIMES THE PIPE DIAMETER.
6. RIP-RAP TO CONSIST OF ANGULAR RUN-OF-QUARRY ROCK (d50= 150mm MINIMUM) AS NOTED ON THE PLAN. RIP-RAP TO BE MINIMUM THICKNESS OF RIP-RAP LAYER TO BE 1.6x AVERAGE ROCK SIZE (d50).
7. RIP-RAP IS TO BE PLACED OVER A 200mm LAYER OF 140mm COBBLES OVER NEEDLE-PUNCHED GEOFAB A44.
8. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE FINISHED RIP-RAP SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS.
9. GAPS IN RIP-RAP TO BE HAND PACKED WITH TOPSOIL & PLANTED WITH NATIVE SEDGES & RUSHES TO PROVIDE. THE INTENT IS FOR THERE TO BE NO VOIDS BETWEEN RIP-RAP BOULDERS.
10. ENSURE THE FINISHED ROCK SURFACE BLENDS WITH THE SURROUNDING GROUND LEVELS. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
11. ENSURE THAT STORMWATER FROM SURROUNDING GROUND IS FREE TO ENTER THE STRUCTURE WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

DISSIPATER SCHEDULE

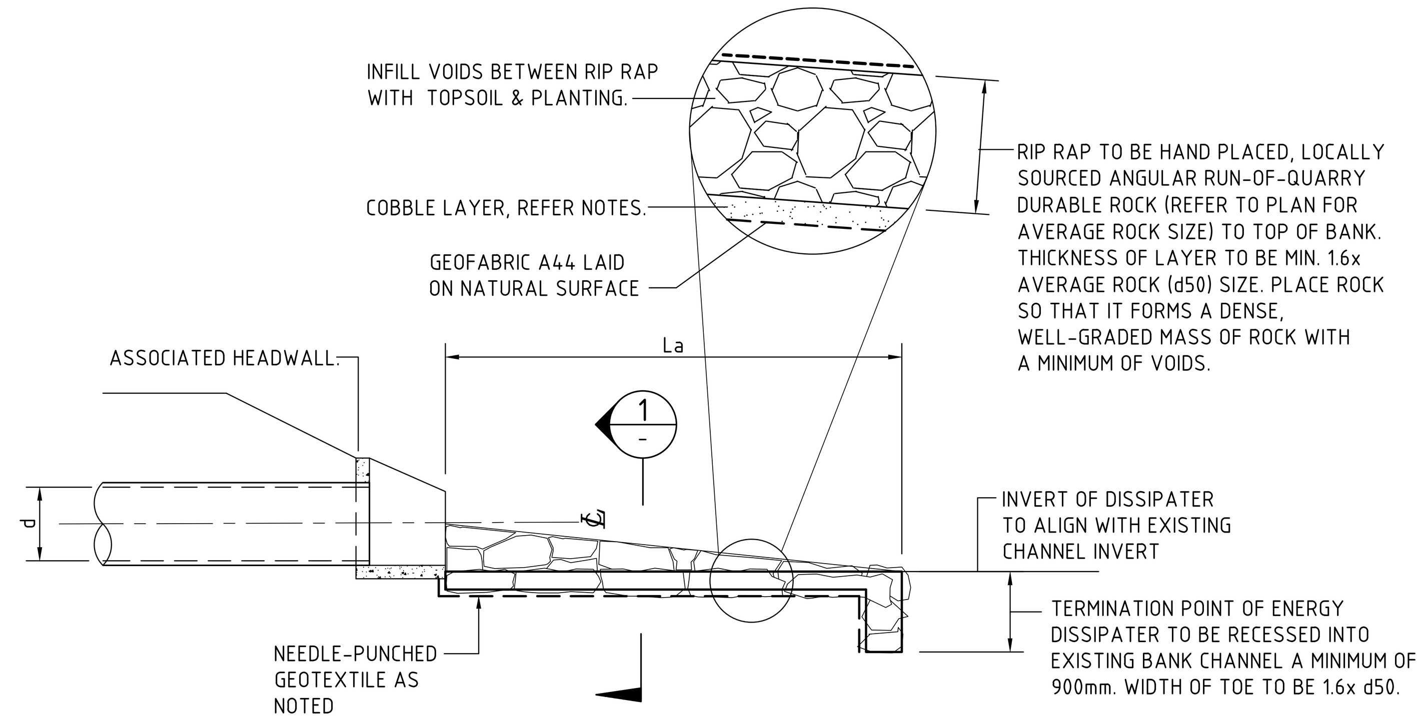
DISCHARGE POINT	d	La	W	RIP-RAP (d50)
OUTLET 01	375	2000	2000	150
OUTLET 02	450	3000	3000	200
OUTLET 03	375	2000	2000	150



PLAN



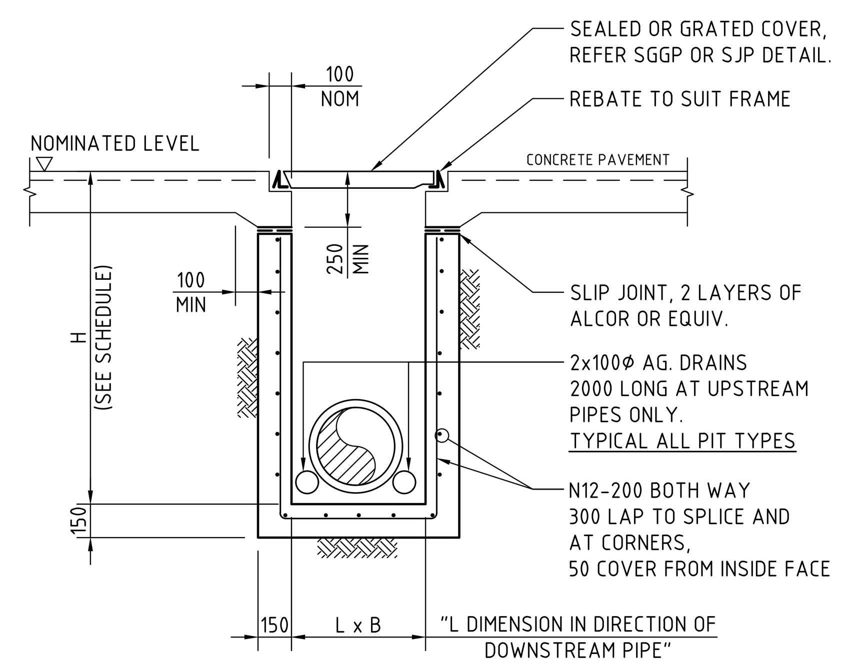
SECTION 1:50



SECTIONAL ELEVATION

STORMWATER OUTLET DISSIPATER WITH HEADWALL

SCALE 1:50



SECTION

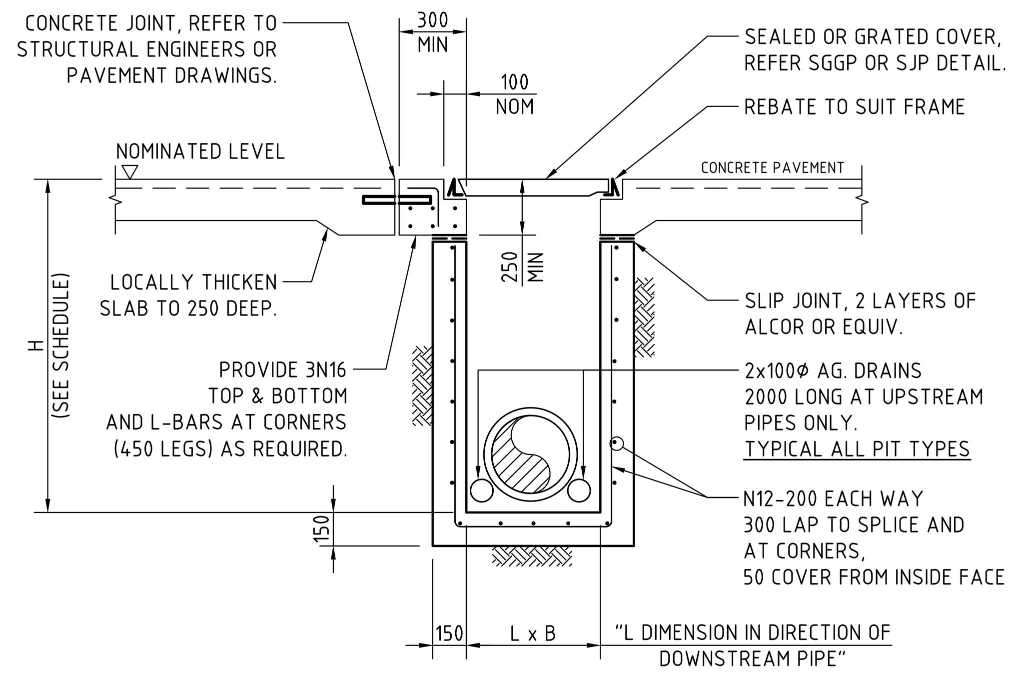
SCALE 1:20

SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL

GRATE/COVER SUPPORT

CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENTS FOR SGGP's & SJP's, WHERE JOINTS ARE NOT LOCATED WITHIN PROXIMITY OF THE GRATE)



SECTION

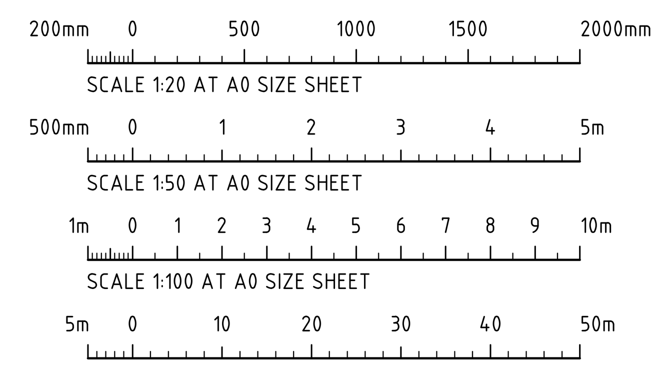
SCALE 1:20

SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL

GRATE/COVER SUPPORT

CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENT FOR SGGP's & SJP's, WHERE PITS ARE LOCATED IN THE CORNER OF SLAB PANELS OR ADJACENT TO SLAB PANEL JOINTS)



FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PIT SURFACE LEVEL	05.03.24	C
REVISED AS CLOUDED	03.08.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

ARCHITECT: VIVA EnergyAustralia

CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
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DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC45

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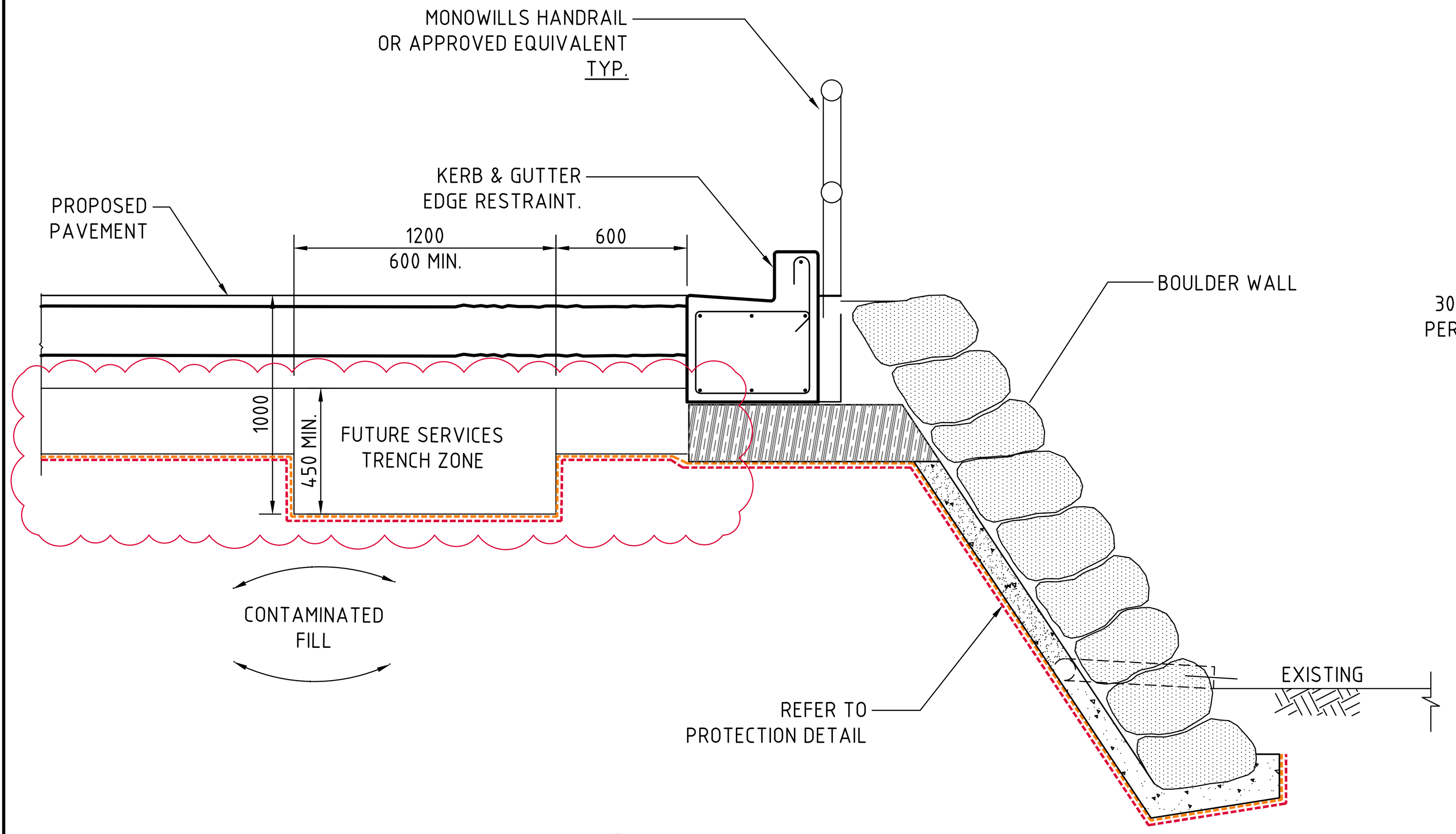
DRAWING TITLE: STORMWATER DRAINAGE DETAILS AND LONGSECTIONS

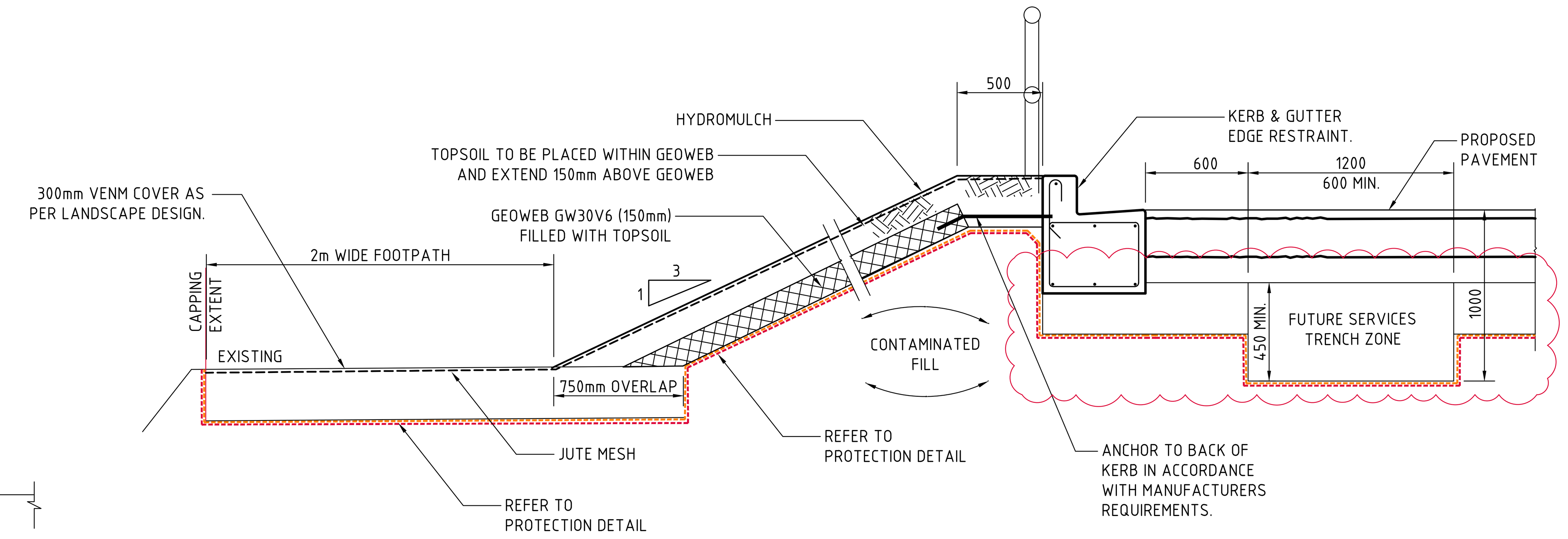
DRAWING No: C013919.06-CC45

ISSUE: C



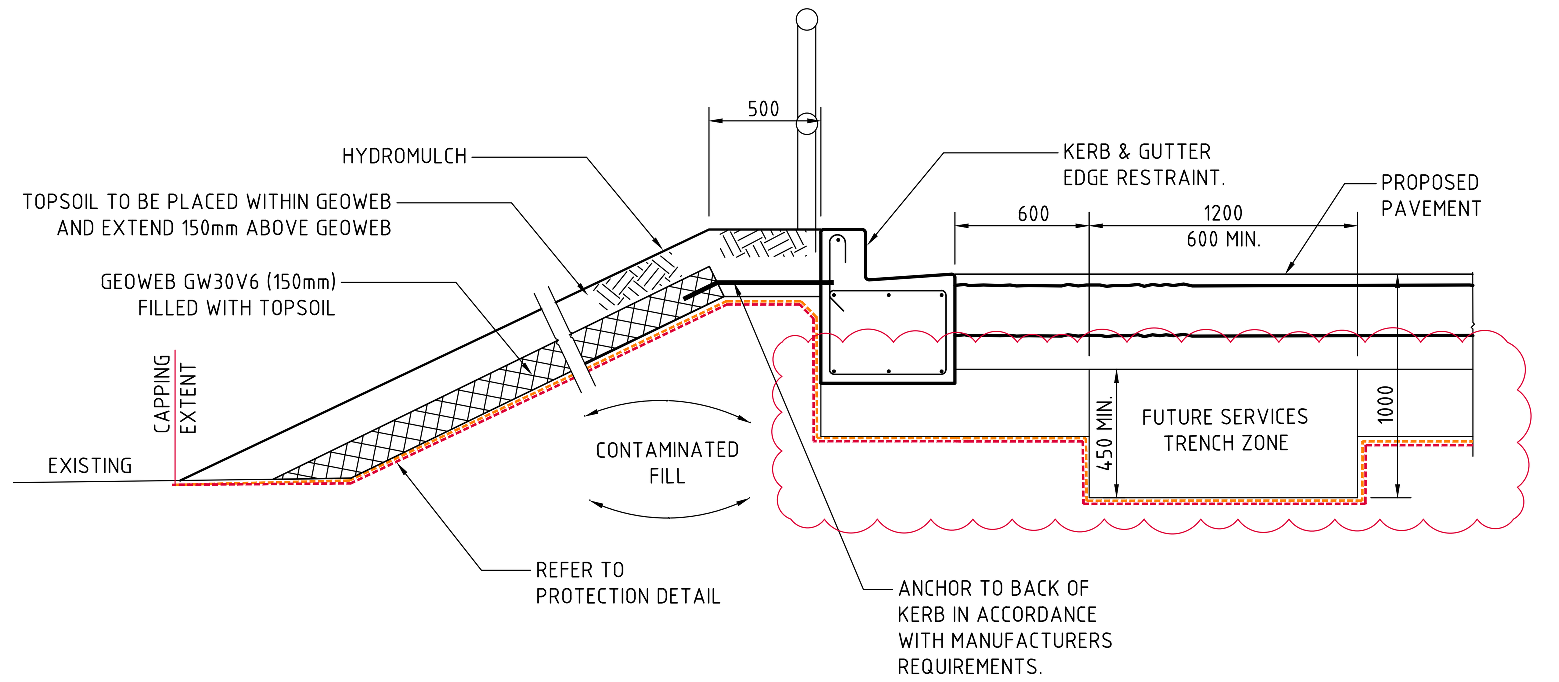
SECTION 1:20 A C40 TYPICAL INTERFACE AT TOP OF WALL

NOTE:
CRASH BARRIER REQUIREMENTS TO TOP OF WALL TO BE CONFIRMED BY CLIENT.



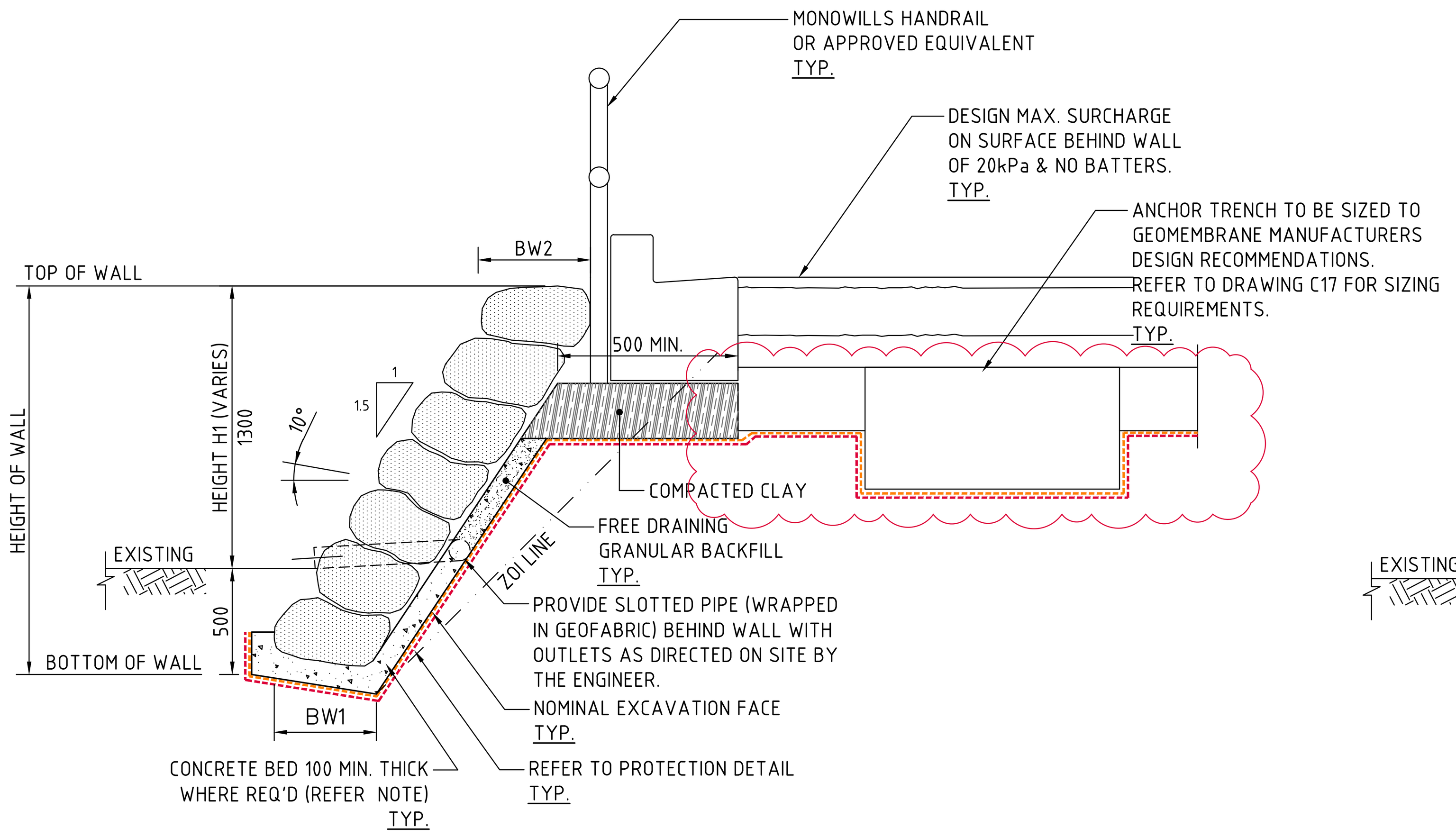
SECTION 1:20 B C40 TYPICAL INTERFACE AT WESTERN BATTER EDGE

NOTE:
GEOWEB TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS. LAYERS SHOWN ARE DIAGRAMMATIC REPRESENTATION SHOWING THE ORDER TO BE PLACED ON EACH OTHER.

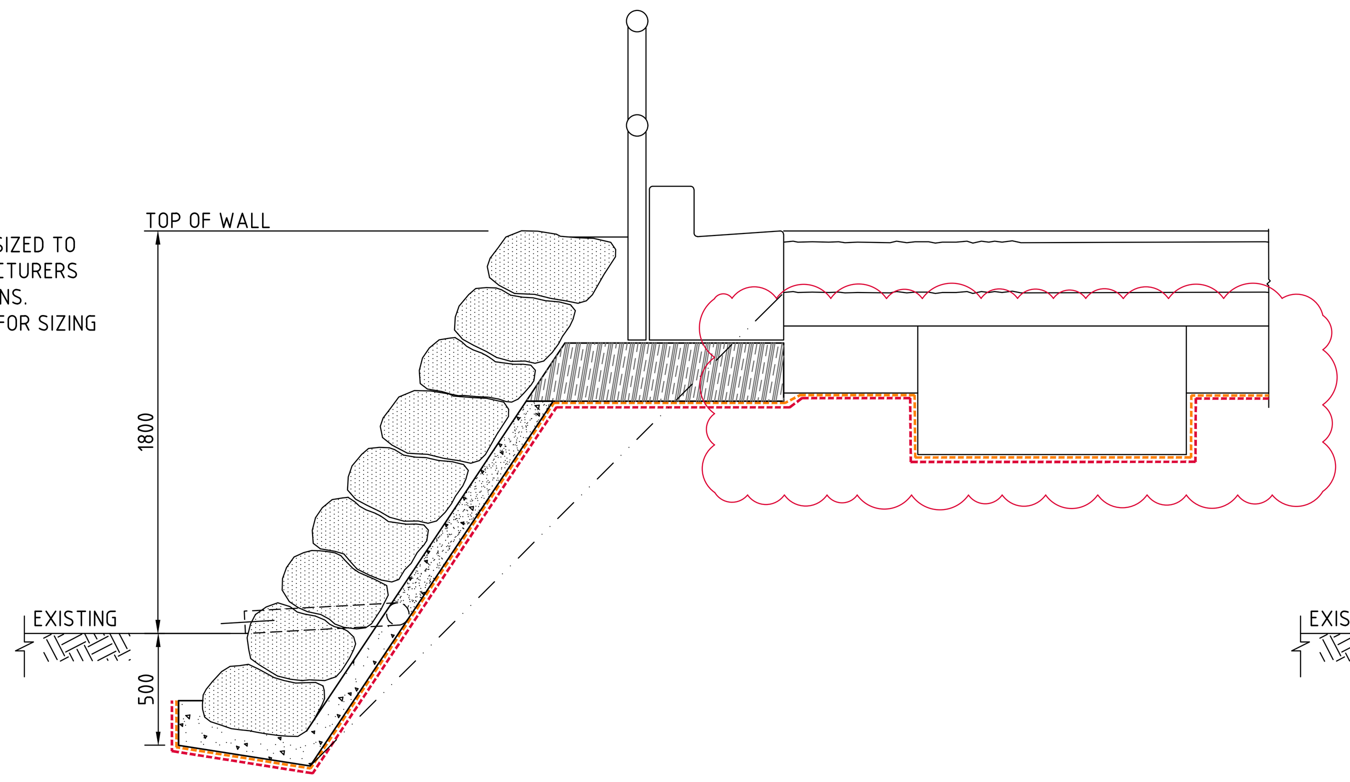


SECTION 1:20 C C40 TYPICAL INTERFACE AT SOUTHERN/EASTERN BATTER EDGE

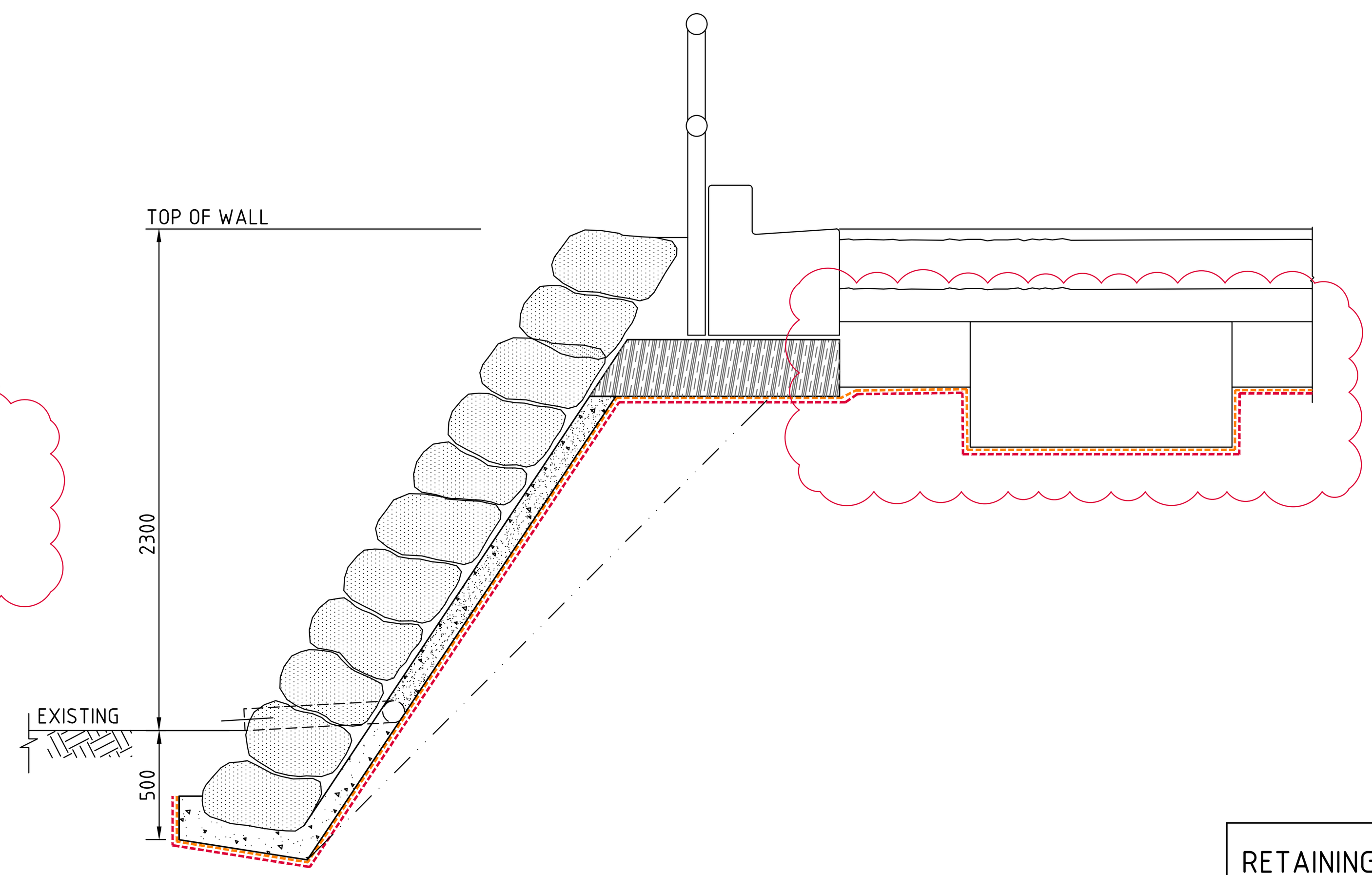
NOTE:
GEOWEB TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS. LAYERS SHOWN ARE DIAGRAMMATIC REPRESENTATION SHOWING THE ORDER TO BE PLACED ON EACH OTHER.



SANDSTONE WALL DETAIL (UP TO 1300mm HIGH)
SCALE 1:20



SANDSTONE WALL DETAIL (UP TO 1800mm HIGH)
SCALE 1:20



SANDSTONE WALL DETAIL (UP TO 2300mm HIGH)
SCALE 1:20

BOULDER RETAINING WALL NOTES:

MINIMUM BEARING CAPACITY OF FOUNDATION TO BE 150kPa ASSUMING THE FOLLOWING:
- CLAY FOUNDATION Cu=50kPa, Ø=0

SLIDING STABILITY IS BASED ON THE FOLLOWING
- FRICTION ANGLE OF BOULDER WALL : NOT LESS THAN 40°
- EFFECTIVE FRICTION ANGLE OF SOIL SUBGRADE: NOT LESS THAN 30° FOR SOIL OR 35° FOR ROCK

SOIL AND ROCK DESIGN PARAMETERS SHALL BE CONFIRMED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF BOULDERS OR CONCRETE BED.

BOULDERS TO BE A NOMINAL 750mm DIA. (500mm DIA. UP TO 1000mm DIA.) PLACED ON THEIR BROADEST BASE. BOULDERS TO BE PLACED IN AN INTERLOCKING ARRANGEMENT ON THE CONTACT SURFACES DIPPING TOWARDS BACK OF THE WALL AT 10° AND SHALL BE INSPECTED BY THE ENGINEER DURING CONSTRUCTION

DENSITY OF INDIVIDUAL BOULDERS SHALL BE MINIMUM 2.5 TONNES/m^3

FOR WALLS ABOVE 1000mm IN HEIGHT, THE FIRST LAYER OF BOULDERS ARE TO SET IN A BED OF N15 CONCRETE AND THE JOINTS BETWEEN SHALL BE FILLED WITH CONCRETE TO A LEVEL EQUAL TO THE SURFACE LEVEL OF THE TOE OF THE WALL.

NO STRUCTURE TO BE BUILT WITHIN H1 FROM THE BACK OF THE TOP OF THE WALL (WHERE H1=HEIGHT OF WALL), UNLESS THE STRUCTURE IS FOUNDED ON ROCK WITH SBV>150kPA

CONSTRUCTION METHODS AND SEQUENCE TO ENSURE THAT DESIGN MAX. SURCHARGE OF 20kPa IS NOT EXCEEDED.

CONSTRUCTION TO BE IN ACCORDANCE WITH AS 4678:2002

WALL DIMENSIONS		
HEIGHT H1	BW1	BW2
500	500	500
1000	700	600
1500	800	700
2000	1000	900
2500	1300	1200

NOTE:
REFER TO 1300mm HIGH DETAIL FOR ALL ITEMS NOT LABELED AND FOR TYPICAL NOTES.

NOTE:
REFER TO 1300mm HIGH DETAIL FOR ALL ITEMS NOT LABELED AND FOR TYPICAL NOTES.

RETAINING WALL NOTES:

1. ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
2. MINIMUM BEARING CAPACITY OF FOUNDATION TO BE AS FOLLOWS :
   a. H MAX. 2.0m = 100 kPa
   b. H MAX. 3.5m = 150 kPa
   c. H MAX. 5.0m = 200 kPa
3. BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
4. WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMDD AND PLACED WITHIN 2% OF OMC.
5. MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O.
   ON PLAN :
   a. LIVE LOAD = 20 kPa
   b. DEAD LOAD = 5 kPa
   c. CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa
6. MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE 300mm MINIMUM UNLESS NOTED OTHERWISE.
7. DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
8. TIED WALLS ARE TO BE TEMPORARILY PROPPED AT TOP UNTIL SUCH TIME THE TOP OF WALL IS TIED TO THE SLAB AND 28-DAY CONCRETE STRENGTH HAS BEEN ACHIEVED.
9. CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500KG STATIC WEIGHT IS TO BE KEPT BACK 1.5m FROM THE REAR FACE OF THE WALL FACING UNITS. COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 1.5m STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.
10. ALL DESIGN AND CONSTRUCT WALL SYSTEM TO BE COMPLETED IN ACCORDANCE WITH THESE NOTES.
11. WALL ELEVATIONS ALLOW FOR NOMINAL EMBEDMENT DEPTHS. WHERE DESIGN AND CONSTRUCT (D+C) WALL SYSTEMS ARE PROPOSED IT IS THE CONTACTORS RESPONSIBILITY TO ALLOW FOR THE FINAL EMBEDMENT DEPTHS AS PER THE D+C DESIGN. ALLOWANCE FOR OVERALL WALL AREAS TO CONSIDER THE FINAL EMBEDMENT DEPTH.
12. WALL ELEVATIONS AND AREAS ARE BASED ON THE VERTICAL PLAN AREA. CONTRACTOR TO ALLOW ADDITIONAL SURFACE AREA WHERE WALLS ARE NOT VERTICAL OR HAVE BACKSLOPES.

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PAVEMENT CLAY LAYER	05.03.24	E
REVISED AS CLOUDED FOR SECTION B	16.02.24	D
ISSUED FOR CONSTRUCTION CERTIFICATE	06.06.23	C
ISSUED FOR CONSTRUCTION CERTIFICATE	31.05.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
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DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC55

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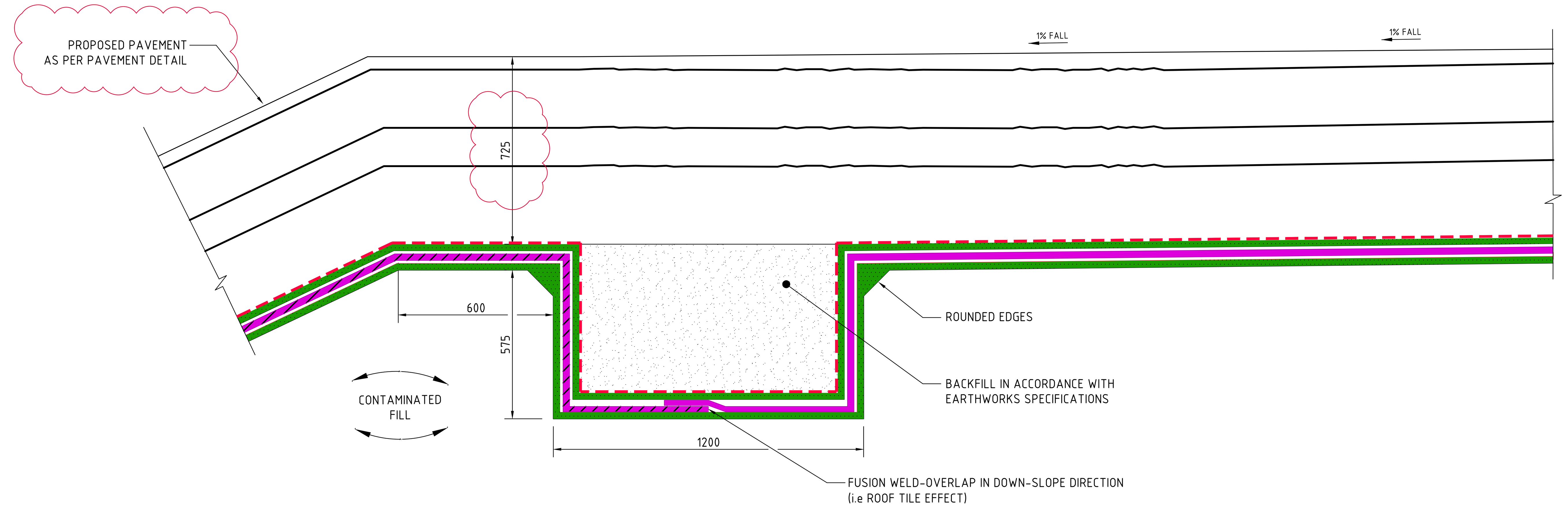
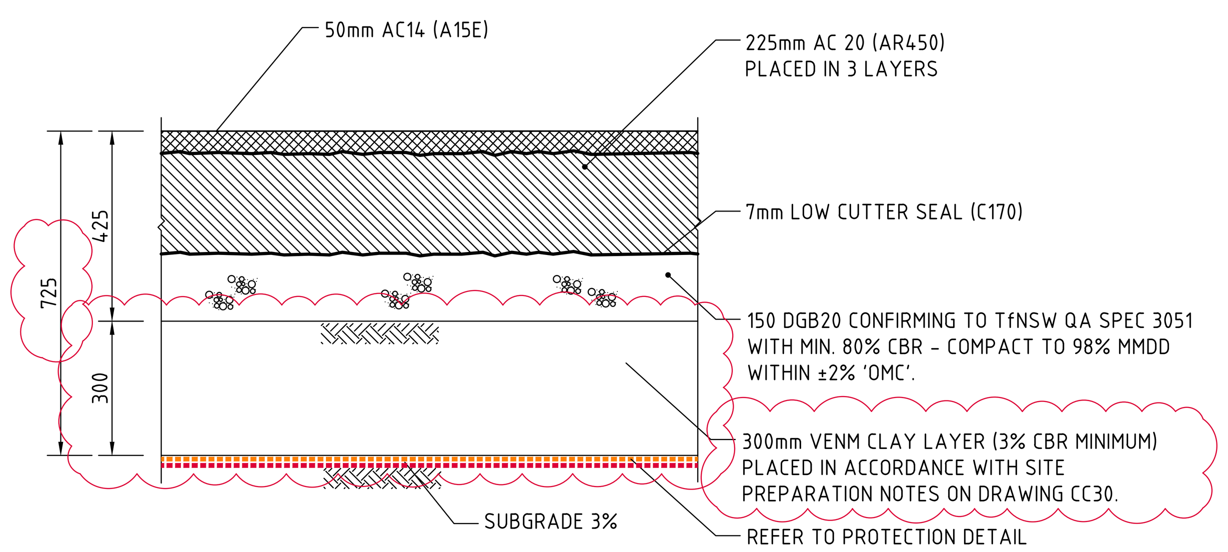
DRAWING TITLE
TYPICAL DETAILS
SHEET 1

DRAWING No C013919.06-CC55
ISSUE E



ANCHOR TRENCH TYPICAL DETAIL

SCALE 1:10

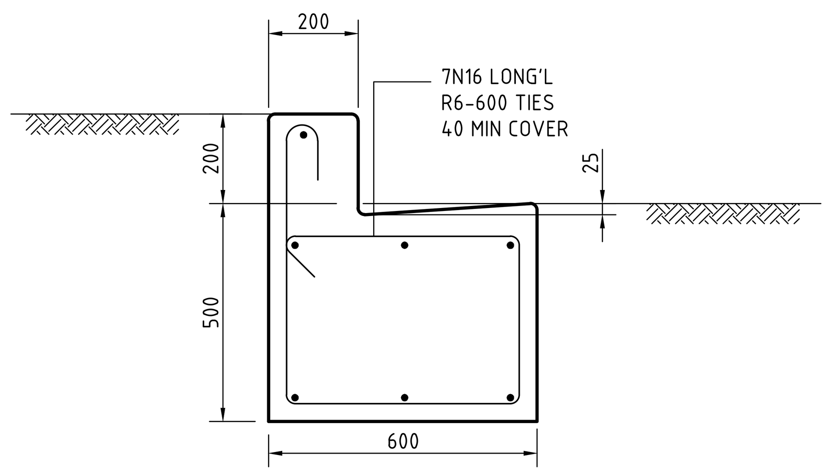


PAVEMENT DETAIL

SCALE 1:10

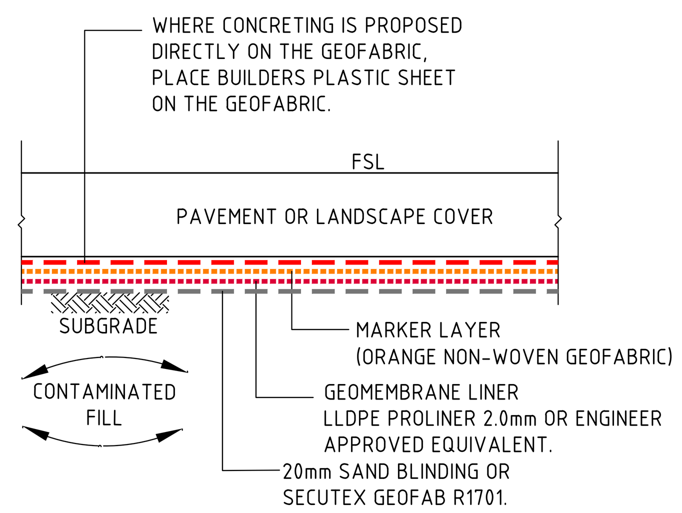
DESIGN TRAFFIC OF 1 x 10^7 ESA's
DESIGN CBR VALUE OF 3.0%
CBR OF SUBGRADE TO BE CONFIRMED TO ENGINEER FOR FINAL PAVEMENT OPTIMISATION AND DESIGN.

NOTE:
CONFIRMATION OF PAVEMENT DESIGN SUBJECT TO CONFIRMATION OF EXISTING SUBGRADE BY GEOTECHNICAL ENGINEER.



KERB & GUTTER EDGE RESTRAINT (ER)

SCALE 1:10



PROTECTION DETAIL

SCALE 1:10

PAVEMENT MAINTENANCE NOTES:

DURING THE LIFE OF THE PAVEMENT, DAMAGE IN VARIOUS FORMS IS LIKELY TO OCCUR. GOOD MAINTENANCE WILL KEEP PROBLEMS TO A MINIMUM AND EXTEND THE LIFE OF PAVEMENTS. THE FOLLOWING LIKELY AREAS OF DAMAGE MAY OR MAY NOT OCCUR DURING THE LIFE OF THE PAVEMENTS:

SLAB PAVEMENTS :
1. DAMAGE TO JOINTS SUCH AS FRETTING OR BREAKING AWAY OF PIECES SHOULD BE REPAIRED USING CONCRETE REPAIR PRODUCTS AND THE JOINTING MATERIAL MADE GOOD.
2. CRACKING OF SLABS WHICH MAY OCCUR OVER THE LIFE OF THE SLAB SHOULD BE REPAIRED BY EPOXY GROUTING AS SOON AS POSSIBLE TO PREVENT LOCAL FRETTING AND BREAKING AWAY. THE DEFINITION OF A CRACK WHICH MAY BECOME DETRIMENTAL IS ONE WHICH IS GREATER THAN 0.3mm.
3. LOCAL DAMAGE DUE TO MECHANICAL PROCESSES OR PALLETS (WITH PROTRUDING NAILS) SHOULD BE REPAIRED AS SOON AS POSSIBLE WITH AN EPOXY CONCRETE REPAIR PRODUCT.
4. LOCAL MOVEMENT OF SLABS CAUSED BY EXTERNAL SOURCES SUCH AS INGRESS OF WATER SHOULD BE REFERRED TO THE ENGINEER TO DETERMINE THE BEST METHOD OF REPAIR.
5. JOINT SEALANTS WILL GENERALLY BREAKDOWN AND NEED REPLACEMENT AFTER 12 MONTHS WHEN MOST OF THE SLAB SHRINKAGE HAS TAKEN PLACE. RESEALING NEEDS TO BE CARRIED OUT TO ENSURE ONGOING SUPPORT TO SLAB EDGES.

ASPHALT PAVEMENTS :
1. UNLESS NOTED OTHERWISE, FLEXIBLE PAVEMENTS SHOWN ON THESE DRAWINGS ARE THE MINIMUM NECESSARY TO SUPPORT LIGHT CAR PARKING FOR A MINIMUM DESIGN LIFETIME.
2. CRACKING OF THE ASPHALT SURFACE AND OTHER DEFECTS SHOULD BE REPAIRED QUICKLY TO PREVENT INGRESS OF WATER TO THE SUBGRADE, WHICH WILL ACCELERATE DETERIORATION OF PAVEMENTS.
3. DRAINAGE GRADES SHOULD BE MAINTAINED TO AVOID PONDING OF SURFACE WATER WHICH MAY CONTRIBUTE TO DETERIORATION.

NOTE:
- LLDPE GEO-MEMBRANE PANELS TO BE PLACED IN ACCORDANCE WITH APPROVED PANEL LAYOUT PLAN. PREPARED BY CONTRACTOR IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION (SECTION 5.5.7.4)
- SINGLE SIDED TEXTURED GEO-MEMBRANE ON SLOPED SIDES, TEXTURED SIDE DOWN.
- MATERIALS TO MEET SPECIFICATIONS, TESTING AND APPROVAL REQUIREMENTS OUTLINED IN TECHNICAL SPECIFICATIONS.

LEGEND:
- CUSHION GEO-TEXTILE
- LLDPE - SMOOTH GEO-MEMBRANE
- LLDPE - SINGLE-SIDED TEXTURED GEO-MEMBRANE
- MARKER LAYER

100mm 0 200 400 600 800 1000mm
SCALE 1:10 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PAVEMENT CLAY LAYER	05.03.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
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DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC56

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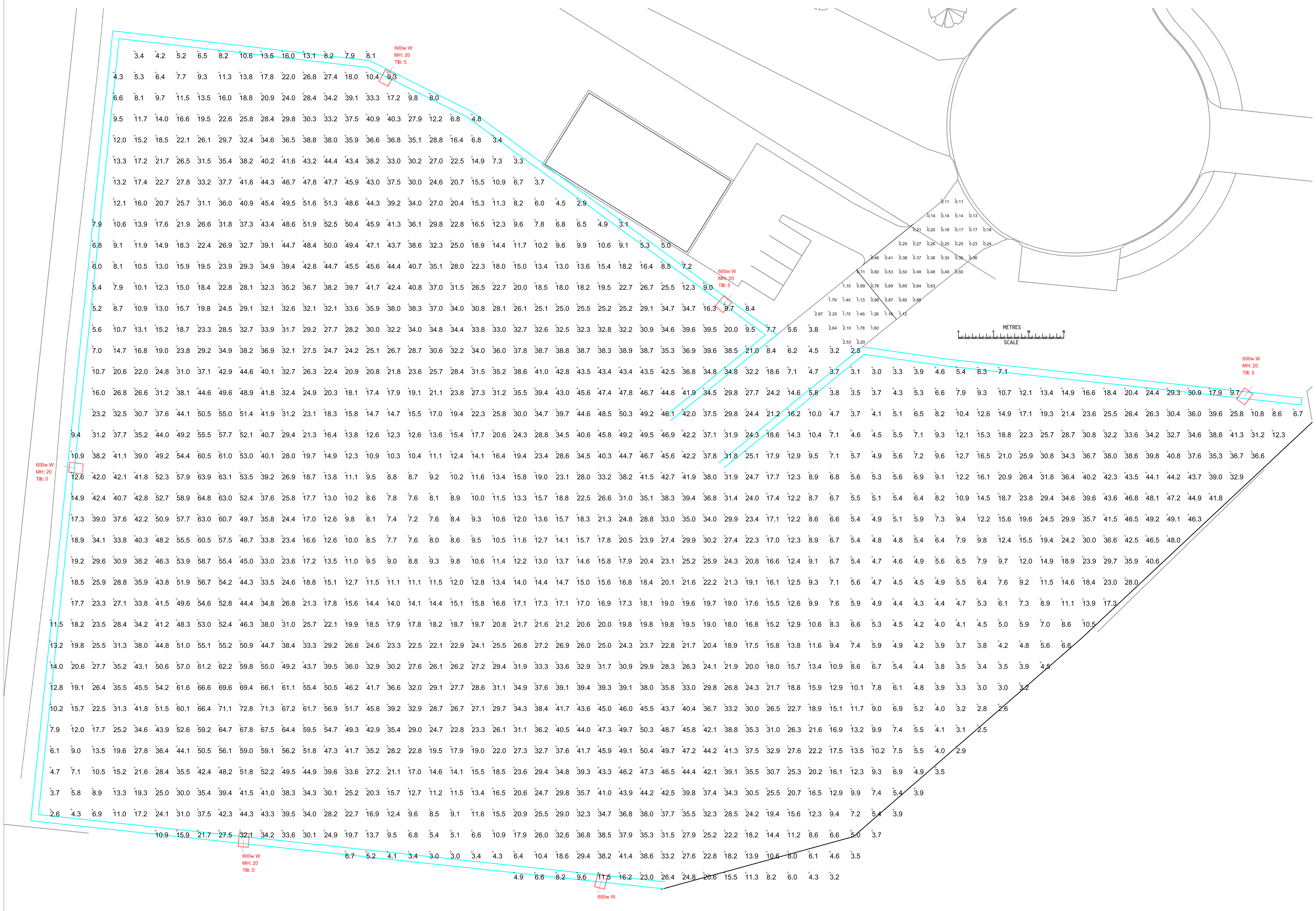
DRAWING TITLE: TYPICAL DETAILS SHEET 2

DRAWING No: C013919.06-CC56 ISSUE: B

APPENDIX B LIGHTING DESIGN DRAWINGS



LIGHTING DESIGN CERTIFICATION

THIS DESIGN SATISFIES THE REQUIREMENTS IN AS1158.3.1 AND AS1680.5 FOR THE SPECIFIED LIGHTING SUB CATEGORY. REFER TO NOTES.

REVIEWERS NAME: Ron Nixon
M.I.E.S. (Aust & NZ) Membership Number IES626
Registered Lighting Practitioner RLP

DATE APPROVED: 10/08/22
SIGNATURE: R J Nixon

NOTES:

- THIS LIGHTING DESIGN WAS PRODUCED USING CLIENT DRAWING LIGHTING_BASE.DWG.
- THE ILLUMINANCE LIGHT TECHNICAL PARAMETERS FOR THE ROADWAY COMPLIES WITH THE RECOMMENDATIONS OF AS/NZS1158.3.1:2020 CATEGORY PR5. THE ILLUMINANCE LIGHT TECHNICAL PARAMETERS FOR THE HARDSTAND COMPLIES WITH THE RECOMMENDATIONS OF AS/NZS1680.5:2012 TABLE 3.1 "General Storage - pedestrian access with through traffic".
- REFER TO LUMINAIRE LABELS ON DRAWING FOR INDIVIDUAL LUMINAIRE AIM ANGLES.
- THE LIGHT LOSS FACTOR OF 0.8 IS BASED ON A LUMINAIRE MAINTENANCE FACTOR OF 0.87 (IP6X LUMINAIRE) AND A LAMP (LED) LUMEN MAINTENANCE FACTOR OF 0.92 (MEDIUM POLLUTION ENVIRONMENT, LUMINAIRES CLEANED EVERY 3 YEARS).
- ADHERENCE TO LAMP REPLACEMENT CYCLES AND LUMINAIRE CLEANING IS ESSENTIAL TO MAINTAIN THE LIGHTING SYSTEM PERFORMANCE. REFER TO TABLE 14.4 AS/NZS1158.1.2 AND TABLE E1 APPENDIX E AS/NZS1158.1.1.
- CALCULATIONS WERE MADE USING LIGHTING ANALYSTS AGI32 VERSION 19.15.1 AND ARE SUBJECT TO ACCURACIES AND TOLERANCES NOMINATED IN AUSTRALIAN AND NEW ZEALAND STANDARDS AS/NZS 3827.1:1998 AND AS/NZS 3827.2:1998.
- COMPLIANCE IS CONDITIONAL ON EACH LUMINAIRE'S ABILITY TO FALL WITHIN ACCEPTABLE DISCOMFORT GLARE INTENSITY (DGI) LEVELS, AS DETAILED IN TABLE 3.9 OF SECTION 3.7.1.3 OF AS/NZS1158.3.1. GIVEN DGI IS THE RESPONSIBILITY OF A LUMINAIRE'S MANUFACTURER, IT IS RECOMMENDED THAT THE CLIENT CONFIRM PROPOSED LUMINAIRES ARE COMPLIANT WITH THIS REQUIREMENT.

Luminaire Schedule
Scene: LH

Symbol	Qty	Label	Height	Tilt	Lumens	Watts	LLF	Description	Filename
	5	600w W	20m	0° & 5°	81688	597	0.800	Schreder SR2H740A3G3 600 Watt 4000k LED Extra Narrow Beam Floodlight	SR2H740A3G3.IES

Calculation Summary
Scene: LH

Label	CalcType	Units	Avg	Max	Min	Max/Avg
Hardstand	Illuminance	Lux	24.91	72.8	2.5	2.92
Roadway	Illuminance	Lux	0.79	2.87	0.11	3.63

Rev	Date	Revision Description	By
0	04/08/22	Initial Issue	RN
A	10/08/22	Pole relocations and 1 additional pole	RN

LIGHT HARMONY - LIGHTING DESIGN PROJECT

LOT 64 CAPPING WORKS CENTRAL SYDNEY INDUSTRIAL ESTATE - 9 DEVON ST

ROADWAY AND HARDSTAND ILLUMINATION ANALYSIS

Date	Scale	Size	Design Reference	Author	Sheet	Drawing No.	Revision
10/08/22	NTS	A2	8936-1A	RN	1/1	8936E1	A

Web: lightharmony.com.au - Email: lharmony@bigpond.net.au - Ph: 07 38226465 - Fax: 07 38226467 - PO Box 3299 Birkdale QLD 4159

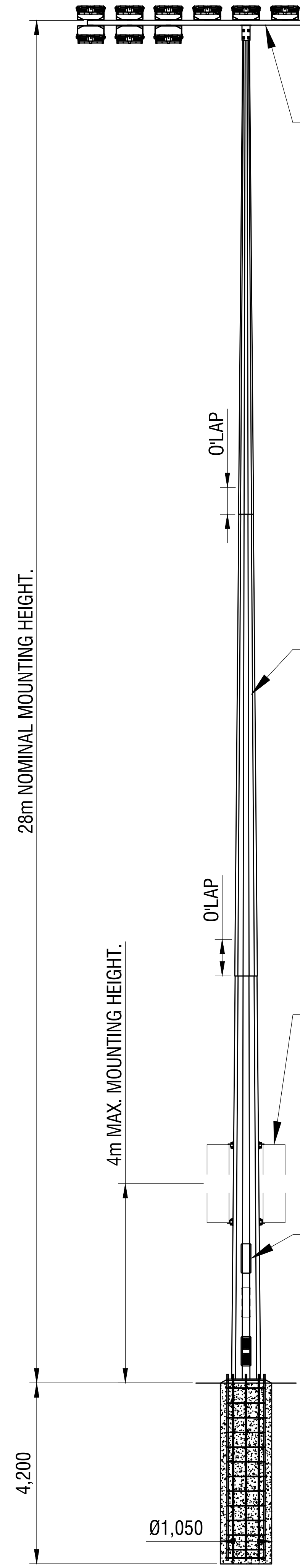
NOTE:

NOTES TYPICAL UNLESS STATED OTHERWISE.

Please sign & date as approved or mark any amendments & return fax to (07) 3718 4911 or email to sales@gmpoles.com.au

Signed	Date
☐ Approved	☐ Please Amend

POLE DESIGN ASSESSMENT CONDUCTED TO AS/NZS 1170.2:2021.

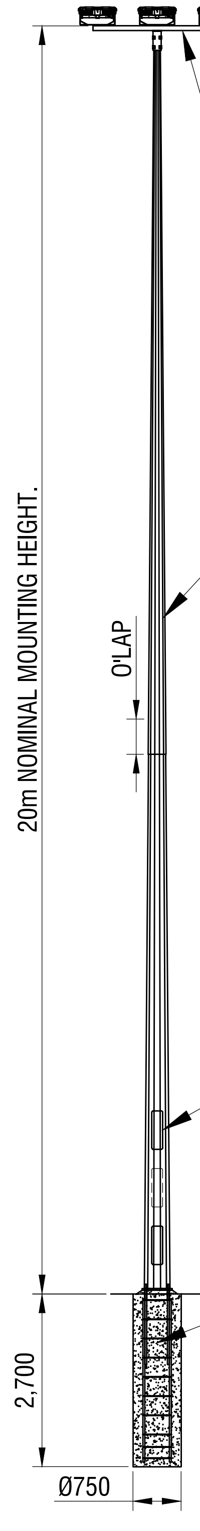


GM POLES MANUFACTURED CROSSARM t/s UP TO 9x OVERSLUNG AND 6x UNDERSLUNG SYLVANIA RAPTOR 1200w LED LUMINAIRE AT MAXIMUM LENS TILT TO HORIZONTAL OF 10°. NO ALLOWANCE FOR EXTERNAL GLARE CONTROL DEVICES. REFER CROSSARM DETAIL SIDE VIEW.

GM POLES MANUFACTURED TAPERED POLYGONAL POLE. POLE AND ACCESSORIES HOT DIP GALVANIZED AFTER FABRICATION. **GMP ID: TP-G28-20-K**

ALLOWANCE FOR 2-OFF ENCLOSURE. MOUNTING BRACKETS BY GM POLES. ENCLOSURE BY OTHERS. MAXIMUM LOAD ALLOWANCE: 1.4m^2, 150kg EA. **CLIENT TO PROVIDE ENCLOSURE DETAILS PRIOR TO POLE FABRICATION.**

3-OFF 600x200 CLEAR FLUSH FITTING ACCESS DOOR c/w INTERNAL GEAR TRAY. LOWER DOOR c/w LOUVRE VENT. MAXIMUM 10-OFF DRIVERS, BY OTHERS, WITHIN POLE. REMAINDER OF DRIVERS WITHIN ENCLOSURE. **CLIENT TO PROVIDE DRIVER DETAILS PRIOR TO POLE FABRICATION.** FINAL DRIVER ARRANGEMENT AND LOCATIONS TO BE DETERMINED BY OTHERS.

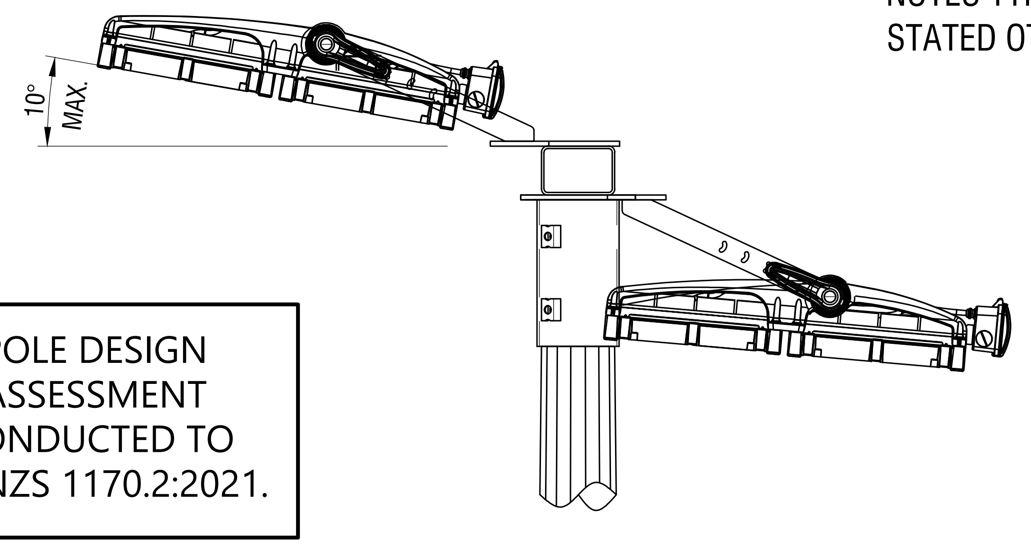


GM POLES MANUFACTURED CROSSARM t/s UP TO 3x OVERSLUNG SYLVANIA RAPTOR 1200w LED LUMINAIRE AT MAXIMUM LENS TILT TO HORIZONTAL OF 10°. NO ALLOWANCE FOR EXTERNAL GLARE CONTROL DEVICES. REFER CROSSARM DETAIL SIDE VIEW.

GM POLES MANUFACTURED TAPERED POLYGONAL POLE. POLE AND ACCESSORIES HOT DIP GALVANIZED AFTER FABRICATION. **GMP ID: TP-E20-25-K**

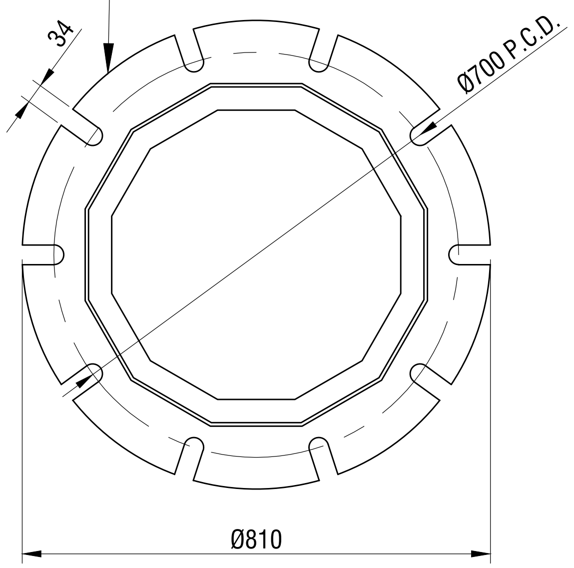
3-OFF 600x170 CLEAR FLUSH FITTING ACCESS DOOR c/w INTERNAL GEAR TRAY.

FOUNDATION CAGE SET INTO 32MPa CONCRETE FOOTING IN SOIL WITH A 150kPa MINIMUM BEARING CAPACITY THROUGHOUT PIER DEPTH. A SITE SPECIFIC SOIL TEST AND GM POLES ENGINEERED FOOTING DESIGN IS RECOMMENDED.



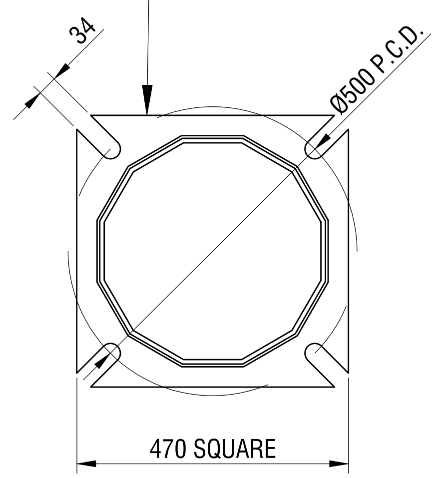
CROSSARM DETAIL SIDE VIEW

BASEPLATE TO SUIT GM POLES 10xM30 HIGH STRENGTH FOUNDATION BOLTS ON A 700mm P.C.D.



BASEPLATE DETAIL 28m POLES

BASEPLATE TO SUIT GM POLES 4xM30 HIGH STRENGTH FOUNDATION BOLTS ON A 500mm P.C.D.



BASEPLATE DETAIL 20m POLES

GM POLES
490 Freeman Rd. RICHLANDS, QLD 4077
Ph: (07) 3718 4900

FRED CATERSON RESERVE GENERAL ARRANGEMENTS.

Rev	Date	Drn	Description	Chk
0	22/06/2022	D.C.	INITIAL ISSUE	D.C.

Drn	Date	Scale	Drawing No	Page
D. Creed	22/06/2022	N.T.S.	CD0007351A-OP	1 of 1

FOOTING GUIDE

GM Poles Pty Ltd
490 Freeman Road, Richlands, QLD, 4077
ABN: 61 081 961 515

Phone: 07 3718 4900
Email: sales@gmpoles.com.au

A QUALITY SUPPLIER OF POLES - ALL PRODUCTS DESIGNED TO CURRENT AUSTRALIAN STANDARDS - MANUFACTURED TO ISO9001

Date: 17/06/2022 1:10:00 PM
From: Daniel Creed
Ref No.: FG 6821
Project Name: FRED CATERSON RESERVE

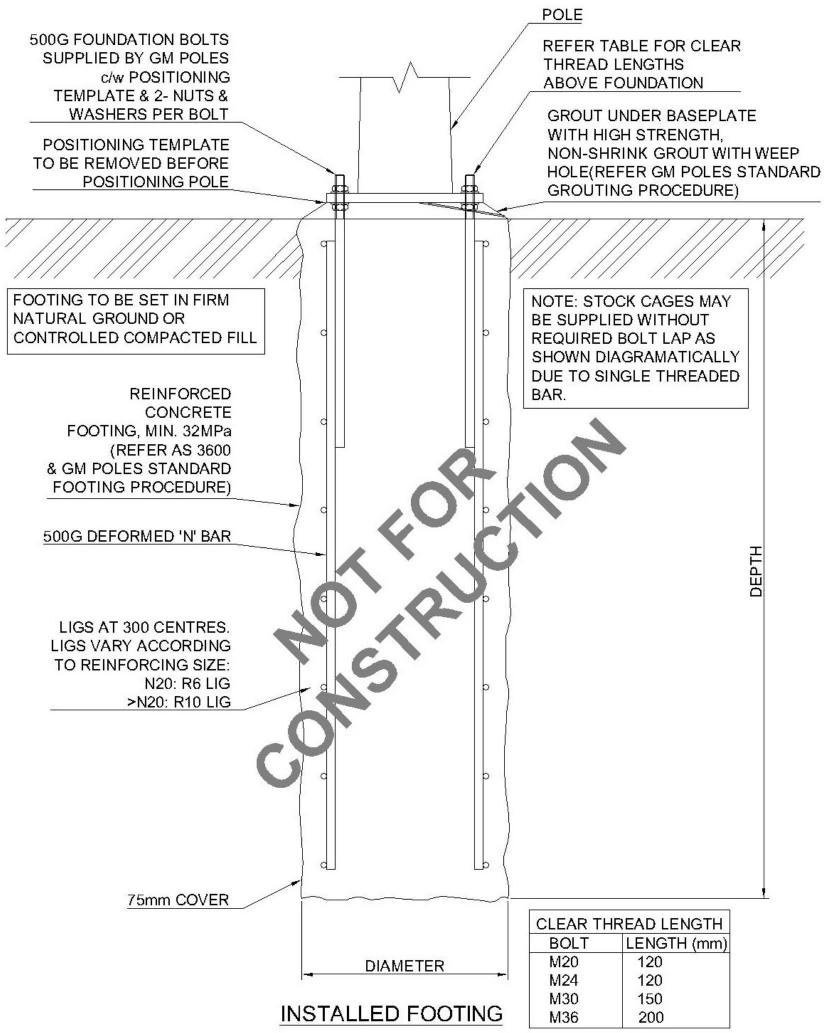
This document is for estimate purposes only. Final design and analysis of foundations is subject to site investigation and engineering certification by a qualified geotechnical engineer. Footings should only be installed by suitably qualified persons.

Item Code	TP-E20-25-K
Foundation Bolts	4XM30/500 P.C.D
Pier Depth	2700mm
Pier Diam	750mm
Steel Reinforcing	4-N30

Bending Moment	74kNm
Shear Force	8.3kN
Pole Weight	568kg
Soil Bearing Capacity	150kPa

Bending moment and shear force are expressed in Ultimate Limit State terms and are preliminary only, subject to a final design

Contact GM Poles for a price for soil test, footing design and installation



CLEAR THREAD LENGTH	
BOLT	LENGTH (mm)
M20	120
M24	120
M30	150
M36	200

Notes: SITE SPECIFIC LOADS CONTAINED HEREIN. REFER CD0007351A-OP.

GM Poles are able to offer a range of services including: Soil testing, foundation design and certification, foundation installation, pole assembly & erection

Schréder
Experts in lightability™

AREA

RAPTOR 3 600W

IP 66

IK 06

Shaping the future of sports floodlighting

The ultimate Aussie-engineered sports floodlight is a high-performing floodlight with leading optical control and innovative design. RAPTOR 3 will provide better spill control and less windage for sports venues as well as other large areas. With razor-sharp reflector systems and asymmetric distribution – four new beam options, the RAPTOR 3 is born to perform.

Its versatile mounting system, with its heavy-duty trunnion arm, RAPTOR 3 is compatible with under and over slung mounting arrangement.

RAPTOR 3 has cutting-edge technology to offer uniformity and visual comfort for players, spectators, and neighbours (low glare and minimised light spill). RAPTOR 3 is fully compatible with Schréder ITERRA Sports Control System.

SPORTS | CAR PARKS | LARGE AREAS | INDUSTRIAL AREA LIGHTING | TRANSIT HUBS | AIRPORT APRONS

Schréder

MAIN APPLICATIONS

- Sports
- Car parks
- Large areas
- Industrial
- Airport aprons
- Transit hubs

KEY ADVANTAGES

- Designed in Australia for Australian and New Zealand conditions
- High lumen efficacy over 135lms/w
- Precision reflector systems, designed to control spill light
- Asymmetric distribution, with four beam options
- Available in CCT 5700K & 4000K CRI 70
- Integral DALI drivers in either 240V or 415V
- Compatible with Schréder ITERRA Sports Control System
- Die-cast aluminium body, UV stabilized powder coated for durability
- Colour: black heatsink with grey frame
- Optimal reliability with 5 year warranty
- All exposed cabling has bird proof conduit
- Supplied with bird spikes

Precision optical design, controlling spill light

Precise aiming with protractor and locking device

Heavy duty trunnion arm, suitable for under and over slinging

Die cast aluminium heat sink for excellent thermal management

Schréder

GENERAL INFORMATION

Recommended installation height	12m to 20m | 40' to 65'
Driver included	No
RCM Mark	Yes
ROHS compliant	Yes
Testing standard	AS/NZS 60598.1:2017

HOUSING AND FINISH

Housing	Die-cast LM6 aluminium frame
Optic	High temperature vacuum metalised reflector
Protector	Tempered glass
Housing finish	Powder coated finish
Standard colour(s)	RAL9011
Tightness level	IP66

PERFORMANCE

Lumen efficacy	135lms/w

ELECTRICAL INFORMATION

Electrical class	Class 1
Nominal voltage	240V/415V – 50Hz/60Hz
Power factor (at full load)	> 0.98
System wattage	2 module 660W
Surge protection (kV)	10kV
Electromagnetic compatibility (EMC)	AS/NZSCISPR15, AS/NZS 60598.1
Control protocol(s)	DALI
Sensor(s)	Devices & sensors for smart city applications

OPTICAL INFORMATION

LED colour temperature	5700K & 4000K
Colour rendering index (CRI)	> 70
Asymmetrical distributions	A0 Extra Narrow, A1 Narrow, A2 Medium, A3 Wide

OPERATING CONDITIONS

Temperature range from operation (Ta)	-20°C to + 40°C

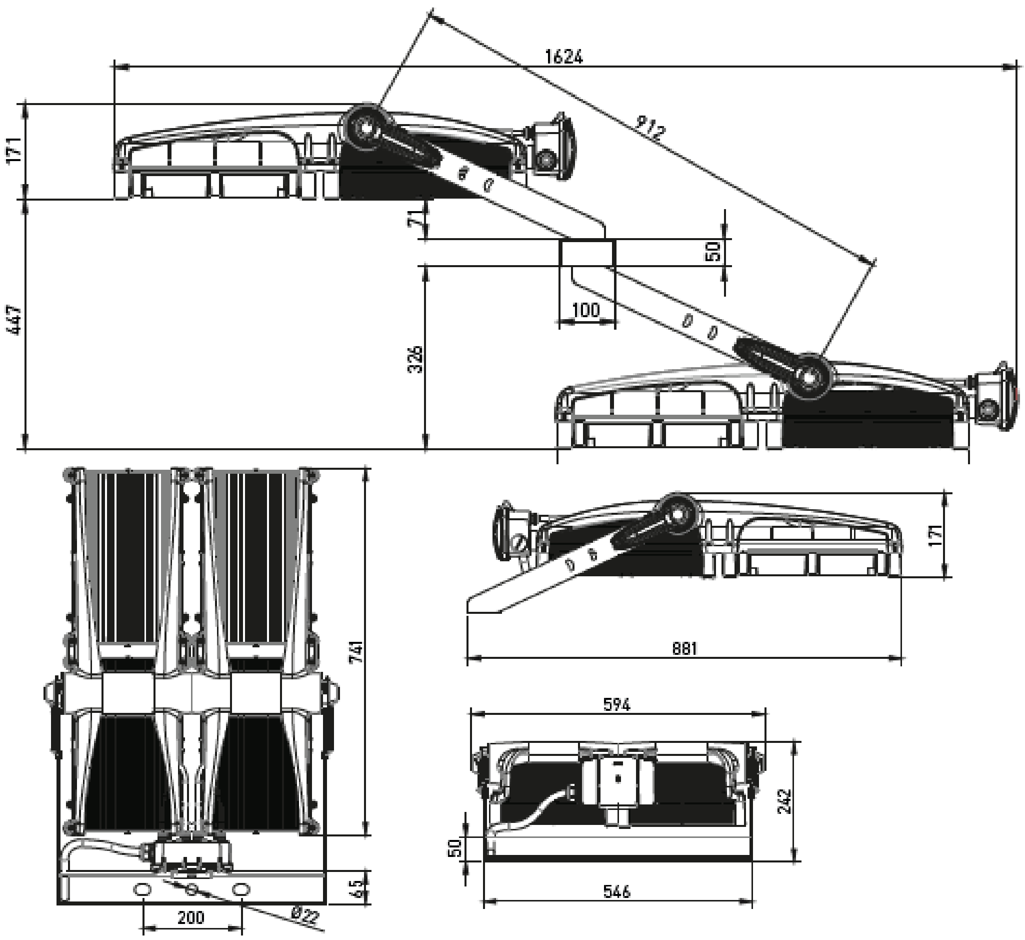
LIFETIME OF THE LEDS @ TA 40°C

All configurations	120,000hrs L90

Schréder

DIMENSIONS AND MOUNTING

L x W x H (mm)	741 x 594 x 171
Weight (kg)	415V - 25.5 240V - 25.0
Aerodynamic resistance Windage (m2)	0.115 (at tilt of 0°) 0.17 (at tilt of 13°)
Mounting possibilities	Galvanised trunnion arm for under and over slinging

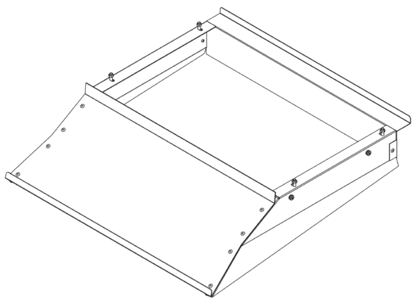


Schréder

Product Code	Name	Beam Dist.	Colour Temp
SR2H757A0GIG3	RAPTOR 3 600W A0 CRI70 CCT5700k 415V DALI (No Feedback)	Asymmetric A0 Extra Narrow	5700
SR2H757A1GIG3	RAPTOR 3 600W A1 CRI70 CCT5700k 415V DALI (No Feedback)	Asymmetric A1 Narrow	5700
SR2H757A2GIG3	RAPTOR 3 600W A2 CRI70 CCT5700 415V DALI (No Feedback)	Asymmetric A2 Medium	5700
SR2H757A3GIG3	RAPTOR 3 600W A3 CRI70 CCT5700k 415V DALI (No Feedback)	Asymmetric A3 Wide	5700
SR2H757A0AIG3	RAPTOR 3 600W A0 CRI70 CCT5700 240V DALI	Asymmetric A0 Extra Narrow	5700
SR2H757A1AIG3	RAPTOR 3 600W A1 CRI70 CCT5700 240V DALI	Asymmetric A1 Narrow	5700
SR2H757A2AIG3	RAPTOR 3 600W A2 CRI70 CCT5700 240V DALI	Asymmetric A2 Medium	5700
SR2H757A3AIG3	RAPTOR 3 600W A3 CRI70 CCT5700 240V DALI	Asymmetric A3 Wide	5700
SR2H740A0GIG3	RAPTOR 3 600W A0 CRI70 CCT4000k 415V DALI (No Feedback)	Asymmetric A0 Extra Narrow	4000
SR2H740A1GIG3	RAPTOR 3 600W A1 CRI70 CCT4000k 415V DALI (No Feedback)	Asymmetric A1 Narrow	4000
SR2H740A2GIG3	RAPTOR 3 600W A2 CRI70 CCT4000 415V DALI (No Feedback)	Asymmetric A2 Medium	4000
SR2H740A3GIG3	RAPTOR 3 600W A3 CRI70 CCT4000k 415V DALI (No Feedback)	Asymmetric A3 Wide	4000
SR2H740A0AIG3	RAPTOR 3 600W A0 CRI70 CCT4000 240V DALI	Asymmetric A0 Extra Narrow	4000
SR2H740A1AIG3	RAPTOR 3 600W A1 CRI70 CCT4000 240V DALI	Asymmetric A1 Narrow	4000
SR2H740A2AIG3	RAPTOR 3 600W A2 CRI70 CCT4000 240V DALI	Asymmetric A2 Medium	4000
SR2H740A3AIG3	RAPTOR 3 600W A3 CRI70 CCT4000 240V DALI	Asymmetric A3 Wide	4000

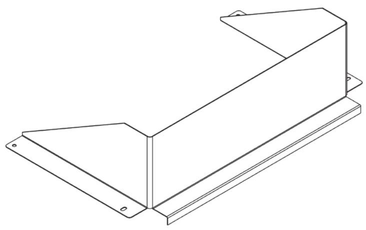
ACCESSORIES - RAPTOR 3 600W APRON HOOD

SR2HAPRONHOOD	L 566 x W 519 x H 15mm	2kg



ACCESSORIES - RAPTOR 3 600W BACK SHIELD

SR4HBACKSHIELD	L 279 x W 434 x H 140	1.15kg



APPENDIX C LANDSCAPE DESIGN

Drawing Title:

Landscape Detail Plan

DWG No: **LTN-01**

GEOSCAPES
LANDSCAPE ARCHITECTS
Suite 303, 8 Help Street, Chatswood NSW 2067 Ph. (02) 9411 1485
www.geoscapes.com.au
ABN 84 620 205 781 ACN 620 205 781

Project Manager: DBL PROPERTY

Client:
VE PROPERTY
LEVEL 16, 720 BOURKE STREET
DOCKLANDS VIC 3008
PH: (03) 8823 444

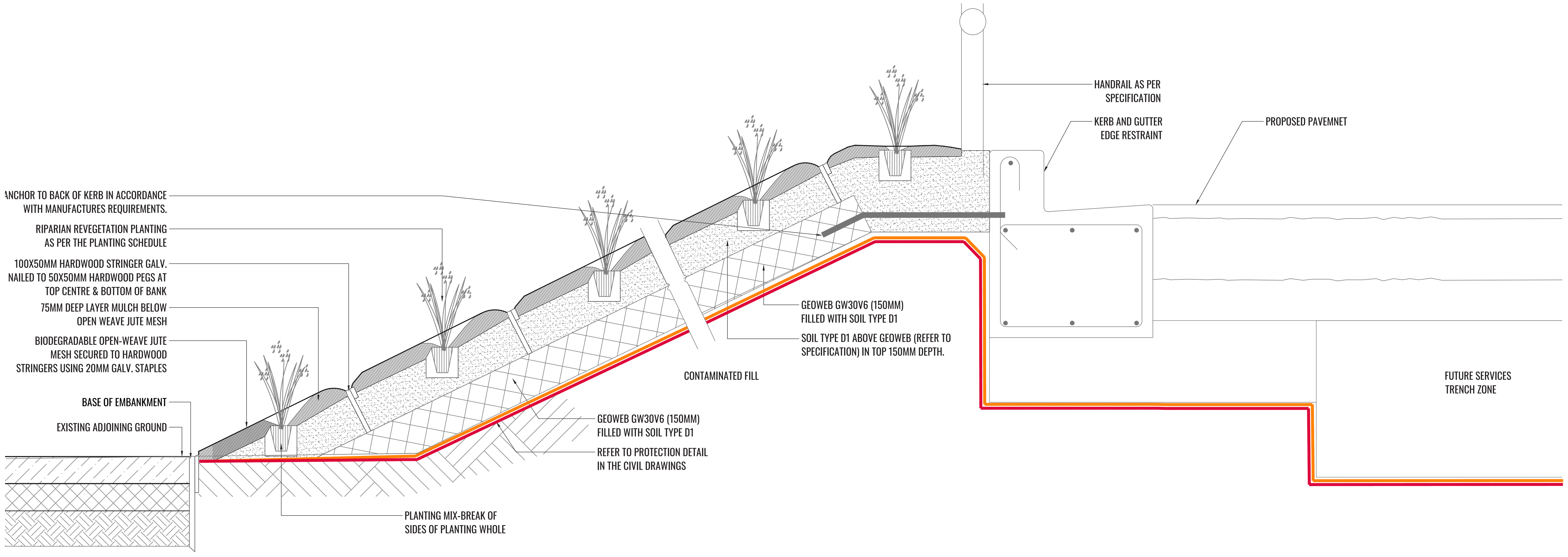
Scale:	Date:	Job Number:	North:
1:300 @ A1	13.03.24	220908	

Project: LOT 64, Sydney Industrial Estate,
9 Devon Street, Rosehill, NSW 2142

Revision — FOR TENDER

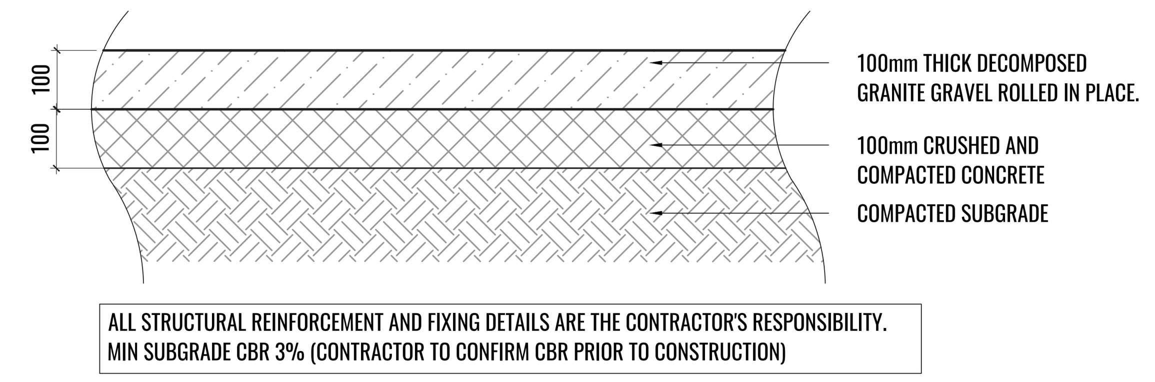
Rev	Date	Description	Drawn	Checked
A	23.09.22	FOR TENDER	RJ	BG
B	27.09.22	FOR TENDER	RJ	BG
C	30.09.22	FOR TENDER	RJ	BG
D	13.03.24	FOR TENDER	KC	BG

LANDSCAPE DETAILS



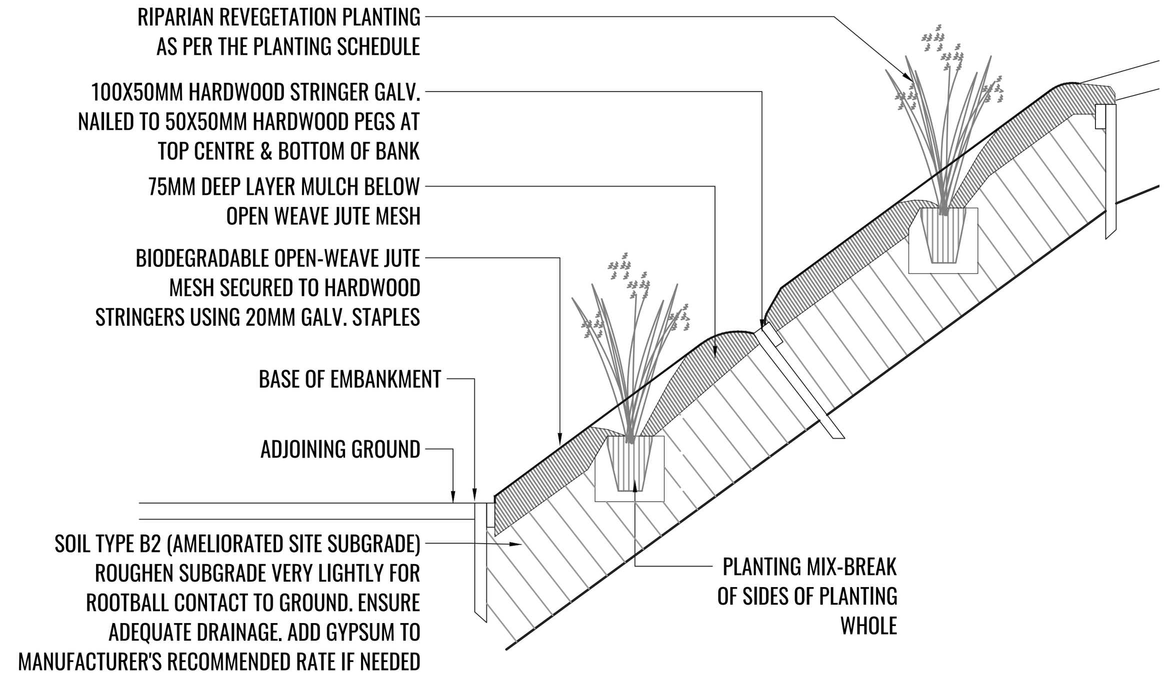
1 **TYPICAL LANDSCAPE EMBANKMENT DETAIL OVER CAPPED AREA WITHIN LANDSCAPE AREA 'A'**

TYPICAL SECTION — SCALE 1:10



2 **TYPICAL DETAIL - DECOMPOSED GRANITE ACCESS PATHWAY**

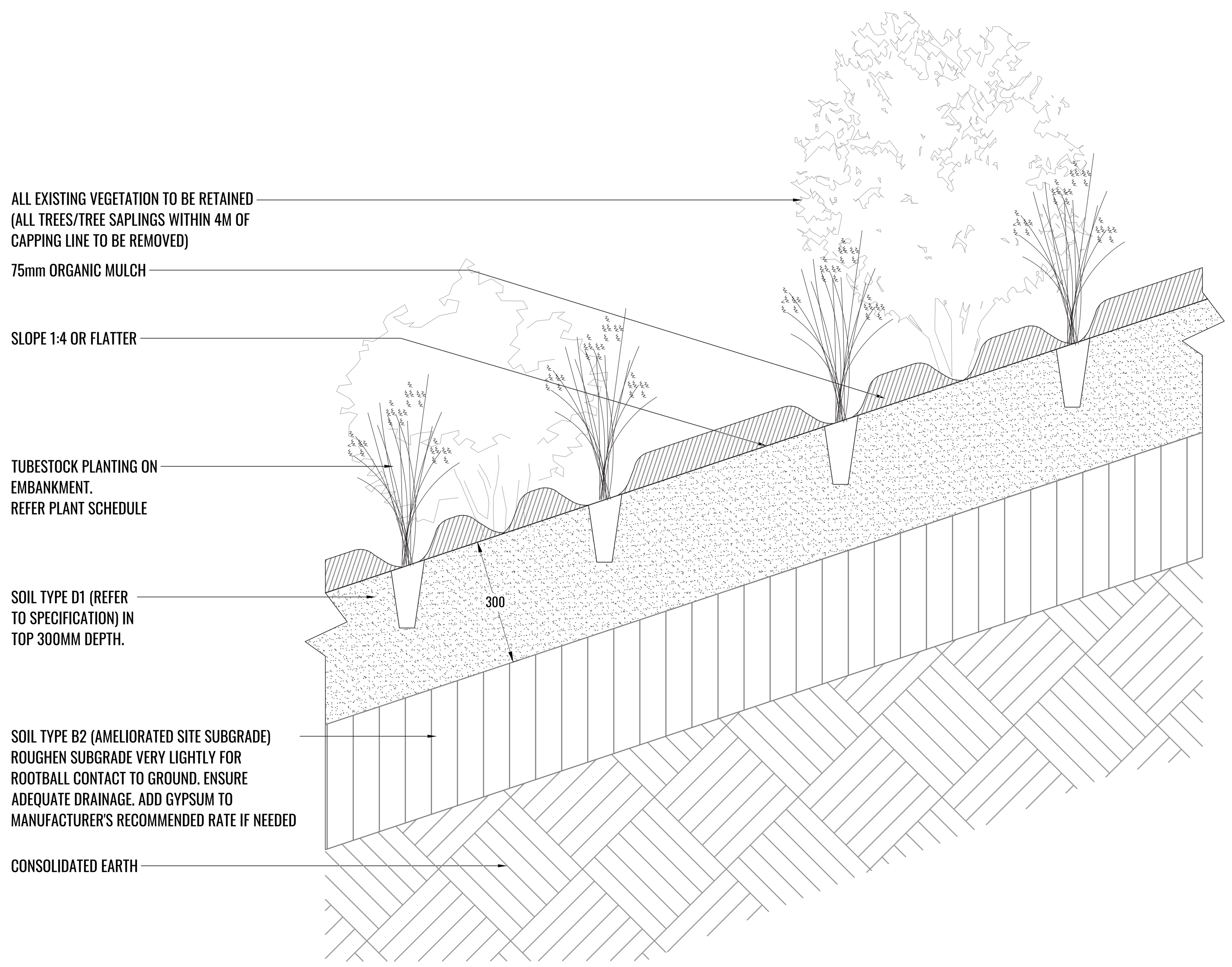
TYPICAL SECTION — SCALE 1:10



3 **TYPICAL LANDSCAPE EMBANKMENT STABILISATION DETAIL FOR SLOPE OF 1:3 OR STEEPER WITHIN LANDSCAPE AREA 'B1' and 'B2'**

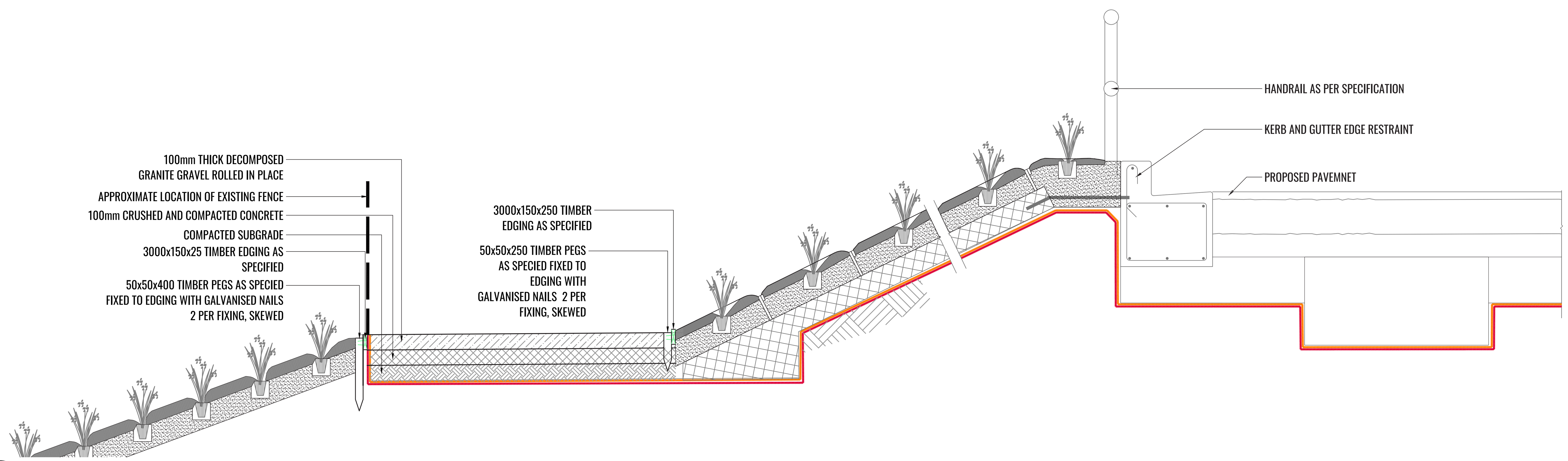
TYPICAL SECTION — SCALE 1:10

ENSURE ANY LANDSCAPE WORKS DOES NOT PENETRATE CAPPING LAYER



4 **TYPICAL TUBESTOCK PLANTING DETAIL FOR SLOPES OF 1:4 OR FLATTER WITHIN LANDSCAPE AREA 'B1' AND 'B2'**

TYPICAL SECTION — SCALE 1:10



5 **TYPICAL PATHWAY AND PLANTING TREATMENT DETAIL TO WESTERN BOUNDARY EDGE**

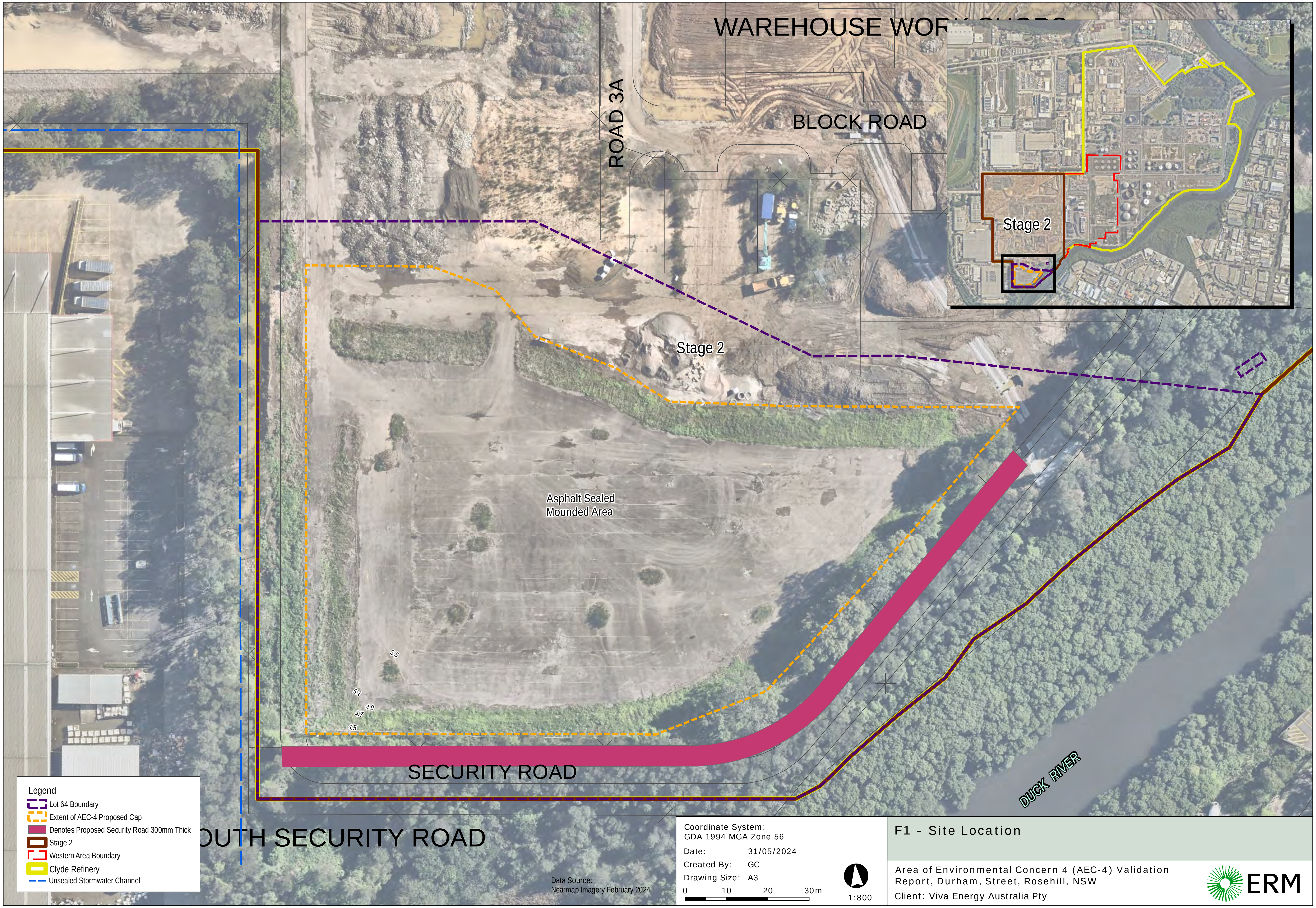
TYPICAL SECTION — SCALE 1:20

Drawing Title:	GEOSCAPES LANDSCAPE ARCHITECTS	Project Manager:	Client:	Scale:	Date:	Job Number:	North:
Landscape Details	Suite 303, 8 Help Street, Chatswood NSW 2067 Ph. (02) 9411 1485	DBL PROPERTY	VE PROPERTY	As shown @ A1	13.03.24	220908	N/A
DWG No: LTN-02	www.geoscapes.com.au ABN 84 620 205 781 ACN 620 205 781		LEVEL 16, 720 BOURKE STREET DOCKLANDS VIC 3008 PH: (03) 8823 444	Project:	LOT 64, Sydney Industrial Estate, 9 Devon Street, Rosehill, NSW 2142		

Revision — FOR TENDER

Rev	Date	Description	Drawn	Checked
A	23.09.22	FOR TENDER	RJ	BG
B	27.09.22	FOR TENDER	RJ	BG
C	30.09.22	FOR TENDER	RJ	BG
D	13.03.24	FOR TENDER	KC	BG

Appendix A-5 Figures from the Stage 2 AA4 Validation



Coordinate System:
GDA 1994 MGA Zone 56

Date: 31/05/2024

Created By: GC

Drawing Size: A3

F1 - Site Location

Area of Environmental Concern 4 (AEC-4) Validation Report, Durham, Street, Rosehill, NSW

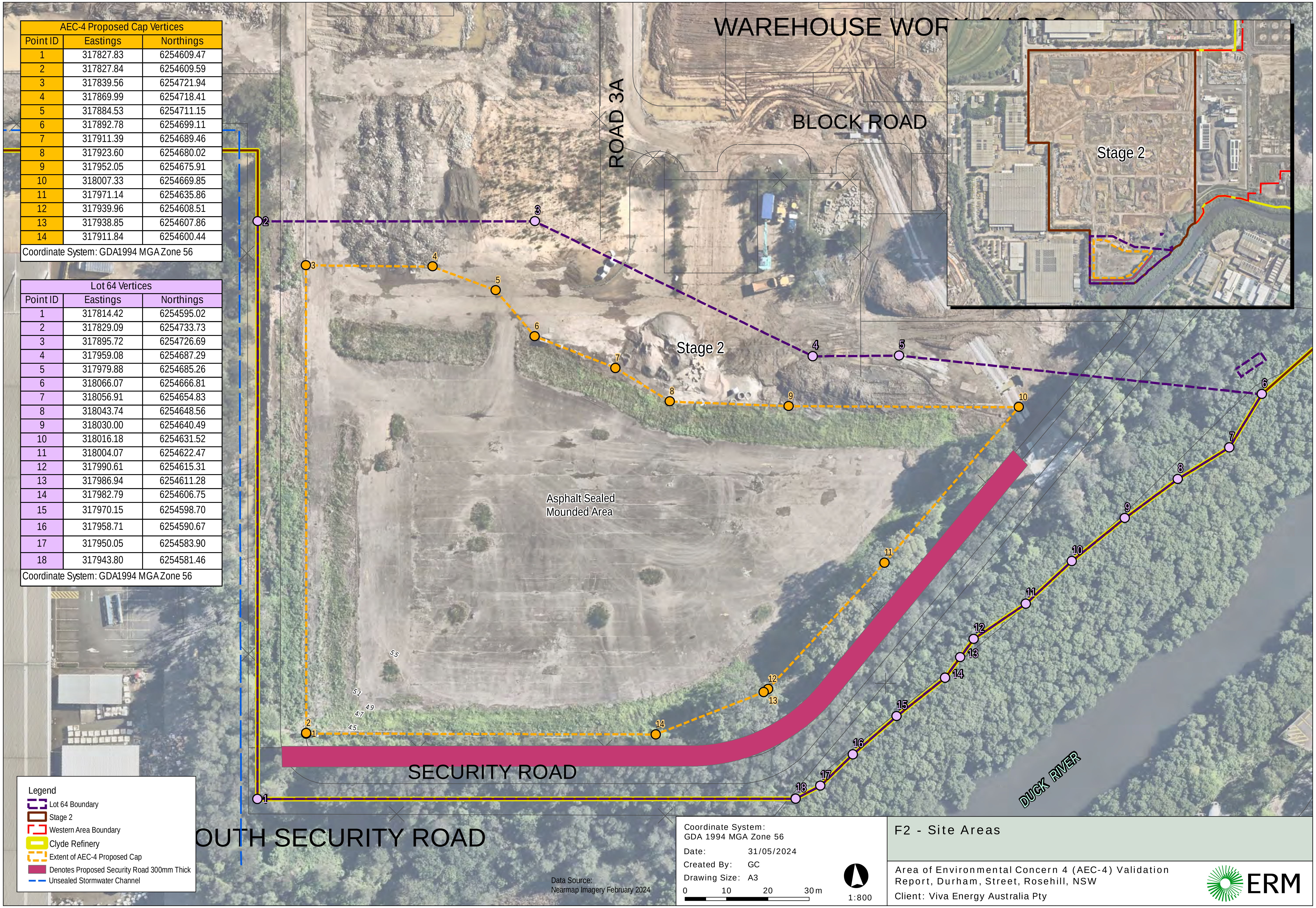
Client: Viva Energy Australia Pty

ERM

0561882_St2AEC4L64V_G001_R0.mxd

AEC-4 Proposed Cap Vertices		
Point ID	Eastings	Northings
1	317827.83	6254609.47
2	317827.84	6254609.59
3	317839.56	6254721.94
4	317869.99	6254718.41
5	317884.53	6254711.15
6	317892.78	6254699.11
7	317911.39	6254689.46
8	317923.60	6254680.02
9	317952.05	6254675.91
10	318007.33	6254669.85
11	317971.14	6254635.86
12	317939.96	6254608.51
13	317938.85	6254607.86
14	317911.84	6254600.44
Coordinate System: GDA1994 MGA Zone 56		

Lot 64 Vertices		
Point ID	Eastings	Northings
1	317814.42	6254595.02
2	317829.09	6254733.73
3	317895.72	6254726.69
4	317959.08	6254687.29
5	317979.88	6254685.26
6	318066.07	6254666.81
7	318056.91	6254654.83
8	318043.74	6254648.56
9	318030.00	6254640.49
10	318016.18	6254631.52
11	318004.07	6254622.47
12	317990.61	6254615.31
13	317986.94	6254611.28
14	317982.79	6254606.75
15	317970.15	6254598.70
16	317958.71	6254590.67
17	317950.05	6254583.90
18	317943.80	6254581.46
Coordinate System: GDA1994 MGA Zone 56		



Coordinate System:
GDA 1994 MGA Zone 56

Date: 31/05/2024

Created By: GC

Drawing Size: A3

0 10 20 30 m

1:800

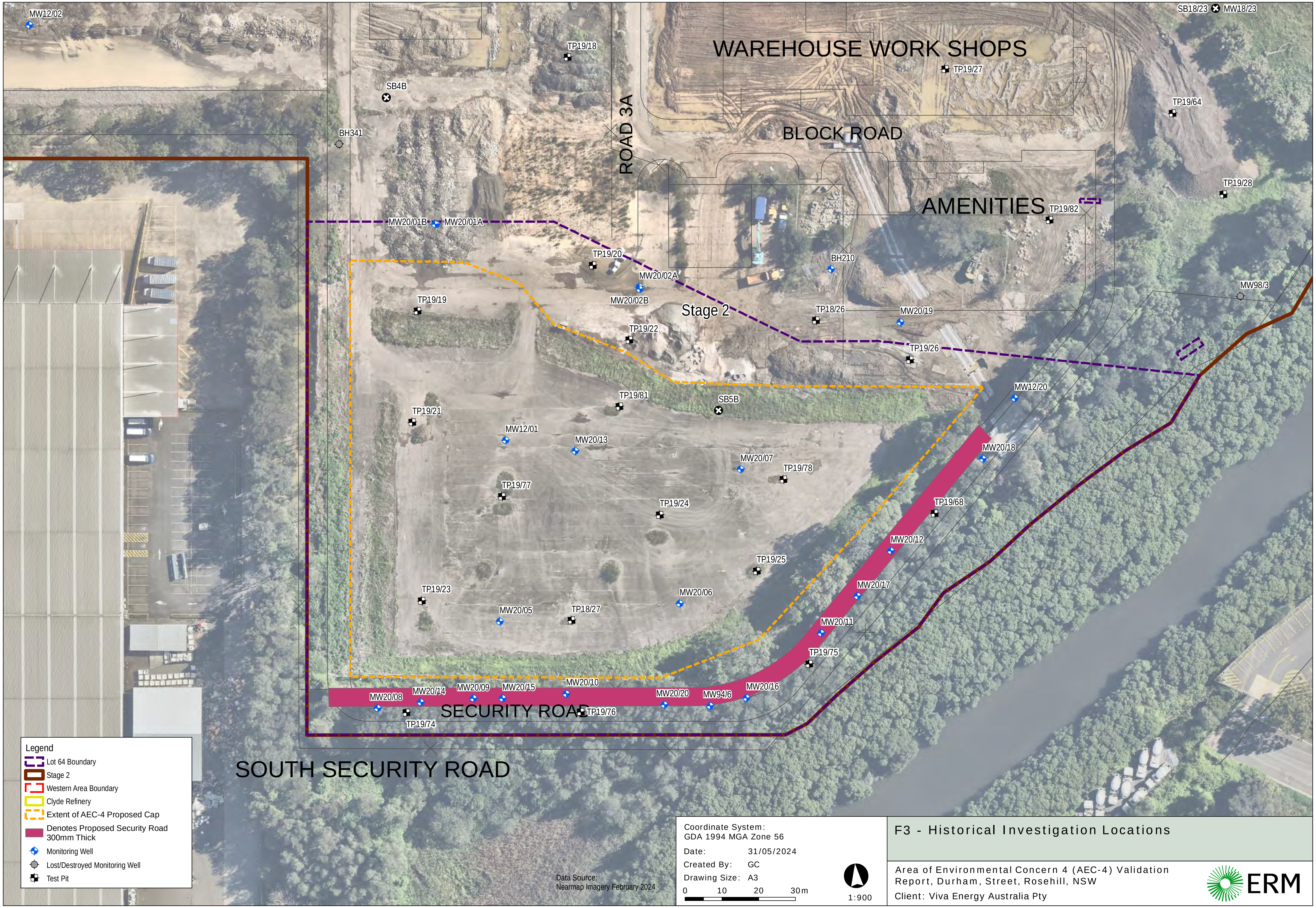
F2 - Site Areas

Area of Environmental Concern 4 (AEC-4) Validation Report, Durham, Street, Rosehill, NSW

Client: Viva Energy Australia Pty

ERM

0561882_St2AEC4L64V_G002_R0.mxd



Coordinate System:
GDA 1994 MGA Zone 56

Date: 31/05/2024

Created By: GC

Drawing Size: A3

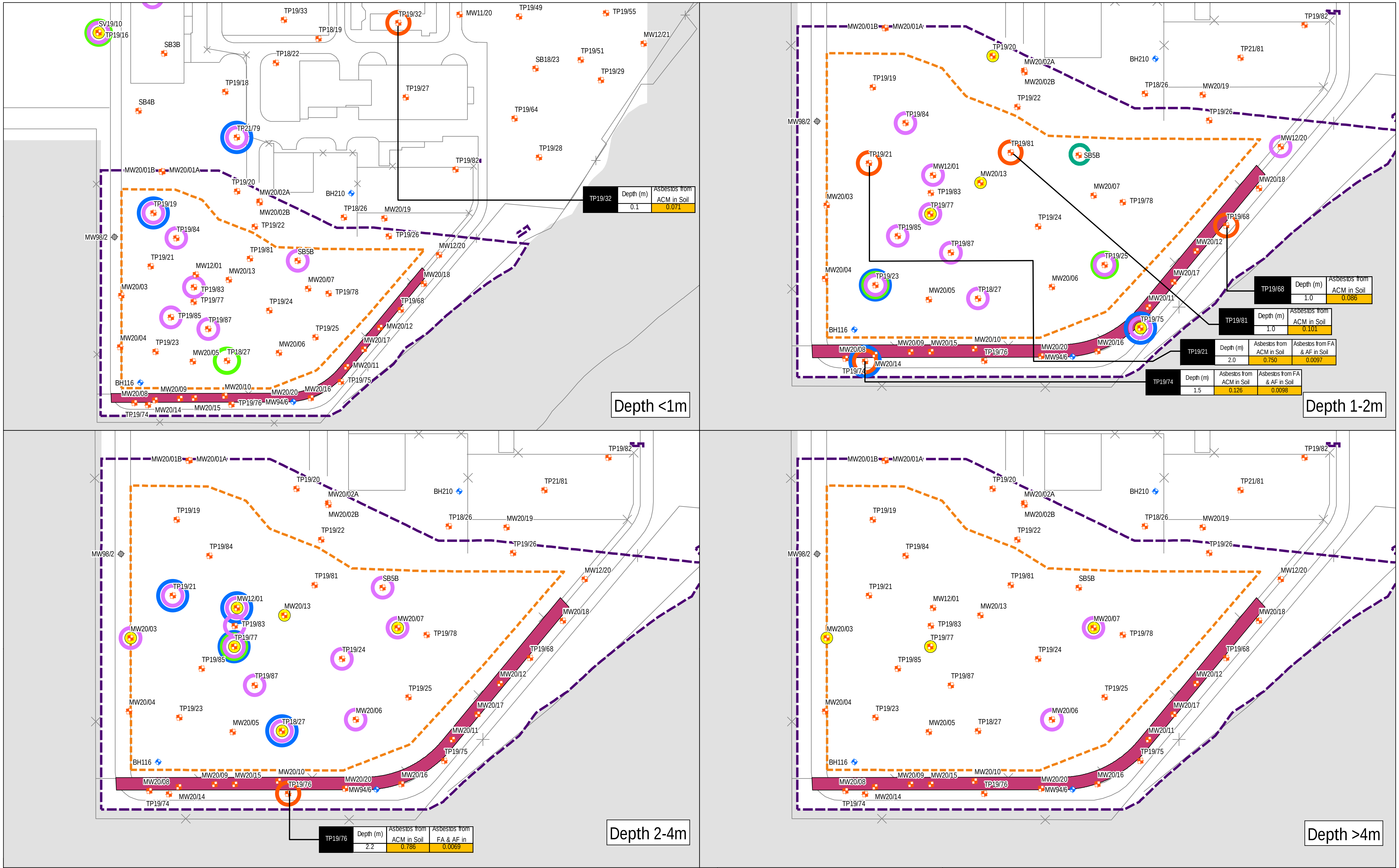
F3 - Historical Investigation Locations

Area of Environmental Concern 4 (AEC-4) Validation Report, Durham, Street, Rosehill, NSW

Client: Viva Energy Australia Pty

ERM

0561882_St2AEC4L64V_G003_R0.mxd



Legend

- Lot 64 Boundary
- Extent of AEC-4 Proposed Cap
- Denotes Proposed Security Road 300mm Thick
- LNAPL Present
- Monitoring Well
- Lost/Destroyed Monitoring Well
- Soil Sampling Location
- TRH Management Limit
- Inhalation (Asbestos)
- Vapour Intrusion
- Direct Contact (Hydrocarbons)
- Direct Contact (Chromium VI)

Coordinate System:
GDA 1994 MGA Zone 56

Date: 31/05/2024
Created By: GC
Drawing Size: A3

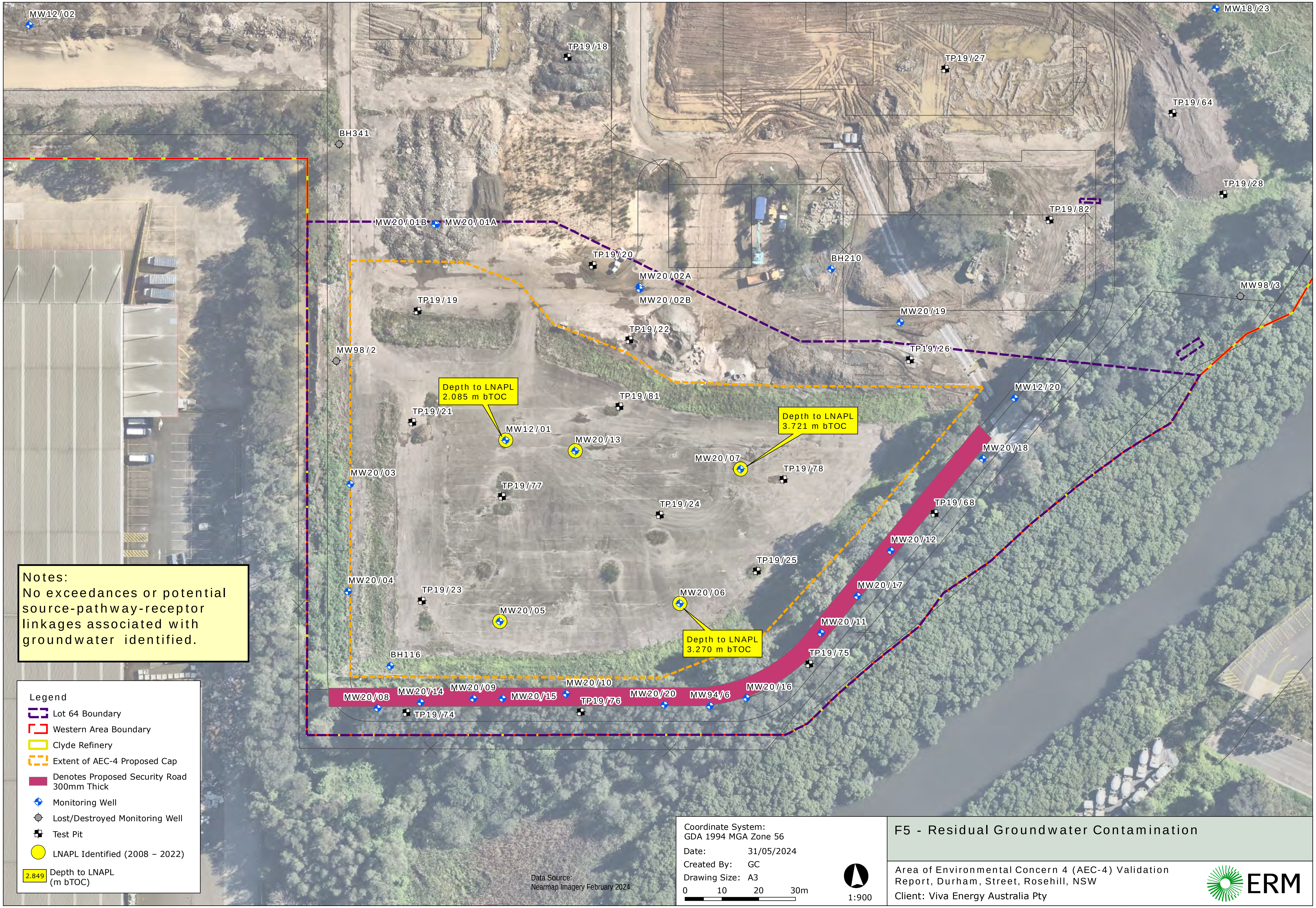
0 10 20 30m
1:1,400

F4 - Residual Soil Contamination

Area of Environmental Concern 4 (AEC-4) Validation Report, Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty

ERM

0561882_St2AEC4L64V_G004_R0.mxd



0561882_St2AEC4L64V_G005_R0.mxd

Appendix A5a - Final Surveys

APPENDIX C SURVEY DATA

- C1 - Subdivision Plans
- C2 - Detailed Design Drawing Set
- C3 - As Built Survey

M.G.A

COORDINATE SCHEDULE OF ROAD BOUNDARIES AND TURNING HEAD			
	POINT	EASTINNG	NORTHING
1	15350	318047.607	6255264.663
2	15351	318041.011	6255259.326
3	15352	317980.432	6254686.701
4	15353	317959.535	6254688.733
5	15354	318020.13	6255261.522
6	15355	318014.793	6255268.118
7	15357	317984.958	6254729.885
8	15358	317980.631	6254689.094
9	15359	317959.851	6254691.341
10	15360	317964.154	6254732.041

NOTE: RADIUS OF TURNING HEAD IS 23m

NOTES:
1. ALL DIMENSIONS SHOWN HEREON ARE APPROXIMATE AND SUBJECT TO FINAL SURVEY
2. NO CADASTRAL SURVEY HAS BEEN UNDERTAKEN

(A) EASEMENT TO DRAIN WATER 10.2 & 13.4 WIDE (AC 424785)
(B) EASEMENT 6.095 WIDE (B309159) – SYDNEY WATER PIPELINE
(C) EASEMENT TO DRAIN WATER 13.4 WIDE (AC424784)
(G) PROPOSED EASEMENT FOR SERVICES 5 WIDE
(H) RIGHT OF ACCESS 21 WIDE AND VARIABLE WIDTH
(L) EASEMENT FOR OVERLAND FLOW 5 WIDE
(M) EASEMENT FOR PEDESTRIAN ACCESS VARIABLE WIDTH

20 0 40 100 140m

SCALE 1:1500

CLIENT

VE PROPERTY PTY LTD

PROJECT

PLAN OF PROPOSED SUBDIVISION OF LOT 57 OF STAGE 2 OF SUBDIVISON OF LOT 100 IN DP1168951 STAGE 3

NOTES

The title boundaries shown hereon were not marked at the time of survey and have been determined by plan dimensions only and not by field survey.

Services shown hereon have been located where possible by field survey. If not able to be so located, services have been plotted from the records of relevant authorities where available and have been noted accordingly on the plan. Where such records do not exist or are inadequate a notation has been made hereon.

Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

20	GKO	03/04/2024	COORDINATE SCHEDULE OF ROAD BOUNDARIES ADDED
11	GKO	04/02/2022	MHWM REDEFINED
10	GKO	21/06/2021	BOUNDARY 63-64 AMENDED
9	GKO	07/06/2021	STAGE 1& 2 AREAS ADDED
8	GKO	23/11/2020	LOT 61 & 62 AMENDED
7	GKO	11/11/2020	AMEND RIPARIAN SETBACK & (H)
6	GKO	02/11/2020	LANDSCAPE SETBACK REMOVED
5	GKO	29/10/2020	PLAN AMENDED
4	GKO	20/10/2020	LOT BOUNDARIES AMENDED
3	GKO	24/07/2020	EASEMENTS DETAIL ADDED
2	GKO	17/07/2020	EASEMENT AMENDED
1	GKO	22/06/2020	INITIAL ISSUE

SYM	CODE	DESCRIPTION
	BIN	BIN
	BM	BENCH MARK
	BO	BOLLARD
	DJM	DRAINAGE MANHOLE
	EFP	ELEC FUSE BOX
	ELP	ELEC GARDEN LIGHT
	EL	ELEC GREEN PILLAR
	LP	ELEC LIGHT POLE
	EP	ELECT SINGLE PIT
	SPL	ELEC STAY POLE
	PP	ELEC POWER POLE
	ELP	ELEC POLE/LIGHT
	TRANS	ELE POLE/TRANSFORM
	FD	FUEL DIP
	GM	GAS MAIN
	GMR	GAS METER
	GAS	GAS VALVE
	AG	GATE
	GUL	GULLY PIT
	HYD	HYDRANT
	BOR	BOREHOLE

SYM	CODE	DESCRIPTION
	OFM	OPTICAL FIBRE MARKER
	OFP	OPTICAL FIBRE PIT
	TM	PALM TREE
	SE	SEAT
	TS	SHRUB
	TCA	TELSTRA PIT
	SLH	SEWER LAMP HOLE
	SMH	SEWER MANHOLE
	SVP	SEWER VENT PIPE
	SI	SIGN
	BUS	BUS STOP SIGN
	T	TREE
	SGL	TRAFFIC LIGHT
	SCL	TRAFFIC CONTROLLER
	SJX	TRAFFIC JUNCTION BOX
	US	UNKNOWN SERVICE
	WAV	WATER AIR VALVE
	WMR	WATER METER
	WEP	WATER PUMP
	WSV	WATER STOP VALVE
	WTP	WATER TAP

Symbols shown are indicative only. The symbol size and orientation does not necessarily represent the real size or orientation of the feature.

DRAINAGE PIPE U/G
DRAIN
ELECT. CABLE A/G
ELECT. CABLE U/G
GAS PIPE
FENCE LINE
SEWERAGE PIPE
TELSTRA CABLE
WATER PIPE

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ISO 9001:2008
FS 535063

HEIGHT DATUM AHD	LOCAL AUTHORITY CITY OF PARRAMATTA	
HEIGHT ORIGIN N/A	SCALE 1:1500 (A1)	
MERIDIAN 56	CONTOUR INTERVAL N/A	
CO-ORD SYSTEM MGA	SURVEYOR N/A	DATE OF SURVEY -
CCAD FILE 74707 ver 9 final subdivision	DRAWN SF/CLP	DATE 3/04/2024
AUTOCAD FILE SY074707.000.13.20	CHECKED GKO	DATE 3/04/2024
ARCHIVE FILE SY074707.000.13.6	APPROVED GKO	DATE 3/04/2024
PLAN NUMBER SY074707.000.13.20	SHEET 1 OF 1	

PD:GKO

CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE NSW 2142
PART LOT 100 DP1168951
PROPOSED LOT 64 CAPPING WORKS

DRAWING LIST:

DRAWING NO.	DRAWING TITLE
CO13919.06-CC10	DRAWING LIST & GENERAL NOTES
CO13919.06-CC11	GENERAL ARRANGEMENT PLAN
CO13919.06-CC12	EXISTING SITE LEVELS & FEATURES
CO13919.06-CC30	PROPOSED EARTHWORKS PLAN
CO13919.06-CC35	PROPOSED EARTHWORKS SECTIONS
CO13919.06-CC40	PROPOSED CAPPING & GRADING PLAN
CO13919.06-CC45	STORMWATER DRAINAGE DETAILS AND LONGSECTIONS
CO13919.06-CC55	TYPICAL DETAILS - SHEET 1
CO13919.06-CC56	TYPICAL DETAILS - SHEET 2

GENERAL NOTES:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
2. ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
3. ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE.
   ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS.
   ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT.
   REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.
4. DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
5. UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
6. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

ELECTRONIC INFORMATION NOTES:

1. THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
2. THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
3. THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
4. THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.

LOCALITY PLAN
SCALE 1:2000

20m 0 50 100 150 200m
SCALE 1:2000 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC10

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COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
DRAWING LIST & GENERAL NOTES

DRAWING No CO13919.06-CC10
ISSUE A

GENERAL ARRANGEMENT PLAN
SCALE 1:1000

FOR CONSTRUCTION CERTIFICATE

10m 0 10 20 30 40 50 60 70 80 90 100m
SCALE 1:1000 AT A0 SIZE SHEET

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC11

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CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
GENERAL ARRANGEMENT PLAN

DRAWING No CO13919.06-CC11
ISSUE A

EXISTING SERVICES NOTES:

1. DURING THE EXECUTION OF WORKS, THE CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF EXISTING SERVICES. THE CONTRACTOR SHALL REPAIR ANY DAMAGE CAUSED TO THE EXISTING SERVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE RELEVANT SERVICE AUTHORITY, AT NO COST TO THE PRINCIPAL.
2. WHERE IT IS NECESSARY TO REMOVE, DIVERT OR CUT INTO ANY EXISTING SERVICE, THE CONTRACTOR SHALL GIVE AT LEAST THREE (3) DAYS NOTICE OF ITS REQUIREMENTS TO THE SUPERINTENDENT, WHO WILL ADVISE WHAT ARRANGEMENTS SHOULD BE MADE FOR THE ALTERATION OF SUCH EXISTING WORKS.
3. EXISTING SERVICES HAVE BEEN PLOTTED FROM SUPPLIED DATA. THE ACCURACY IS NOT GUARANTEED. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ESTABLISH THE LOCATION AND LEVEL OF ALL EXISTING SERVICES PRIOR TO COMMENCING WORK. ALL CLEARANCES AND APPROVALS SHALL ALSO BE OBTAINED FROM THE RELEVANT SERVICE AUTHORITY PRIOR TO THE COMMENCEMENT OF WORK.
4. ALL NEW AND EXHUMED SERVICES THAT CROSS EXISTING AND FUTURE ROADS/PAVEMENTS WITHIN THE SITE SHALL BE BACKFILLED WITH DGB20 MATERIAL TO SUBGRADE LEVEL AND COMPACTED TO 98% STANDARD DENSITY RATIO. SUBJECT TO PRIOR APPROVAL FROM RELEVANT AUTHORITY.
5. ON COMPLETION OF SERVICES INSTALLATION. ALL DISTURBED AREAS SHALL BE RESTORED TO ORIGINAL, INCLUDING KERBS, FOOTPATHS, CONCRETE AREAS, GRAVEL AREAS, GRASSED AREAS AND ROAD PAVEMENTS.
6. CARE TO BE TAKEN WHEN EXCAVATING NEAR UTILITY SERVICES. NO MECHANICAL EXCAVATION TO BE UNDERTAKEN OVER SERVICES. LIAISE WITH RELEVANT AUTHORITY.
7. THE CONTRACTOR SHALL ALLOW FOR THE CAPPING OFF, EXCAVATION AND REMOVAL IF REQUIRED OF ALL EXISTING SERVICES IN AREAS AFFECTED BY THE WORKS WITHIN THE CONTRACT AREA AS SHOWN ON THE DRAWINGS UNLESS DIRECTED OTHERWISE BY THE SUPERINTENDENT. ALL TO REGULATORY AUTHORITY STANDARDS AND APPROVAL.
8. THE CONTRACTOR IS TO MAINTAIN EXISTING STORMWATER DRAINAGE FLOWS THROUGH THE ROADS AT ALL TIMES. MAKE DUE ALLOWANCE FOR ALL SUCH FLOWS AT ALL TIMES.
9. PRIOR TO COMMENCEMENT OF ANY WORKS THE CONTRACTOR SHALL OBTAIN THE SUPERINTENDENT'S APPROVAL OF THE PROGRAM FOR THE RELOCATION/CONSTRUCTION OF TEMPORARY SERVICES.
10. CONTRACTOR SHALL CONSTRUCT TEMPORARY SERVICES AS REQUIRED TO MAINTAIN EXISTING SUPPLY TO BUILDINGS REMAINING IN OPERATION DURING WORKS TO THE SATISFACTION AND APPROVAL OF THE SUPERINTENDENT. ONCE DIVERSION IS COMPLETE AND COMMISSIONED THE CONTRACTOR SHALL REMOVE ALL SUCH TEMPORARY SERVICES AND MAKE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT.
11. INTERRUPTION TO SUPPLY OF EXISTING SERVICES SHALL BE DONE SO AS NOT TO CAUSE ANY INCONVENIENCE OR DAMAGE TO THE ADJACENT RESIDENCES. CONTRACTOR TO GAIN APPROVAL OF THE SUPERINTENDENT FOR TIME OF INTERRUPTION.
12. THE CONTRACTOR SHALL UNDERTAKE A DIAL BEFORE YOU DIG (DBYD 1100) SERVICES SEARCH BEFORE THE COMMENCEMENT OF ANY WORKS.

EXISTING SITE LEVELS AND FEATURES
SCALE 1:250

FOR CONSTRUCTION CERTIFICATE

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA EnergyAustralia
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC12

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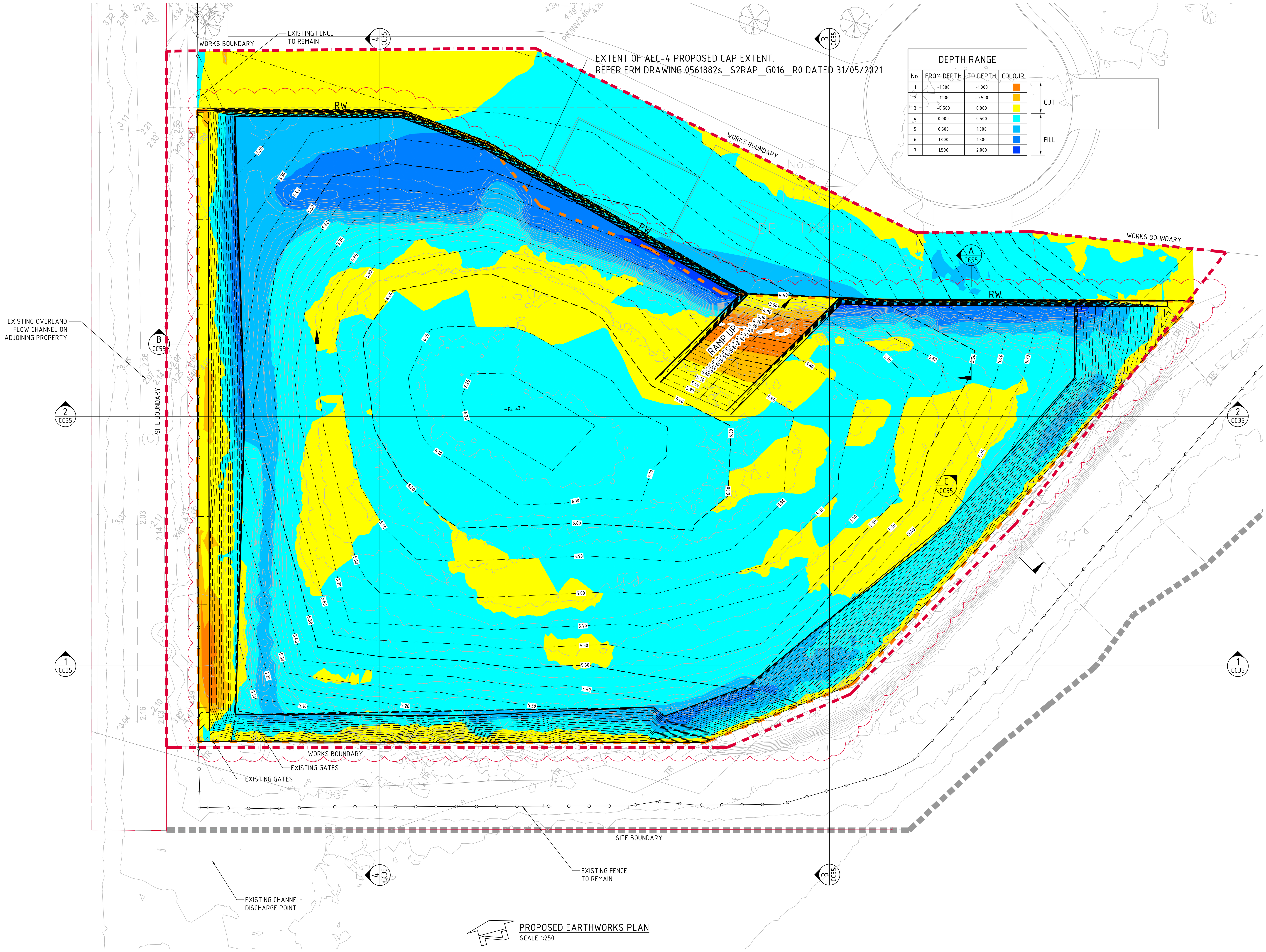
CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE: EXISTING SITE LEVELS & FEATURES
DRAWING No: C013919.06-CC12
ISSUE: A



PROPOSED EARTHWORKS PLAN
SCALE 1:250

DEPTH RANGE			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-1.500	-1.000	
2	-1.000	-0.500	
3	-0.500	0.000	
4	0.000	0.500	
5	0.500	1.000	
6	1.000	1.500	
7	1.500	2.000	

CUT
FILL

SITE PREPARATION NOTES:

1. ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT SYDGE289002-AB PROVIDED BY TETRA TECH COFFEY DATED 17 AUGUST 2021.
2. EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY ERM TITLED 0561882s__S2RAP__G016__R0 DATED 31 MAY 2021..
3. STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
4. COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
5. PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
6. AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
7. SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
8. IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
9. ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE LAYER. FURTHER, LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (AS1289.5.4.1) OR HILF TEST METHOD (AS1289.5.7.1). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS SHOULD BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION
10. ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS [IN THE STATED PERIOD] ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION.
11. PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
12. EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
13. MATCH EXISTING LEVELS AT BATTER INTERFACE.
14. CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
15. DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

ALLOWANCES FOR STRUCTURE

	DEPTH OF PAVEMENT
PAVEMENT	725mm
LANDSCAPING	300mm

EARTHWORK ESTIMATES

SITE AREA	= 1.65 Ha
CUT	= - 700m³
FILL	= +3,400m³
ALLOWANCES	
RETAINING WALLS	= -1,000m³ (APPROX. TBC)
STORMWATER	= - 100m³ (APPROX. TBC)
SERVICES TRENCH	= - 600m³ (APPROX. TBC)
DIFFERENCE	= +1,000m³ (i.e. FILL OVER CUT)

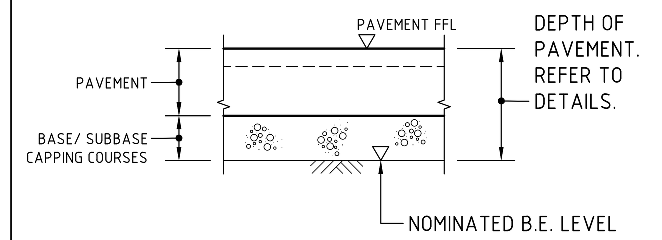
NOTE:
VOLUMES BASED ON NO TOPSOIL/ PAVEMENT STRIP OVER THE NOMINATED AREA. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED EXCAVATION RELATED TO CONSTRUCTION ACTIVITIES. DETAILED EXCAVATION ALLOWANCE IS APPROXIMATE ONLY AND ACCOUNTS FOR RETAINING WALL CONSTRUCTION. THE ALLOWANCES VOLUMES ARE TO BE CONFIRMED BY THE CONTRACTOR. REFER ANY CONCERNS TO ENGINEER.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ERM DATED 31 MAY 2021.

- 50.00 - EXISTING CONTOUR
- 50.00 - B.E.L. CONTOUR (MAJOR 0.5m)
- 50.10 - B.E.L. CONTOUR (MINOR 0.1m)
- 50.000 - B.E.L. SPOT LEVEL
- CAPPING BOUNDARY
- WORKS BOUNDARY



NOMINATED B.E.L. DETAIL
NTS

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED	05.03.24	C
REVISED AS CLOUDED	16.02.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC30

CONSULT AUSTRALIA

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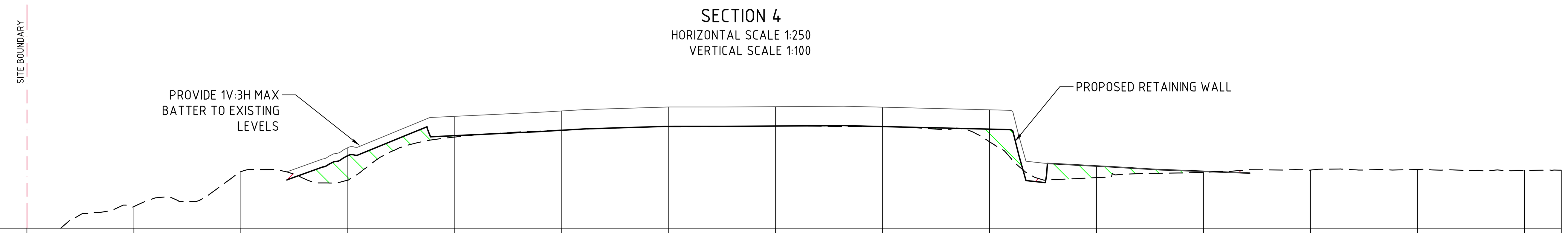
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
PROPOSED EARTHWORKS PLAN

DRAWING No C013919.06-CC30
ISSUE C

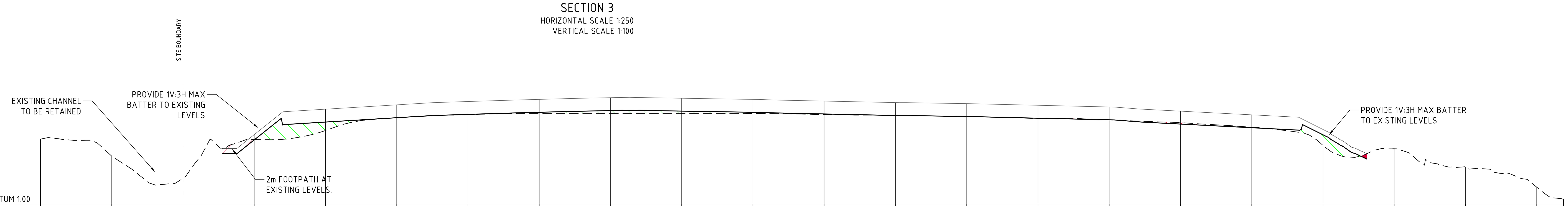
FINISHED SURFACE LEVEL				5.679	6.188	6.487	6.586	6.656	6.725	6.753	6.742	6.657	6.426	6.195	4.405		
BULK EARTHWORKS LEVEL				5.379	5.463	5.762	5.861	5.931	6.000	6.028	6.017	5.932	5.701	5.470	4.405		
CUT/FILL DEPTH				0.756	0.047	0.162	0.061	0.014	0.002	0.028	0.018	-0.006	0.827	1.071	-0.077		
EXISTING SURFACE LEVEL	1.82	2.327	4.085	5.123	5.415	5.600	5.800	5.917	5.999	6.000	5.999	5.938	4.874	4.399	4.481	4.567	4.62
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	153.538

SECTION 4
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



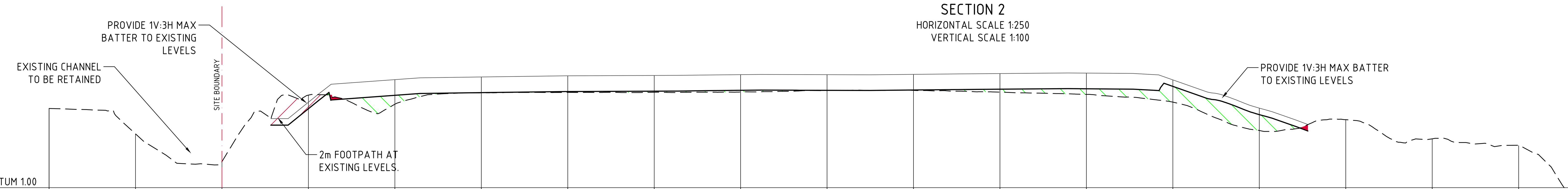
FINISHED SURFACE LEVEL					5.018	6.191	6.395	6.540	6.555	6.534	6.436	4.331	4.132				
BULK EARTHWORKS LEVEL					4.718	5.466	5.670	5.815	5.830	5.809	5.711	4.331	4.132				
CUT/FILL DEPTH					0.020	0.050	-0.011	0.015	0.000	0.005	0.474	0.436	0.036				
EXISTING SURFACE LEVEL	0.79	1.306	2.809	4.118	3.798	5.416	5.681	5.800	5.830	5.804	5.237	3.895	4.096	4.179	4.203	4.165	4.18
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	153.457

SECTION 3
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



FINISHED SURFACE LEVEL				4.903	6.333	6.576	6.766	6.885	6.979	6.951	6.886	6.790	6.705	6.647	6.552	6.458	6.223	6.017	5.192				
BULK EARTHWORKS LEVEL				4.603	5.608	5.851	6.041	6.160	6.254	6.226	6.161	6.065	5.980	5.922	5.827	5.733	5.498	5.292	4.892				
CUT/FILL DEPTH				-0.023	0.475	-0.010	0.016	0.060	0.154	0.126	0.066	0.032	-0.016	0.018	0.019	0.005	-0.076	-0.028	0.592				
EXISTING SURFACE LEVEL	4.65	3.692	2.434	4.626	5.132	5.861	6.025	6.100	6.100	6.100	6.096	6.033	5.995	5.903	5.808	5.727	5.574	5.321	4.300	4.104	3.085	1.946	1.26
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	213.750

SECTION 2
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100



FINISHED SURFACE LEVEL				4.951	5.994	6.118	6.171	6.187	6.226	6.226	6.240	6.277	6.297	5.983	4.677								
BULK EARTHWORKS LEVEL				4.651	5.269	5.393	5.446	5.462	5.501	5.501	5.515	5.552	5.572	5.683	4.377								
CUT/FILL DEPTH				-0.628	0.413	0.012	0.042	0.052	0.078	0.010	0.017	0.134	0.258	0.730	0.733								
EXISTING SURFACE LEVEL	4.66	3.486	2.201	5.279	4.856	5.381	5.404	5.410	5.422	5.491	5.498	5.419	5.313	4.953	3.643	4.145	3.256	2.941	0.551	0.546	0.543	0.475	0.46
CHAINAGE		10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	

SECTION 1
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:100

LEGEND:

- DENOTES FINISHED LEVELS PROFILE
- DENOTES EARTHWORKS PROFILE
- DENOTES EXISTING PROFILE
- DENOTES AREA IN CUT
- DENOTES AREA IN FILL

1m 0 1 2 3 4 5 6 7 8 9 10m
SCALE 1:100 AT A0 SIZE SHEET

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ALL PAVEMENT AND SUBGRADE LEVELS RAISED 300mm	05.03.24	C
REVISED AS CLOUDED	16.02.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

CLIENT: VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC35

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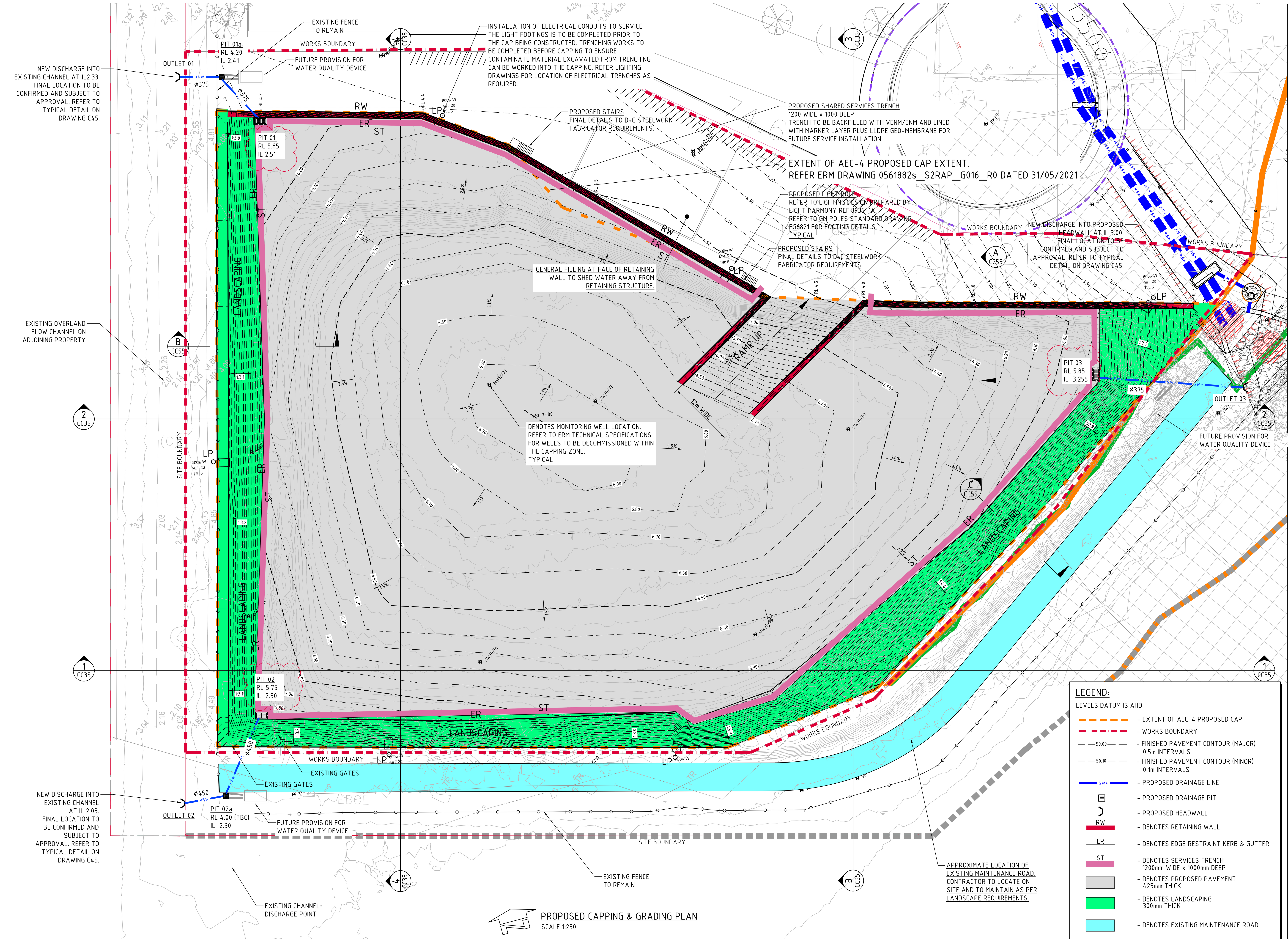
DRAWING TITLE: PROPOSED EARTHWORKS SECTIONS

DRAWING No: C013919.06-CC35 ISSUE: C



PROPOSED CAPPING & GRADING PLAN
SCALE 1:250

LEGEND:

LEVELS DATUM IS AHD.

- EXTENT OF AEC-4 PROPOSED CAP
- WORKS BOUNDARY
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- PROPOSED DRAINAGE LINE
- PROPOSED DRAINAGE PIT
- PROPOSED HEADWALL
- RW – DENOTES RETAINING WALL
- ER – DENOTES EDGE RESTRAINT KERB & GUTTER
- ST – DENOTES SERVICES TRENCH 1200mm WIDE x 1000mm DEEP
- DENOTES PROPOSED PAVEMENT 425mm THICK
- DENOTES LANDSCAPING 300mm THICK
- DENOTES EXISTING MAINTENANCE ROAD
- LP – DENOTES LIGHT POLE

FINISHED LEVELS PLAN NOTES:

1. LEVELS DATUM IS AUSTRALIAN HEIGHT DATUM (A.H.D.).
2. GRADING REQUIREMENTS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS2890.1, AS2890.2 AND AS2890.6.
3. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
4. CONTOUR INTERVALS
   - THE MINOR CONTOUR INTERVAL IS 0.1m.
   - THE MAJOR CONTOUR INTERVAL IS 0.5m.
5. HARDSTAND GRADING
   - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%).
   - GRADING OF ON-GRADE DOCKS TO BE 1:100 (1%) FALL AWAY FROM THE DOCK FACE FOR A LENGTH OF 15m U.N.O.
   - GRADING OF TRUCK CIRCULATION ZONES TO BE MINIMUM AS NOTED ABOVE, 3-4% NOMINAL AND MAX. 5%.
6. CAR PARKING AREA GRADES
   - MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%), DESIRABLE MINIMUM GRADE 1:50 (2%).
   - MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) N CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
   - DISABLED ACCESS PARKING ZONES AND SHARED SPACE TO BE MAXIMUM OF 1:33 (3%) IN ASPHALT PAVEMENT AND MAXIMUM OF 1:40 (2.5%) IN CONCRETE PAVEMENT.
   - CARPARK RAMP GRADES TO BE MAX 1:5 WITH 2.5m SMOOTH TRANSITION AT TOP AND BOTTOM U.N.O.
7. TRUCK RAMP GRADES
   - MAXIMUM B-DOUBLE OR 19.0m AV RAMP GRADES ARE TO BE 1:8.3 (12%) U.N.O. ON PLAN
   - PROVIDE MINIMUM 4.0m LONG TRANSITION WHERE CHANGES OF GRADE EXCEED 1:20 (5%) AT A CREST U.N.O.
   - PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGE OF GRADE EXCEED 1:20 (5%) AT A SAG U.N.O.
   - TRANSITIONS ARE TO PROVIDE A SMOOTH CONTINOUS CIRCULAR AND TANGENTIAL CHANGE IN GRADE TO ENSURE NO SHARP OR ACUTE CHANGES IN GRADE ARE PRESENT.
8. WHERE FIRE BRIGADE ACCESS IS REQUIRED, MAXIMUM RAMP GRADIENTS ARE TO BE 1:6 (16.6%), DESIRABLE RAMP GRADIENTS ARE TO BE 1:8 (12.5%) WITH 7m TRANSITION TOP AND BOTTOM U.N.O. ON PLAN.
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H U.N.O. BASED ON GEOTECHNICAL ASSESSMENT. PROVIDE MINIMUM 0.5m BERM BETWEEN THE BACK OF KERB OR PAVEMENT EDGES AND THE TOP OR TOE OF A BATTER.
10. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL. GRADE.
12. ALL PAVEMENTS ARE TO BE SET AT 30mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS. PROVIDE LOCAL FEATHERING AT DOORWAYS OR ROLLER SHUTTERS TO PROVIDE FLUSH FINISH AS REQUIRED.
13. WHERE NEW AND EXISTING INTERFACING IS REQUIRED, MATCH EXISTING LEVELS AND PROVIDE SMOOTH INTERFACE BETWEEN NEW AND EXISTING GRADIENTS. REFER ANY CONCERNS TO THE ENGINEER.

STORMWATER DRAINAGE NOTES:

1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
3. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
4. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
5. ALL STORMWATER PIPES Ø375 OR GREATER SHALL BE CLASS 2 (WITH HS2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
6. ALL PIPES UP TO AND INCLUDING Ø300 TO BE uPVC GRADE SN8 UNO.
7. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
8. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c=25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
9. IN ADDITION TO ITEM 9 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
10. PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
11. CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING HS2 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
12. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 uPVC TO EACH SIDE OF PIPE.
13. ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
14. WHERE SUBSOIL DRAINAGE PASSES UNDER A PAVEMENT OR A SLAB, UNSLOTTED UPVC ARE TO BE PROVIDED UNLESS NOTED OTHERWISE.
15. ALL PIPE GRADES 1 IN 200 MINIMUM UNO.
16. PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
17. MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
18. PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY', THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' U.N.O.
19. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
20. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
21. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.
22. WHERE CONNECTION TO EXISTING INGROUND DRAINAGE SYSTEMS, OPEN SWALES, CHANNELS OR ANY OTHER EXISTING SYSTEM, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND INVERT ON SITE AT THE BEGINNING OF THE CONSTRUCTION PERIOD. REFER ANY VARIANCE FROM DOCUMENTATION OR SURVEYS TO THE ENGINEER FOR CLARIFICATION.

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
PAVEMENT LEVELS RAISED 300mm AND PIT SURFACE LEVEL REVISED	05.03.24	D
REVISED AS CLOUDED	16.02.24	C
REVISED FOR INVERTS AND OUTLET 3 AS CLOUDED	03.08.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: EnergyAustralia (VIVA)
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC40

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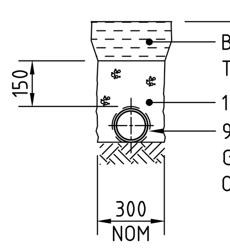
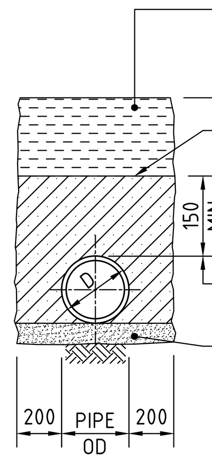
DRAWING TITLE: PROPOSED CAPPING & GRADING PLAN
DRAWING No: C013919.06-CC40
ISSUE: D

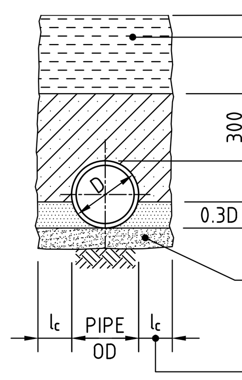


SUPPORT TO AGRICULTURAL DRAIN
SCALE 1:20

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0

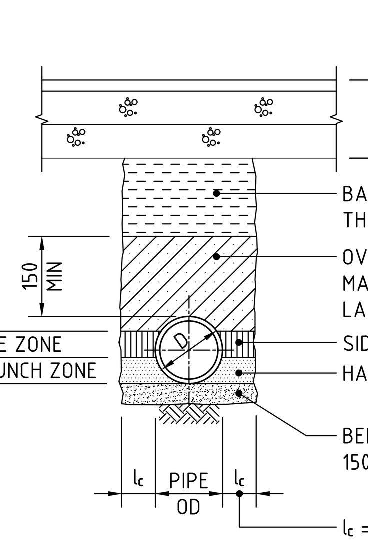


SUPPORT TO uPVC PIPES
SCALE 1:20



TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS
SCALE 1:20

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	20 TO 0

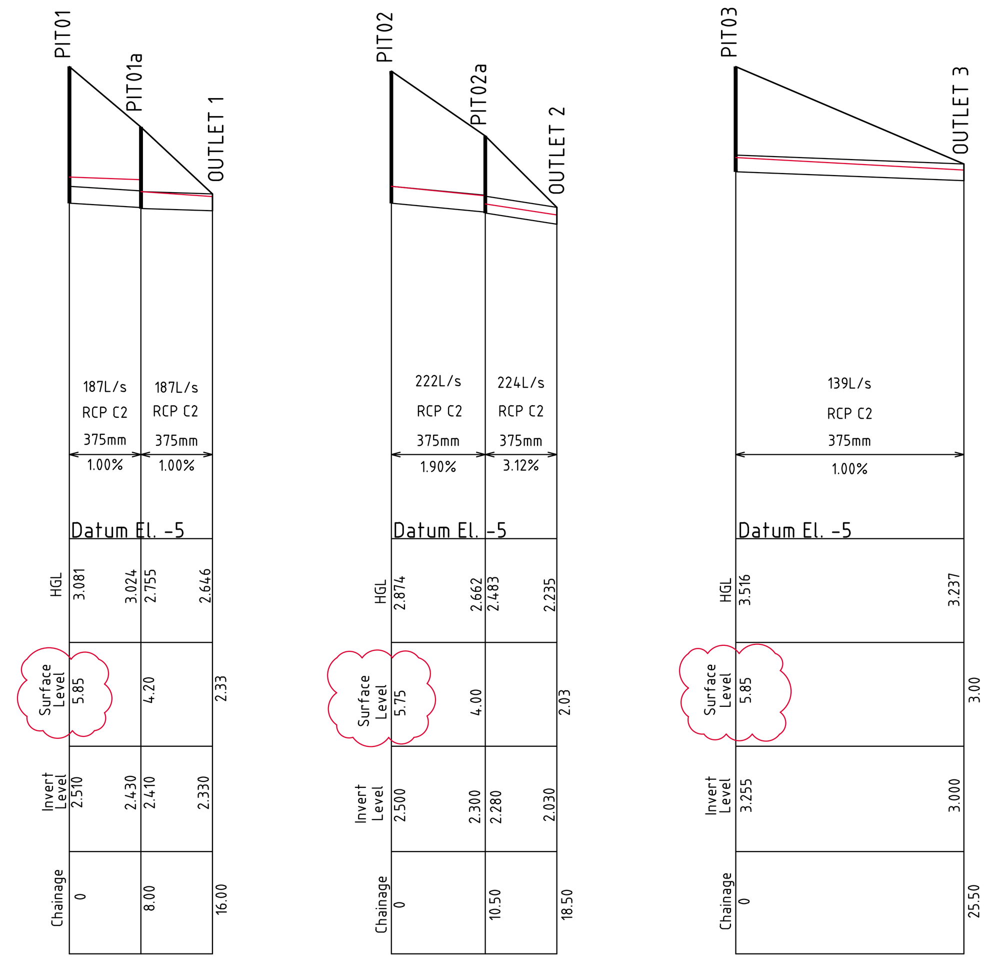


TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT
SCALE 1:20
D ≤ 1350, MAX FILL = 4.0m
D > 1350, MAX FILL = 3.0m

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE WIDTH	
PIPE SIZE (mm)	lc (mm)
≤ 900Ø	150
1050Ø	175
1200Ø	200
1350Ø	225
1500Ø	250
1650Ø	275
1800Ø	300
ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800Ø	

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0
SELECT FILL MATERIAL IN ACCORDANCE WITH TABLE 7 AS 3725:2007	

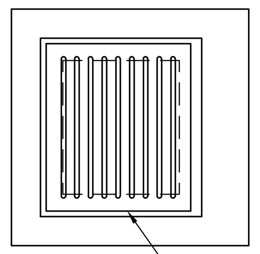


PIT 01 TO OUTLET 1
SCALE 1:500 HORIZONTAL
SCALE 1:100 VERTICAL

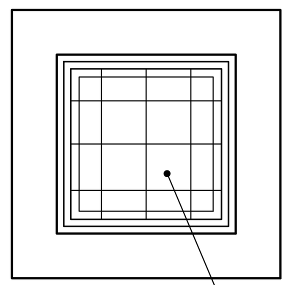
PIT 02 TO OUTLET 2
SCALE 1:500 HORIZONTAL
SCALE 1:100 VERTICAL

PIT 03 TO OUTLET 3
SCALE 1:500 HORIZONTAL
SCALE 1:100 VERTICAL

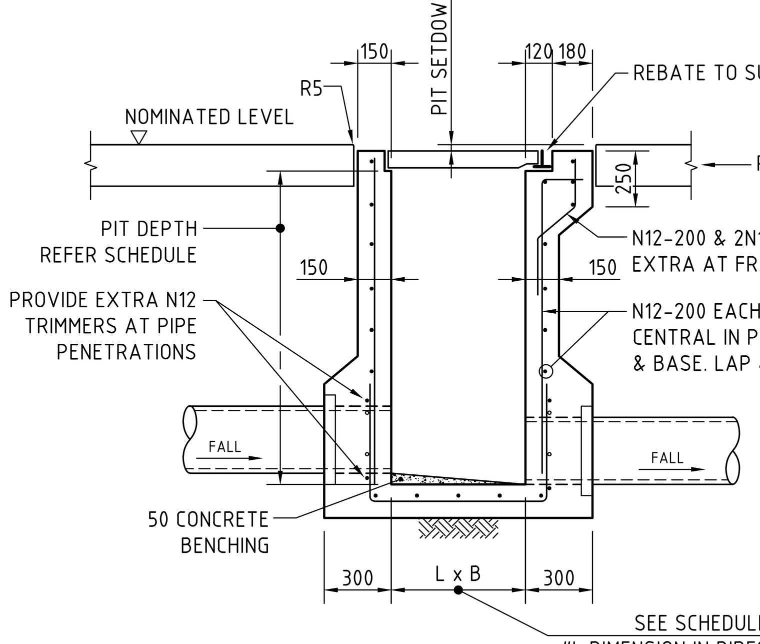
NOTE:
H.G.L & FLOWRATE SHOWN FOR Q20 A.R.I STORM EVENT



PLAN
SCALE 1:20

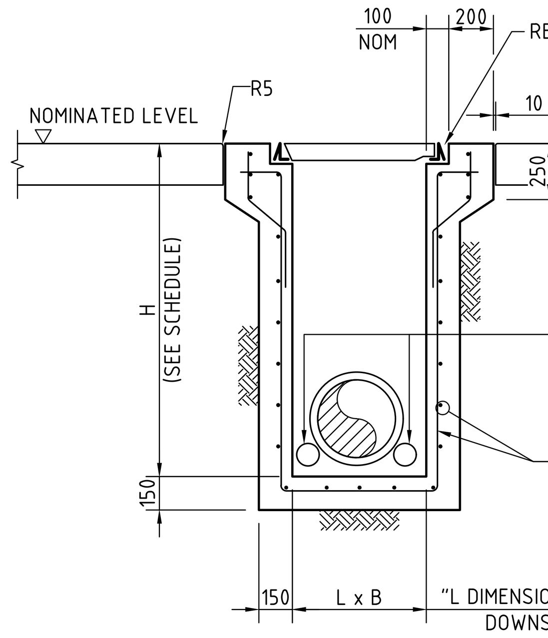


PLAN
SCALE 1:20



SECTION
SCALE 1:20

SINGLE GRATED GULLY PIT - SGGP



SECTION
SCALE 1:20

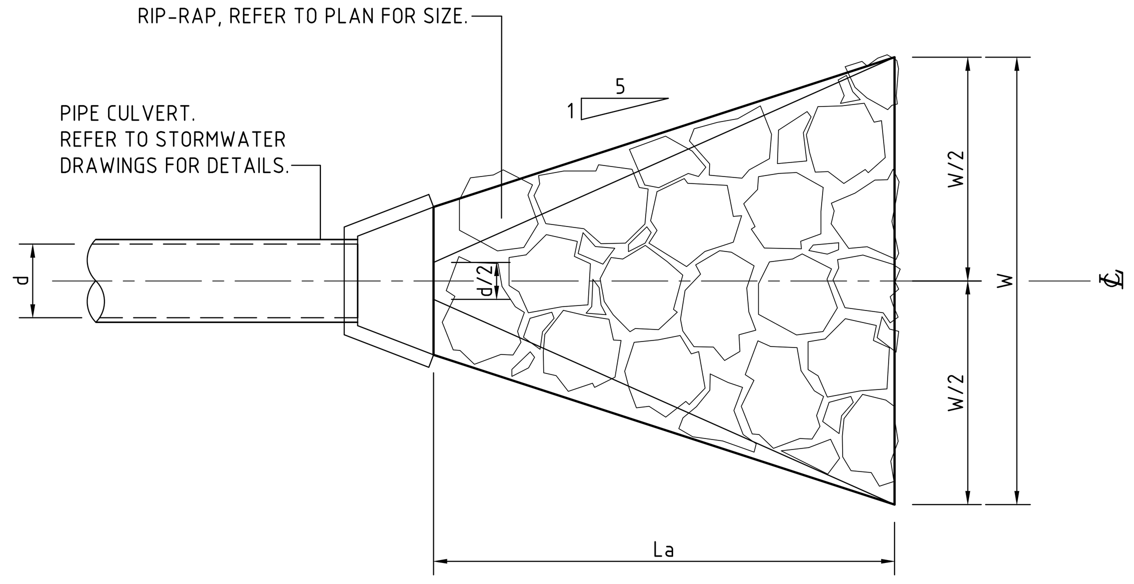
SEALED JUNCTION PIT - SJP

DISSIPATER NOTES :

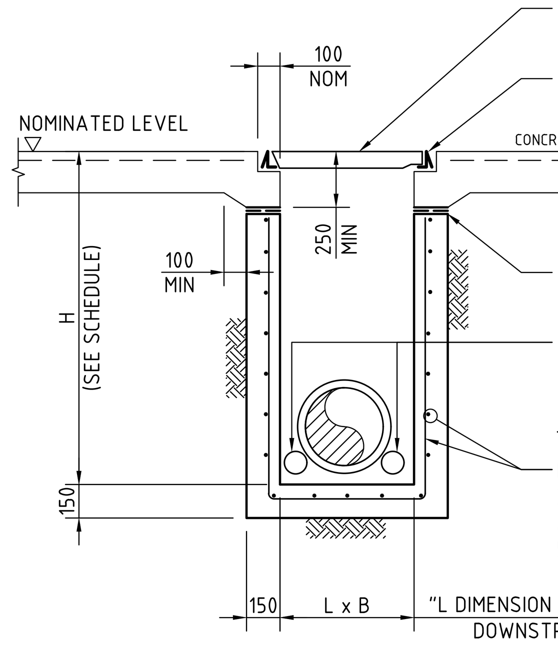
1. ALIGN STRUCTURE EVENLY WITH BANK.
2. LOCATE STRUCTURE AT INVERT LEVEL OF STREAM AND POINT IN A DOWNSTREAM DIRECTION.
3. PIPE TO REST ON, AND BE PACKED IN, BY RIP-RAP (SIZE AS NOTED).
4. DISCHARGE INTO STREAM WHERE BEDROCK IS PRESENT, OTHERWISE SCOUR PROTECT AS REQUIRED.
5. SCOUR PROTECT THE OPPOSITE BANK AS REQUIRED. SCOUR PROTECTION TO BE PROVIDED WHERE OPPOSITE BANK IS WITHIN 12-14 TIMES THE PIPE DIAMETER.
6. RIP-RAP TO CONSIST OF ANGULAR RUN-OF-QUARRY ROCK (d50= 150mm MINIMUM) AS NOTED ON THE PLAN. RIP-RAP TO BE MINIMUM THICKNESS OF RIP-RAP LAYER TO BE 1.6x AVERAGE ROCK SIZE (d50).
7. RIP-RAP IS TO BE PLACED OVER A 200mm LAYER OF 140mm COBBLES OVER NEEDLE-PUNCHED GEOFAB A44.
8. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE FINISHED RIP-RAP SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS.
9. GAPS IN RIP-RAP TO BE HAND PACKED WITH TOPSOIL & PLANTED WITH NATIVE SEDGES & RUSHES TO PROVIDE. THE INTENT IS FOR THERE TO BE NO VOIDS BETWEEN RIP-RAP BOULDERS.
10. ENSURE THE FINISHED ROCK SURFACE BLENDS WITH THE SURROUNDING GROUND LEVELS. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
11. ENSURE THAT STORMWATER FROM SURROUNDING GROUND IS FREE TO ENTER THE STRUCTURE WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

DISSIPATER SCHEDULE

DISCHARGE POINT	d	La	W	RIP-RAP (d50)
OUTLET 01	375	2000	2000	150
OUTLET 02	450	3000	3000	200
OUTLET 03	375	2000	2000	150

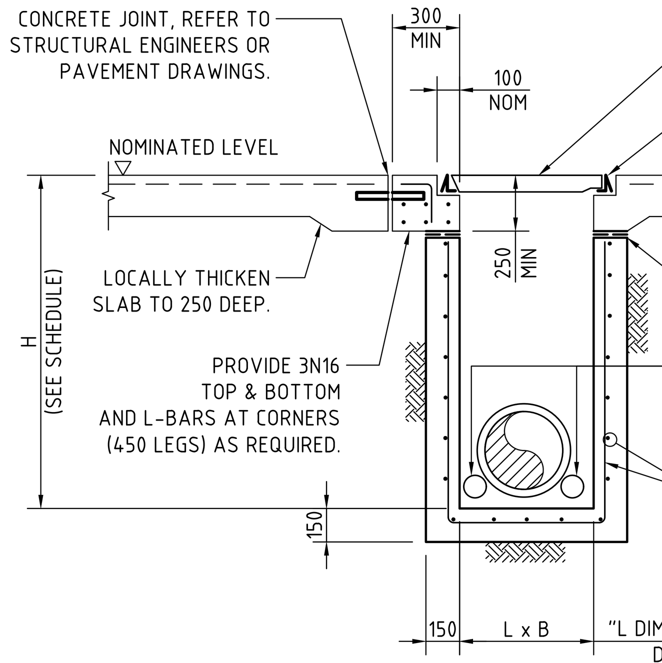


PLAN



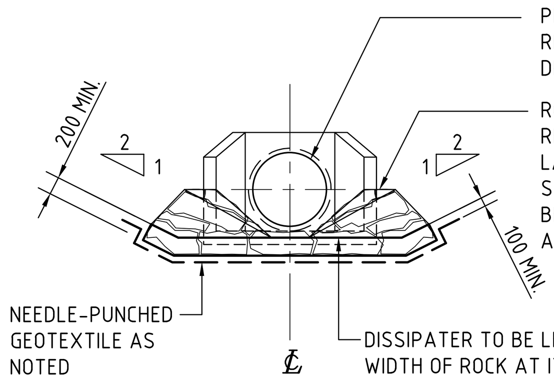
SECTION
SCALE 1:20

SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB
(ADOPT IN CONCRETE PAVEMENTS FOR SGGP's & SJP's, WHERE JOINTS ARE NOT LOCATED WITHIN PROXIMITY OF THE GRATE)

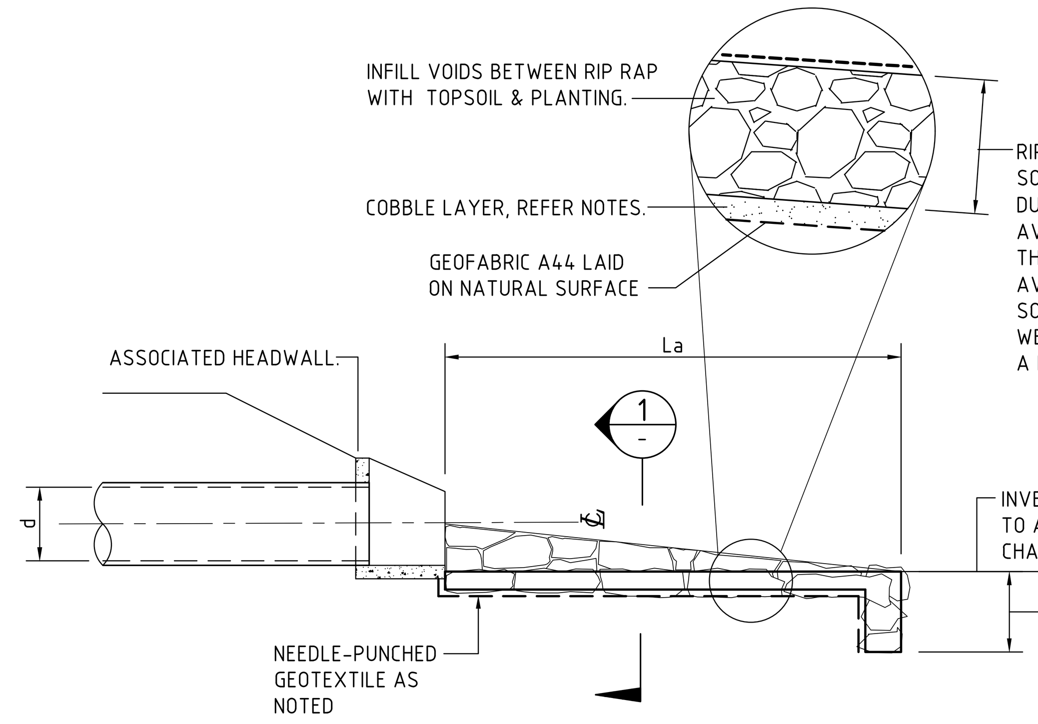


SECTION
SCALE 1:20

SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB
(ADOPT IN CONCRETE PAVEMENT FOR SGGP's & SJP's, WHERE PITS ARE LOCATED IN THE CORNER OF SLAB PANELS OR ADJACENT TO SLAB PANEL JOINTS)

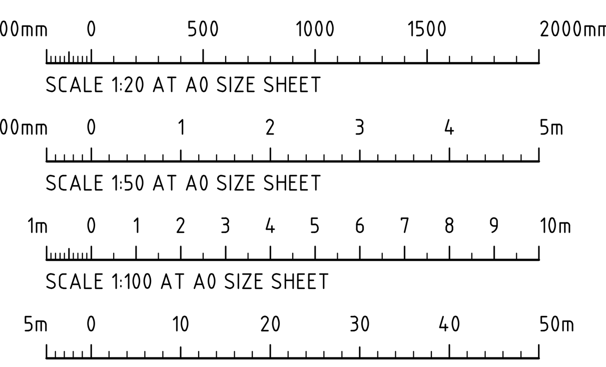


SECTION 1:50



SECTIONAL ELEVATION

STORMWATER OUTLET DISSIPATER WITH HEADWALL
SCALE 1:50



FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PIT SURFACE LEVEL	05.03.24	C
REVISED AS CLOUDED	03.08.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

VIVA Energy Australia

CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC45

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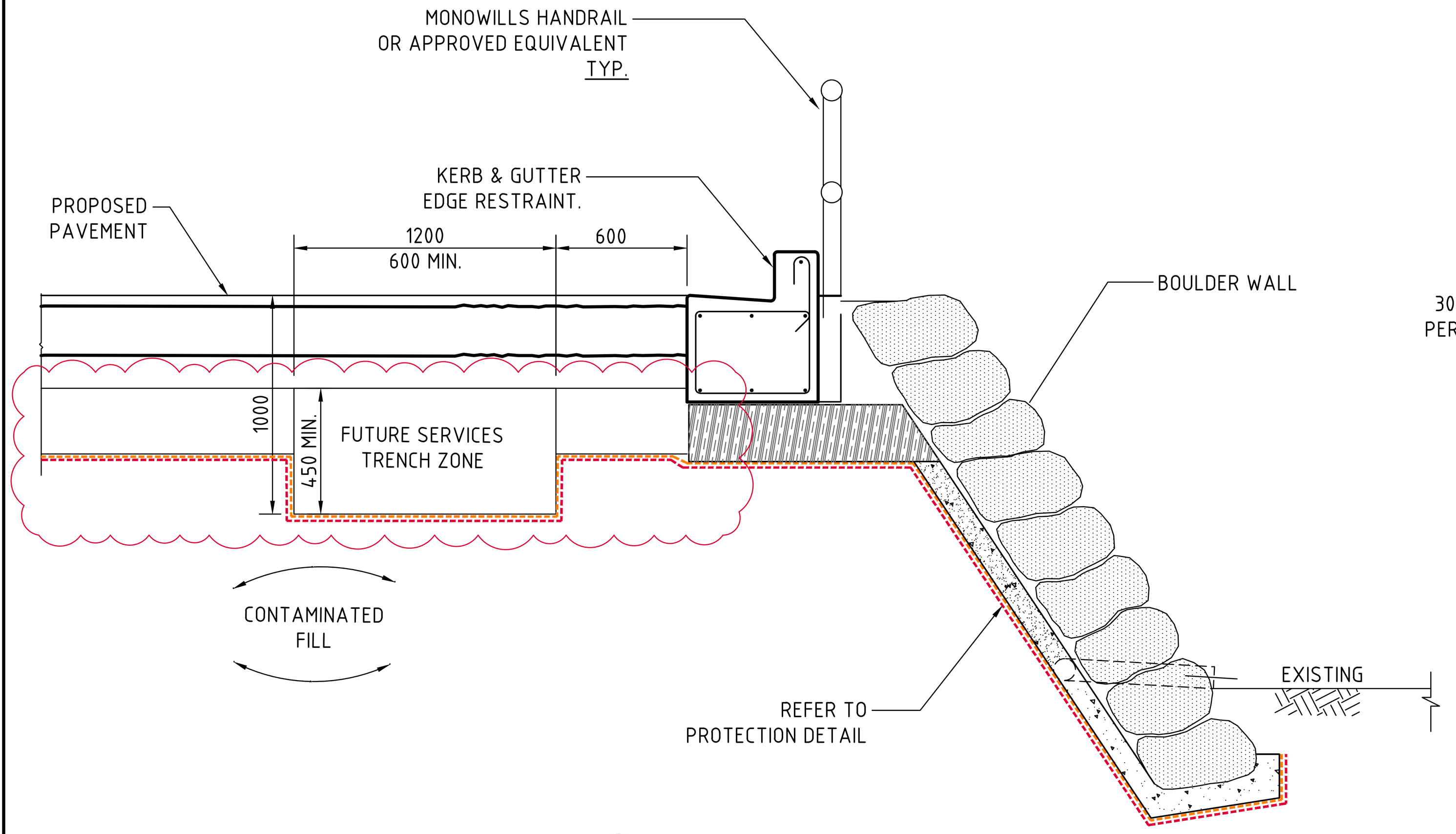
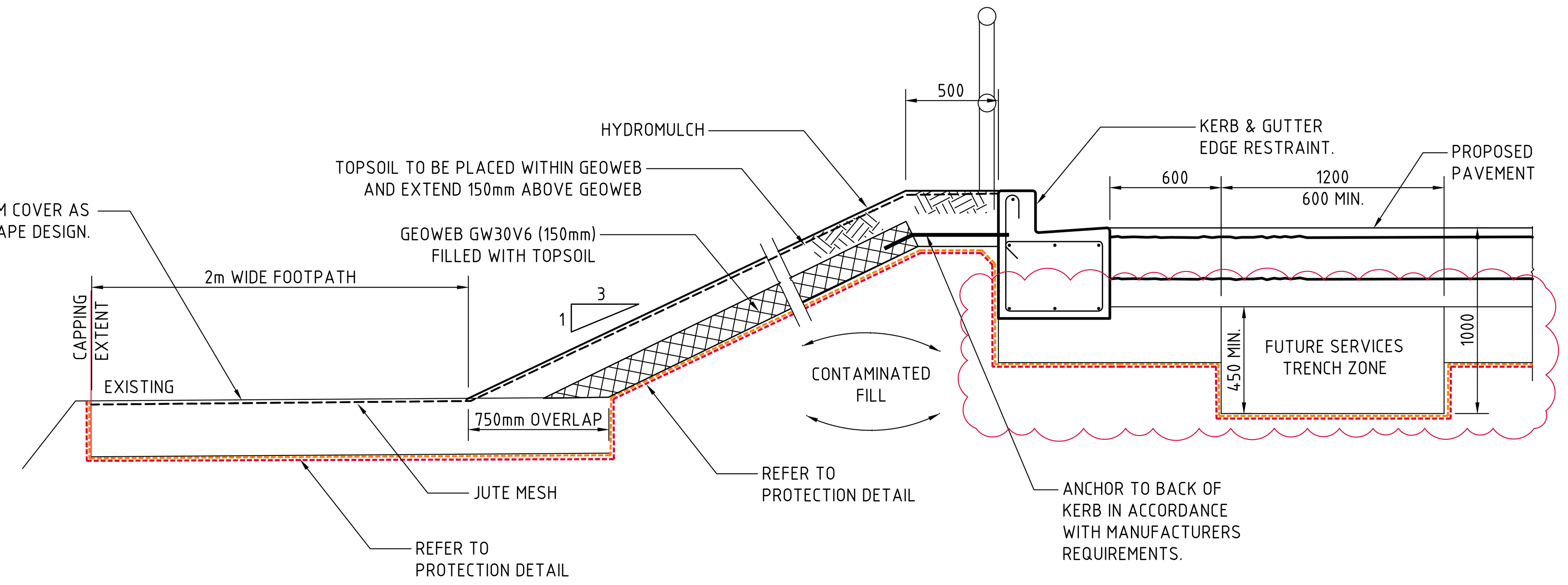
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE: STORMWATER DRAINAGE DETAILS AND LONGSECTIONS
DRAWING No: CO13919.06-CC45
ISSUE: C



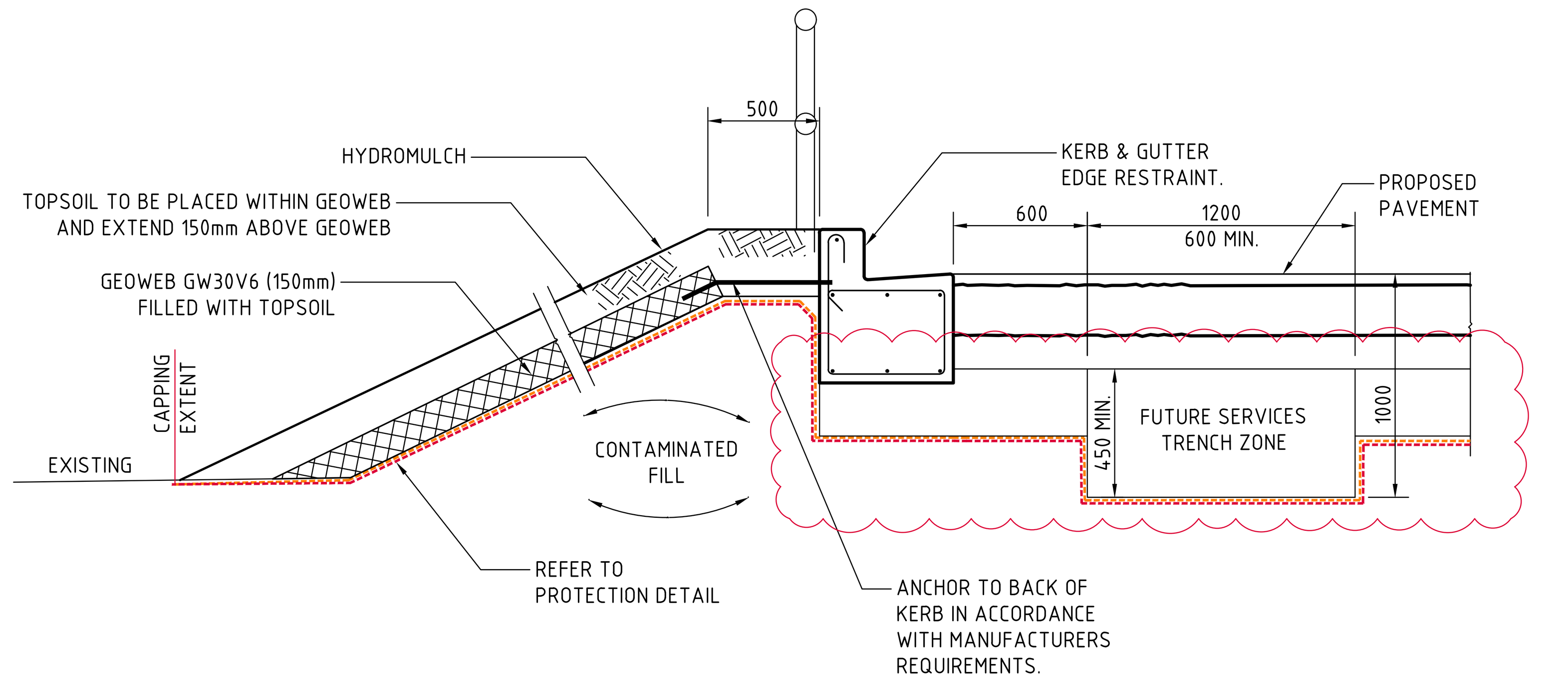
SECTION 1:20 A C40 TYPICAL INTERFACE AT TOP OF WALL

NOTE:
CRASH BARRIER REQUIREMENTS TO TOP OF WALL TO BE CONFIRMED BY CLIENT.



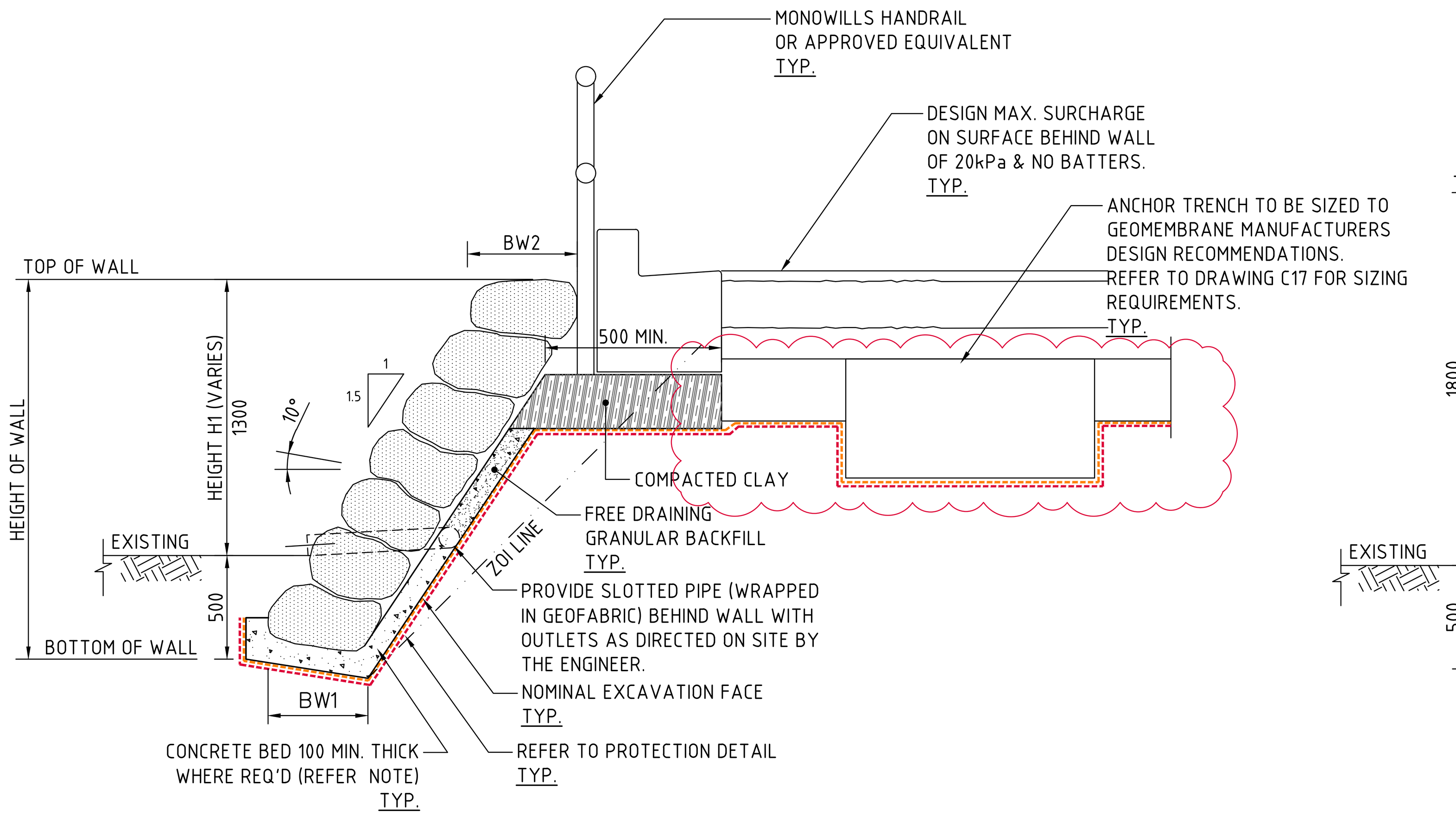
SECTION 1:20 B C40 TYPICAL INTERFACE AT WESTERN BATTER EDGE

NOTE:
GEOWEB TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS. LAYERS SHOWN ARE DIAGRAMMATIC REPRESENTATION SHOWING THE ORDER TO BE PLACED ON EACH OTHER.

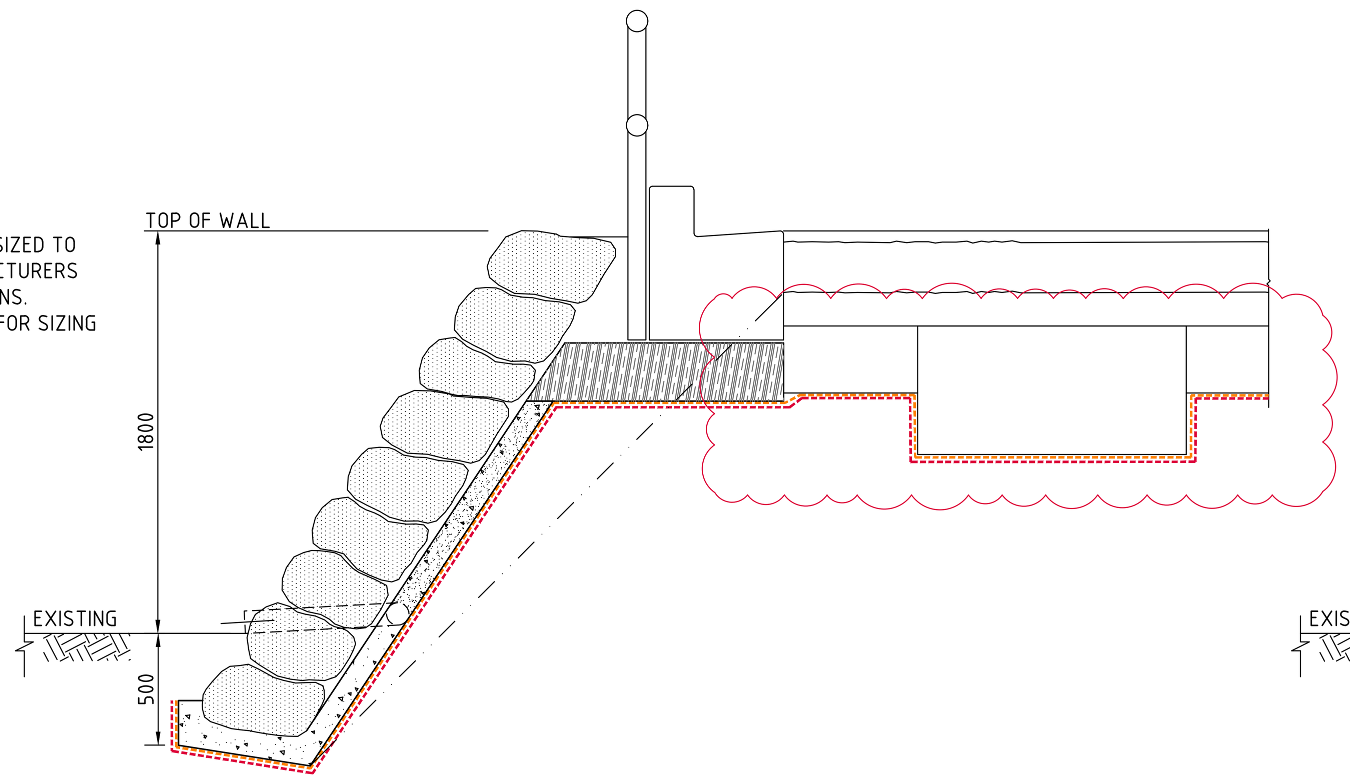


SECTION 1:20 C C40 TYPICAL INTERFACE AT SOUTHERN/EASTERN BATTER EDGE

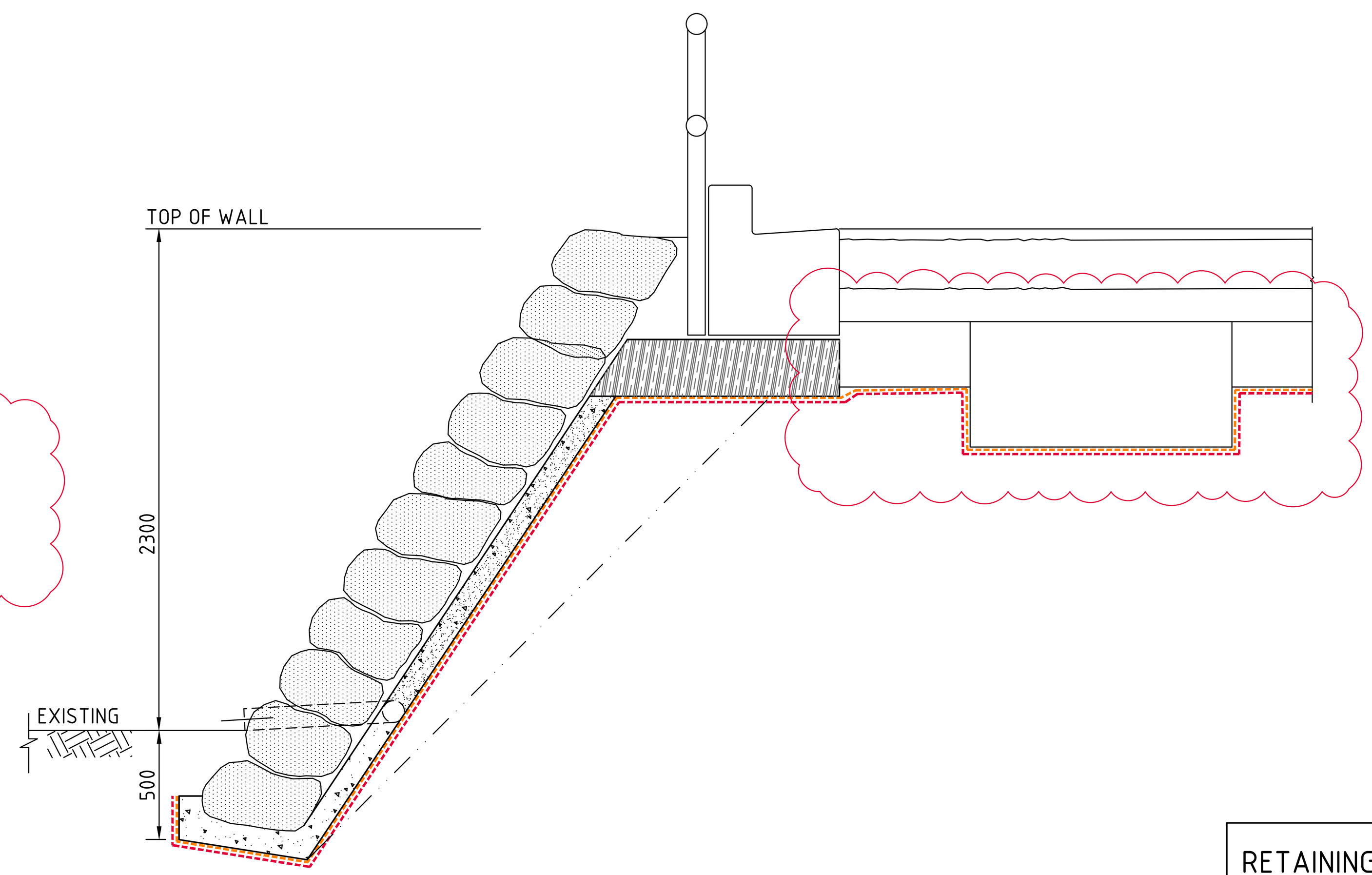
NOTE:
GEOWEB TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS. LAYERS SHOWN ARE DIAGRAMMATIC REPRESENTATION SHOWING THE ORDER TO BE PLACED ON EACH OTHER.



SANDSTONE WALL DETAIL (UP TO 1300mm HIGH)
SCALE 1:20



SANDSTONE WALL DETAIL (UP TO 1800mm HIGH)
SCALE 1:20



SANDSTONE WALL DETAIL (UP TO 2300mm HIGH)
SCALE 1:20

BOULDER RETAINING WALL NOTES:

MINIMUM BEARING CAPACITY OF FOUNDATION TO BE 150kPa ASSUMING THE FOLLOWING:
- CLAY FOUNDATION Cu=50kPa, Ø=0

SLIDING STABILITY IS BASED ON THE FOLLOWING
- FRICTION ANGLE OF BOULDER WALL : NOT LESS THAN 40°
- EFFECTIVE FRICTION ANGLE OF SOIL SUBGRADE: NOT LESS THAN 30° FOR SOIL OR 35° FOR ROCK

SOIL AND ROCK DESIGN PARAMETERS SHALL BE CONFIRMED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF BOULDERS OR CONCRETE BED.

BOULDERS TO BE A NOMINAL 750mm DIA. (500mm DIA. UP TO 1000mm DIA.) PLACED ON THEIR BROADEST BASE. BOULDERS TO BE PLACED IN AN INTERLOCKING ARRANGEMENT ON THE CONTACT SURFACES DIPPING TOWARDS BACK OF THE WALL AT 10° AND SHALL BE INSPECTED BY THE ENGINEER DURING CONSTRUCTION

DENSITY OF INDIVIDUAL BOULDERS SHALL BE MINIMUM 2.5 TONNES/m^3

FOR WALLS ABOVE 1000mm IN HEIGHT, THE FIRST LAYER OF BOULDERS ARE TO SET IN A BED OF N15 CONCRETE AND THE JOINTS BETWEEN SHALL BE FILLED WITH CONCRETE TO A LEVEL EQUAL TO THE SURFACE LEVEL OF THE TOE OF THE WALL.

NO STRUCTURE TO BE BUILT WITHIN H1 FROM THE BACK OF THE TOP OF THE WALL (WHERE H1=HEIGHT OF WALL), UNLESS THE STRUCTURE IS FOUNDED ON ROCK WITH SBV>150kPA

CONSTRUCTION METHODS AND SEQUENCE TO ENSURE THAT DESIGN MAX. SURCHARGE OF 20kPa IS NOT EXCEEDED.

CONSTRUCTION TO BE IN ACCORDANCE WITH AS 4678:2002

WALL DIMENSIONS

HEIGHT H1	BW1	BW2
500	500	500
1000	700	600
1500	800	700
2000	1000	900
2500	1300	1200

NOTE:
REFER TO 1300mm HIGH DETAIL FOR ALL ITEMS NOT LABELED AND FOR TYPICAL NOTES.

NOTE:
REFER TO 1300mm HIGH DETAIL FOR ALL ITEMS NOT LABELED AND FOR TYPICAL NOTES.

RETAINING WALL NOTES:

1. ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
2. MINIMUM BEARING CAPACITY OF FOUNDATION TO BE AS FOLLOWS :
   a. H MAX. 2.0m = 100 kPa
   b. H MAX. 3.5m = 150 kPa
   c. H MAX. 5.0m = 200 kPa
3. BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
4. WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMDD AND PLACED WITHIN 2% OF OMC.
5. MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O. ON PLAN :
   a. LIVE LOAD = 20 kPa
   b. DEAD LOAD = 5 kPa
   c. CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa
6. MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE 300mm MINIMUM UNLESS NOTED OTHERWISE.
7. DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
8. TIED WALLS ARE TO BE TEMPORARILY PROPPED AT TOP UNTIL SUCH TIME THE TOP OF WALL IS TIED TO THE SLAB AND 28-DAY CONCRETE STRENGTH HAS BEEN ACHIEVED.
9. CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500KG STATIC WEIGHT IS TO BE KEPT BACK 1.5m FROM THE REAR FACE OF THE WALL FACING UNITS. COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 1.5m STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.
10. ALL DESIGN AND CONSTRUCT WALL SYSTEM TO BE COMPLETED IN ACCORDANCE WITH THESE NOTES.
11. WALL ELEVATIONS ALLOW FOR NOMINAL EMBEDMENT DEPTHS. WHERE DESIGN AND CONSTRUCT (D+C) WALL SYSTEMS ARE PROPOSED IT IS THE CONTRACTORS RESPONSIBILITY TO ALLOW FOR THE FINAL EMBEDMENT DEPTHS AS PER THE D+C DESIGN. ALLOWANCE FOR OVERALL WALL AREAS TO CONSIDER THE FINAL EMBEDMENT DEPTH.
12. WALL ELEVATIONS AND AREAS ARE BASED ON THE VERTICAL PLAN AREA. CONTRACTOR TO ALLOW ADDITIONAL SURFACE AREA WHERE WALLS ARE NOT VERTICAL OR HAVE BACKSLOPES.

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PAVEMENT CLAY LAYER	05.03.24	E
REVISED AS CLOUDED FOR SECTION B	16.02.24	D
ISSUED FOR CONSTRUCTION CERTIFICATE	06.06.23	C
ISSUED FOR CONSTRUCTION CERTIFICATE	31.05.23	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC55

CONSULT AUSTRALIA

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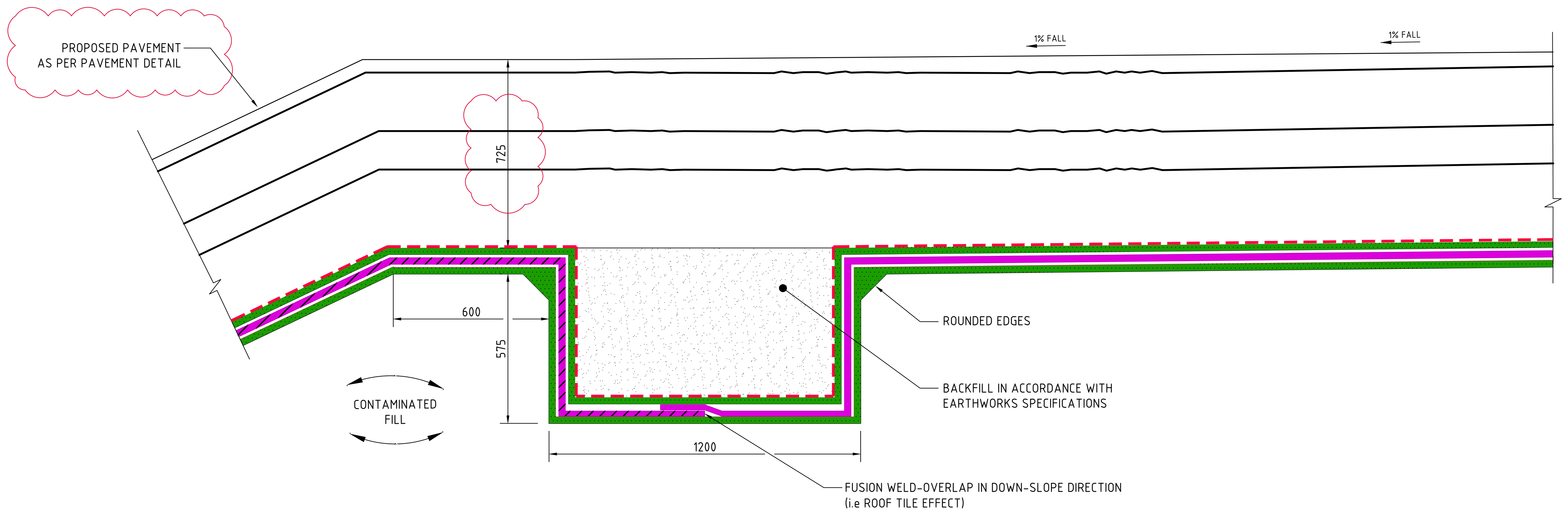
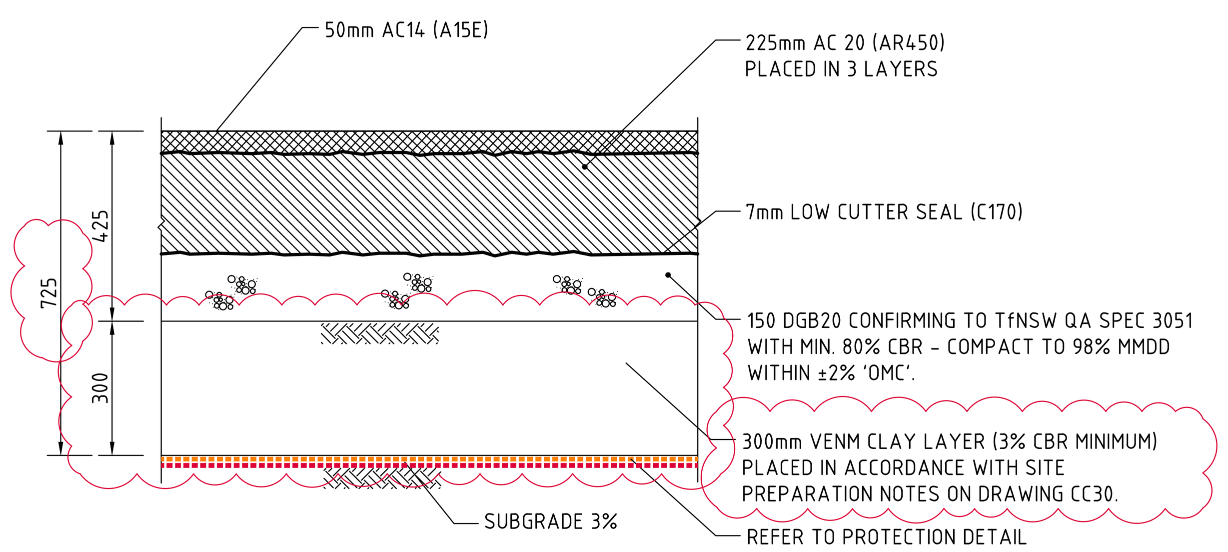
DRAWING TITLE
TYPICAL DETAILS
SHEET 1

DRAWING No C013919.06-CC55
ISSUE E



ANCHOR TRENCH TYPICAL DETAIL

SCALE 1:10

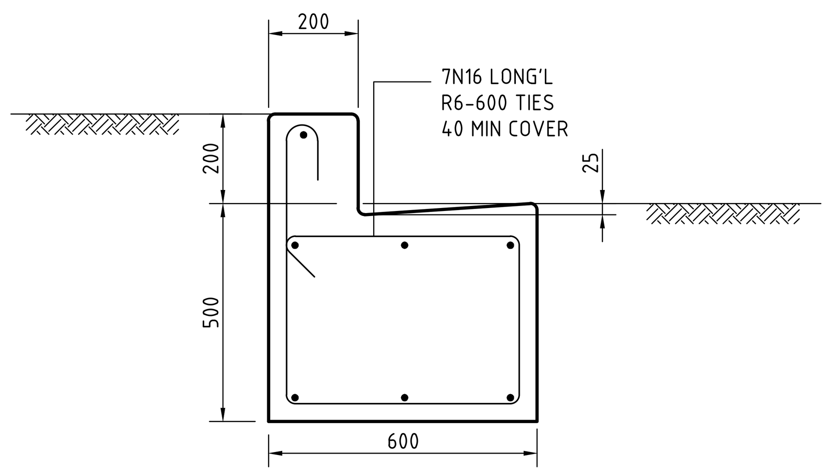


PAVEMENT DETAIL

SCALE 1:10

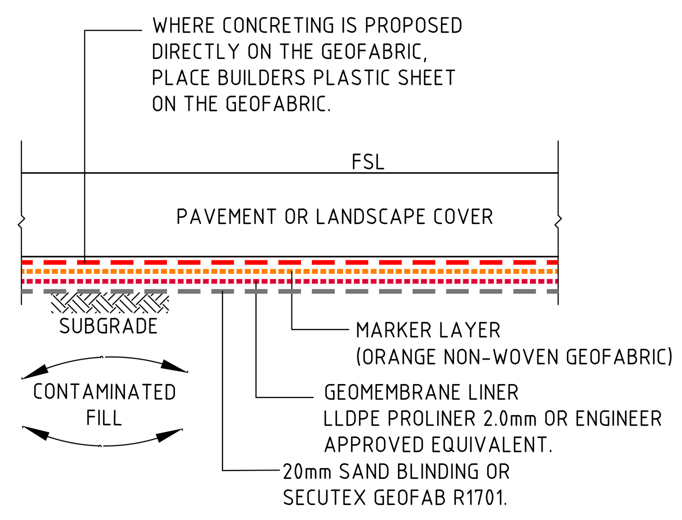
DESIGN TRAFFIC OF 1×10^7 ESA's
DESIGN CBR VALUE OF 3.0%
CBR OF SUBGRADE TO BE CONFIRMED TO ENGINEER FOR
FINAL PAVEMENT OPTIMISATION AND DESIGN.

NOTE:
CONFIRMATION OF PAVEMENT DESIGN SUBJECT
TO CONFIRMATION OF EXISTING SUBGRADE BY
GEOTECHNICAL ENGINEER.



KERB & GUTTER EDGE RESTRAINT (ER)

SCALE 1:10



PROTECTION DETAIL

SCALE 1:10

PAVEMENT MAINTENANCE NOTES:

DURING THE LIFE OF THE PAVEMENT, DAMAGE IN VARIOUS FORMS IS LIKELY TO OCCUR. GOOD MAINTENANCE WILL KEEP PROBLEMS TO A MINIMUM AND EXTEND THE LIFE OF PAVEMENTS. THE FOLLOWING LIKELY AREAS OF DAMAGE MAY OR MAY NOT OCCUR DURING THE LIFE OF THE PAVEMENTS:

SLAB PAVEMENTS :

1. DAMAGE TO JOINTS SUCH AS FRETTING OR BREAKING AWAY OF PIECES SHOULD BE REPAIRED USING CONCRETE REPAIR PRODUCTS AND THE JOINTING MATERIAL MADE GOOD.
2. CRACKING OF SLABS WHICH MAY OCCUR OVER THE LIFE OF THE SLAB SHOULD BE REPAIRED BY EPOXY GROUTING AS SOON AS POSSIBLE TO PREVENT LOCAL FRETTING AND BREAKING AWAY. THE DEFINITION OF A CRACK WHICH MAY BECOME DETRIMENTAL IS ONE WHICH IS GREATER THAN 0.3mm.
3. LOCAL DAMAGE DUE TO MECHANICAL PROCESSES OR PALLETS (WITH PROTRUDING NAILS) SHOULD BE REPAIRED AS SOON AS POSSIBLE WITH AN EPOXY CONCRETE REPAIR PRODUCT.
4. LOCAL MOVEMENT OF SLABS CAUSED BY EXTERNAL SOURCES SUCH AS INGRESS OF WATER SHOULD BE REFERRED TO THE ENGINEER TO DETERMINE THE BEST METHOD OF REPAIR.
5. JOINT SEALANTS WILL GENERALLY BREAKDOWN AND NEED REPLACEMENT AFTER 12 MONTHS WHEN MOST OF THE SLAB SHRINKAGE HAS TAKEN PLACE. RESEALING NEEDS TO BE CARRIED OUT TO ENSURE ONGOING SUPPORT TO SLAB EDGES.

ASPHALT PAVEMENTS :

1. UNLESS NOTED OTHERWISE, FLEXIBLE PAVEMENTS SHOWN ON THESE DRAWINGS ARE THE MINIMUM NECESSARY TO SUPPORT LIGHT CAR PARKING FOR A MINIMUM DESIGN LIFETIME.
2. CRACKING OF THE ASPHALT SURFACE AND OTHER DEFECTS SHOULD BE REPAIRED QUICKLY TO PREVENT INGRESS OF WATER TO THE SUBGRADE, WHICH WILL ACCELERATE DETERIORATION OF PAVEMENTS.
3. DRAINAGE GRADES SHOULD BE MAINTAINED TO AVOID PONDING OF SURFACE WATER WHICH MAY CONTRIBUTE TO DETERIORATION.

NOTE:

- LLDPE GEO-MEMBRANE PANELS TO BE PLACED IN ACCORDANCE WITH APPROVED PANEL LAYOUT PLAN. PREPARED BY CONTRACTOR IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION (SECTION 5.5.7.4)
- SINGLE SIDED TEXTURED GEO-MEMBRANE ON SLOPED SIDES, TEXTURED SIDE DOWN.
- MATERIALS TO MEET SPECIFICATIONS, TESTING AND APPROVAL REQUIREMENTS OUTLINED IN TECHNICAL SPECIFICATIONS.

LEGEND:

- CUSHION GEO-TEXTILE
- LLDPE - SMOOTH GEO-MEMBRANE
- LLDPE - SINGLE-SIDED TEXTURED GEO-MEMBRANE
- MARKER LAYER

100mm 0 200 400 600 800 1000mm
SCALE 1:10 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PAVEMENT CLAY LAYER	05.03.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
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PROJECT
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DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC56

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DRAWING TITLE
TYPICAL DETAILS
SHEET 2

DRAWING No C013919.06-CC56
ISSUE B

Appendix B

Site Audit Documentation

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Australia
www.ghd.com

Our ref: 21/27799/IAA18

13 May 2022

Adam Speers
Viva Energy Australia Pty Ltd
Level 31 (Suite 2), Governor Macquarie Tower, 1 Farrer Place
Sydney NSW 2000

Interim Audit Advice 18 – Review of preliminary capping design drawings – Stage 2 Audit Area 4 (Lot 64)

Dear Adam

1. Introduction

Andrew Kohlrusch of GHD Pty Ltd (the auditor) was commissioned by Viva Energy Australia Pty Ltd (Viva Energy) to conduct an environmental site audit of the Western Area of the former Clyde Refinery (herein referred to as the Western Area Remediation Project or WARP). The WARP is located at Durham Street, Rosehill on the Camellia Peninsula, NSW.

This audit is statutory as per Consent Condition B3 for SSD N° 9302. The site has also been notified to the NSW Environment Protection Authority (EPA) under *Section 60 of the Contaminated Land Management Act 1997*.

The WARP comprises approximately 40 hectares of the Clyde Terminal which is no longer required for operational purposes. Viva Energy has commenced remediation of the WARP to facilitate sale and redevelopment for commercial/industrial use in accordance with the site zoning IN3 as per the Parramatta Council Local Environmental Plan (LEP) 2011.

Given the scale of remedial works the WARP was declared State Significant Development (SSD N° 9302) and as such to assess the potential environmental impacts from remediation, an Environmental Impact Statement (EIS) containing a Conceptual Remedial Action Plan (RAP) was submitted in late 2019 to Department of Planning, Industry, and Environment (DPIE).

The Consent Conditions for SSD N° 9302 were issued on 7 May 2020. Viva Energy is staging the remediation of the WARP as follows:

- Stage 1 – Former Process West – project completed in 2020.
- Stage 2 – Former Utilities and Movements – projected for completion in 2022.
- Stage 3 – Former Process East – projected for completion in 2022/23.

The staging of the remediation of the WARP is being conducted as per Consent Condition A9 of SSD N° 9302.

In consideration of the redevelopment strategy for Stage 2, the auditor notes that the proposed lots and road for this portion of the WARP were subdivided into four audit areas (AA1 to AA4), each of which has been progressively remediated and validated, such that Section A Site Audit Statements (SAS) have been prepared for each of the audited areas.

The proposed lots (as per the subdivision approval issued under SSD Nº 10549) have been grouped as follows:

– AA1: Lots 51 to 55 and adjoining proposed road (audit completed December 2021).
– AA 2: Lots 59, 60, 63 and adjoining proposed road (audit completed in April 2022).
– AA3: Lots 56, 58, 61, 62 and adjoining proposed road (subject to validation following completion of bio-piling process).
– AA4: Lot 64 (the subject of this IAA). The location of Lot 64 (Stage 2 AA4) is shown in **Figure 1** extracted from the Stage 2 AA2 Validation report prepared by ERM[1].

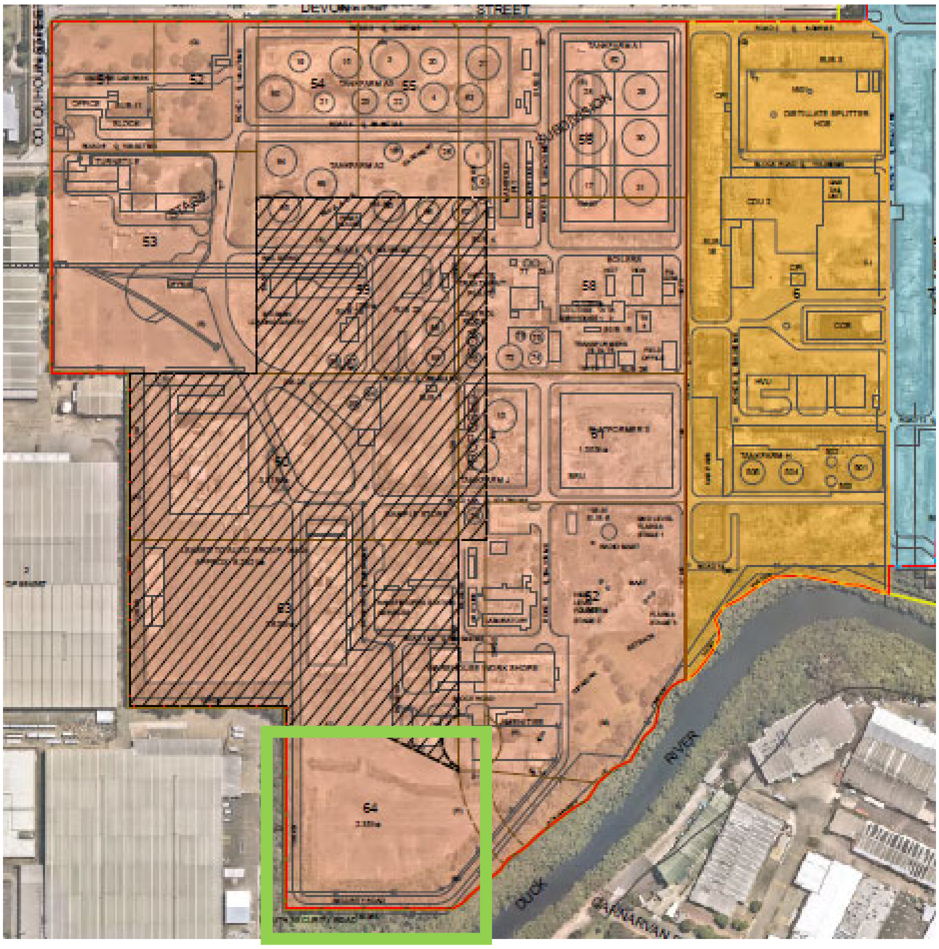

Figure 1 Location of Lot 64 – Stage 2 AA4

2. Background information

Proposed Lot 64 contains Area of Environmental Concern (AEC) 4 which comprised the former Southern Buried Waste Area. The Human Health Risk Assessment (HHRA) prepared by ERM[2] identified the following potential human health risks associated with AEC 4:

– **Vapour intrusion** for commercial workers owing to the presence of benzene, TRH F1, TRH C_6-C_{16} aliphatic and TRH C_7-C_{16} aromatic at concentrations greater than the SSTLs derived for the WARP.

[1] Stage 2 Validation Report - Proposed Lots 59, 60 and 63, April 2022.
[2] Clyde Western Area Remediation Project, Human Health and Ecological Risk Assessment, February 2020.

- **Direct contact** for commercial workers and construction workers owing to the presence of benzo(a)pyrene TEQ, TRH >C_{10}-C_{34} and hexavalent chromium at concentrations greater than the SSTLs derived for the WARP.
- **Inhalation** of asbestos, particularly asbestos fines (ACM > 7mm) and asbestos (FA+AF < 7mm) due to the ASC NEPM HSL-D asbestos exceedances.

Before the preparation of the Stage 2 Remedial Action Plan (the Stage 2 RAP)[3], ERM prepared two Remedial Option Assessments (ROA). The 2020 ROA was presented for all three Stages and was based on data collected up until June 2020. Further, ERM developed a specific ROA for the AEC-4 (the AEC-4 ROA[4]) following the completion of the Environmental Site Assessment (the AEC-4 ESA[5]).

The purpose of the AEC-4 ROA was to refine the understanding of potential remedial options for identified contamination within AEC-4, based on the outcomes of the AEC-4 ESA. The AEC-4 ROA was developed in accordance with the NSW EPA guidelines and the approach presented in the CRC CARE (2018).

Due to the heterogeneous nature of the soil contamination within AEC-4, including fibrous asbestos within the fill, consideration of the low mobility of contamination via groundwater migration and subsequent low risk of harm to Duck River, ERM concluded in the AEC-4 ROA that the appropriate remedial option is through management via an engineered cap and contain strategy.

ERM reported that the cap and contain approach would effectively limit exposure to current and future site users through the construction of an engineered cap that prevents direct contact by future commercial receptors.

It was reported by ERM in the AEC-4 ROA that the proposed future use of the site is for car parking and/or container storage and that no permanent or occupied buildings are proposed. In addition, an LTEMP will be required to document the presence of residual impacts, monitor conditions following cap establishment, and control works that have the potential to disturb managed material.

The Stage 2 RAP, including the discussion of the AEC-4 ROA, was independently reviewed by the auditor with the outcomes reported in the Site Audit Report SAR 065-2127799 issued in August 2021.

The auditor in August 2021 issued the Site Audit Statement (SAS) 065-2127799 certifying that the nature and extent of the contamination had been appropriately determined (Section B1) and that the Stage 2 RAP was appropriate for the proposed commercial/industrial land uses (Section B2).

3. Auditor commentary on the preliminary capping design drawings

The following preliminary drawings prepared by Costin Roe were submitted by Viva Energy on 30 April 2022 for the auditor review:

- CO 13919.06 – C10.A
- CO 13919.06 – C11.A
- CO 13919.06 – C12.A
- CO 13919.06 – C13.A
- CO 13919.06 – C14.A
- CO 13919.06 – C15.B
- CO 13919.06 – C16.B
- CO 13919.06 – C17.B

[3] Clyde Western Area Remediation Project, Stage 2 - Detailed Remediation Action Plan, July 2021.
[4] Clyde Western Area Remediation Project – Remediation Options Analysis (AEC-4), June 2021.
[5] Clyde Western Area Remediation Project – Supplementary Site Assessment – Southern Buried Waste Area (AEC-4), June 2021.

The preliminary drawings were reviewed by the audit team, including one of the auditor's specialist support team members, Mrs. Alison Horlyck – an experienced civil engineer of GHD's Waste Management team. The following comments have been made by the audit team.

3.1 Drawing C10-C12.A

The cap extent shown on C12 refers to an ERM drawing. Confirmation is required that the extent of the cap is suitable.

3.2 Drawing C10-C17.B

- The cap is to limit water infiltration. Based on the HHRA, there is a potential for vapour intrusion risks for future commercial workers from impacted soils (refer to summary included in **Section 2**). Could there be gas/vapour build-up beneath the cap? Will subsequent vapour intrusion monitoring be required or should appropriate vapour mitigation measures be incorporated into the design?
- GCL will act as a marker layer to reduce exposure to asbestos contamination. Is the depth/type of material above the GCL sufficient for asbestos? (i.e. only 300 mm soil on the batters and will there need to be inspections/maintenance of these areas?).
- Will there be any specification for the materials to be placed directly against the GCL (above and below)? e.g. maximum particle size, cation exchange capacity. Does there need to be a minimum soil layer between the contaminated fill and the GCL?
- The GCL is shown to pass under stormwater pipes, under roads and pavements, and behind retaining walls. It is not shown specifically to be continuous under the stormwater pits.
- Any water that migrates through the pavement or vegetation soil should be able to drain out, so it does not pond on the GCL. Any areas of ponded water will have higher infiltration. In particular, the anchor trench at the batter toe and at the edge of the pavement where the concrete kerb is proposed are areas where water may not be able to drain. The cross-sections also show some existing bunds around the perimeter of the works which may prevent water from draining from the capped area.

3.3 Drawing CO 13919.06 – C13.A

- On C13, northeast corner, near Pit 03 discharge it looks like the works interact with a large headwall.
- On C13, stormwater storm event sizing is missing (note 2).

3.4 Drawing CO 13919.06 – C14.A

C14 note 7 has instructions on moisture etc for site won fill. Is this appropriate for the contaminated soils?

3.5 Drawing CO 13919.06 – C16.B

- Is the compacted clay plug shown in the retaining wall details on C16 relevant to this project? If so, how does this interact with the GCL?
- C16 Pavement and road details – Will compaction of the DGB layer damage the GCL?
- C16 Landscape detail – Is a 300mm soil layer sufficient for the protection of GCL from desiccation for rooting of proposed vegetation? Will is be sufficient for mechanical damage (e.g. maintenance of vegetation)? Will it be stable on 1 in 3 batters (including if saturated)?

3.6 Drawing CO 13919.06 – C17.B

- Will the handrail have its own footing? Is there enough depth above the GCL for this? Are handrails suitable for the carpark (i.e. does it need to stop cars going down the batters/retaining wall)?
- Will there be any lighting, bollards, other poles, etc installed for the carpark that could impact the GCL? Or should this be taken into account in the design of the cap – i.e. designated areas to allow future installation of underground services without having to breach the cap.

3.7 Other comments

Given that the approach presented in the Stage 2 RAP for the capping of AEC 4 was conceptual, it is suggested that ERM prepare a letter or similar that demonstrates the capping strategy (as per the key requirements listed in the *Auditor guidelines* (Section 4.3.3.)):

- Maximises the long-term stability of the capping and/or containment system(s) and any proposed structures above it (from an engineering perspective) and, where applicable, minimises the potential for leachate formation and/or volatilisation
- Does not include the erection of structures on the capped and/or contained area that may result in a risk of harm to public health or the environment
- Recommends a notification mechanism to ensure that the capped and/or contained areas are protected from any unintentional or uncontrolled disturbance that could breach the integrity of the physical barrier, such as recommending placing a notation or covenant on the property title or a notation on a s.149 certificate or issuing an order or placing a covenant on the title to land under the CLM Act to require ongoing maintenance under the Act.

In addition, commentary should be provided that other preferred approaches from the remediation hierarchy, as set out in s.6(16) Assessment of Site Contamination Policy Framework of Schedules A and B of the NEPM, are not applicable.

4. Conclusions

Based on the historical results collected within the AEC-4 (Lot 64) together with the most recent AEC-4 ESA, the auditor considered that the cap and contain strategy discussed in the AEC-04 ROA is appropriate to manage the potential human health risks identified by ERM in its HHRA. However, the matters raised in **Section 3** of this interim audit advice should be addressed before the capping design is finalised.

In addition, the auditor considers it would be beneficial to have the long-term monitoring management plan (LTEMP) for AEC 4 reviewed in parallel with the cap design to confirm that any constraints related to the capping will be covered by the LTEMP.

This letter should be regarded as interim advice to the overall review and site audit process and should not be considered a Site Audit Statement under the CLM Act, 1997. This interim audit advice letter will subsequently be referred to and provided as an Annex to the final Site Audit Statement and Site Audit Report.

Sincerely

GHD Pty Ltd

Andrew Kohlrusch
NSW EPA Accredited Auditor
0447 685 055

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Our ref: 21/27799/IAA19

27 July 2023

Adam Speers
Viva Energy Australia Pty Ltd
Level 31 (Suite 2), Governor Macquarie Tower, 1 Farrer Place
Sydney NSW 2000

Interim Audit Advice 19 – Review of AEC-4 Proposed Capping Construction Technical Specification (Proposed Lot 64)

Dear Adam

1. Introduction

Andrew Kohlrusch of GHD Pty Ltd (the auditor) was commissioned by Viva Energy Australia Pty Ltd (Viva Energy) to conduct an environmental site audit of the Western Area of the former Clyde Refinery (the site). This area is referred to as the Western Area Remediation Project or WARP and is situated at Durham Street, Rosehill on the Camellia Peninsula, NSW.

This audit is a statutory requirement under Consent Condition B3 for SSD N^{o} 9302. Additionally, the site has been notified by the NSW Environment Protection Authority (EPA) under Section 60 of the Contaminated Land Management Act 1997 (the CLM Act).

The Interim Audit Advice (IAA) 19 has been prepared by the auditor after reviewing the following report submitted by Environmental Resources Management Australia Pty Ltd (ERM):

– *Clyde Western Area Remediation Project, Proposed Lot 64 – AEC-4 Capping Construction Technical Specification*, 24 July 2023 (the **Technical Specification**).

In reviewing the Technical Specification report, the auditor also took into account relevant information and findings presented in the following documents:

– ERM 2020. *Clyde Western Area Remediation Project, Human Health and Ecological Risk Assessment,* February 2020 (the **HHERA**).
– ERM 2021a. *Clyde Western Area Remediation Project – Supplementary Site Assessment – Southern Buried Waste Area (AEC-4),* June 2021 (the **AEC-4 ESA**).
– ERM 2021b. *Clyde Western Area Remediation Project – Remediation Options Assessment (‘AEC-4’),* June 2021 (the **AEC-4 ROA**).
– ERM, 2021c. *Clyde Western Area Remediation Project, Stage 2 - Detailed Remediation Action Plan*, July 2021 (the **Stage 2 RAP**).
– Costin Roe 2022. Capping Design Drawings:
  - CO 13919.06 – C10.A; CO 13919.06 to C11.A; CO 13919.06 to C12.A; CO 13919.06 to C13.A; CO 13919.06 to C14.A; CO 13919.06 to C15.B; CO 13919.06 to C16.B and CO 13919.06 to C17.B

2. Background

The WARP covers approximately 40 hectares of the Clyde Terminal and. Viva Energy has initiated the remediation of the WARP to facilitate its sale and redevelopment for commercial/industrial use as per the site zoning IN3, as specified in the Parramatta Council Local Environmental Plan (LEP) – 2011.

Due to the scope of remedial works, the WARP was declared State Significant Development (SSD Nº 9302). Consequently, an Environmental Impact Statement (EIS) containing a Conceptual Remedial Action Plan (RAP) was submitted to the Department of Planning, Industry, and Environment (DPIE) in late 2019 to assess potential environmental impacts from the remediation process.

The Consent Conditions for SSD Nº 9302 were issued on 7 May 2020. Since then Viva Energy is implementing a staged approach to the remediation of the WARP, as outlined in Consent Condition A9. The staging includes the following phases:

– Stage 1 – Former Process West: Completed in 2020.
– Stage 2 – Former Utilities and Movements: Completed in 2022, apart from AEC-4, for which remediation is proposed to be completed in 2023.
– Stage 3 – Former Process East: Projected for completion in late 2023.

For Stage 2, the proposed lots and road in this section were subdivided into four audit areas (AA1 to AA4). Each of these areas has been progressively remediated and validated, resulting in the preparation of Section A Site Audit Statements (SAS) for each audited area.

The proposed lots (as per the subdivision approval issued under SSD Nº 10549) have been grouped as follows:

– AA1: Lots 51 to 55 and adjoining proposed road (audit completed in 2021)
– AA 2: Lots 59, 60, 63 and adjoining proposed road (audit completed in 2022)
– AA3: Lots 56, 58, 61, 62 and adjoining proposed road (audit completed in 2022)
– AA4: Lot 64 (the subject of this IAA). The location of Lot 64 (Stage 2 AA4) is shown in **Figure 1**

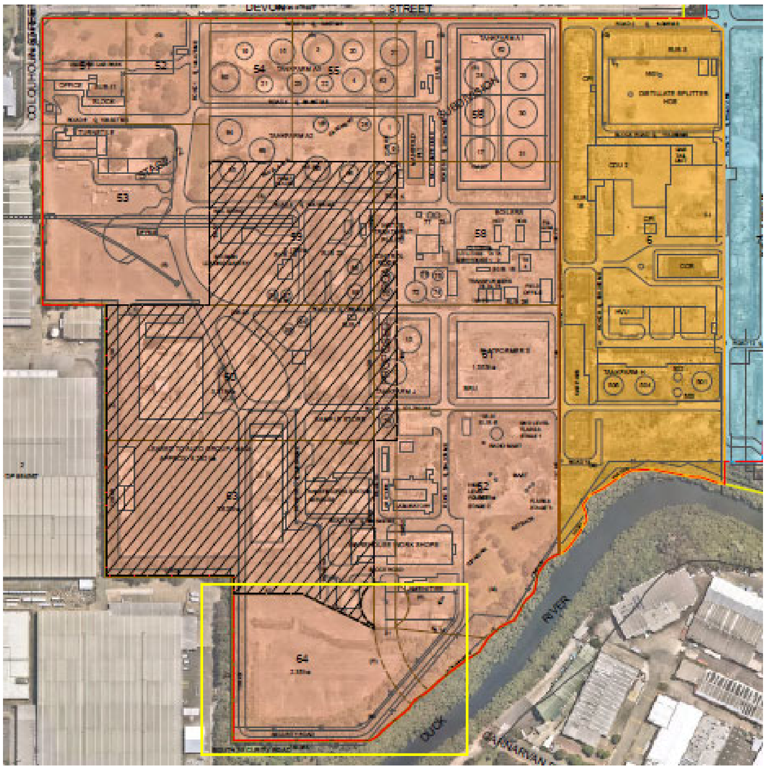

Figure 1 Location of Lot 64 – Stage 2 AA4

3. Auditor commentary on the Technical Specification report

During the review of the Technical Specification report, the auditor relied on one of the auditor's specialist support team members, Ms Alison Horlyck – an experienced civil engineer of GHD's Waste Management team – to review the capping design drawings.

The auditor reviewed a preliminary version of the Technical Specification report issued in April 2023. ERM subsequently revised the report, which the auditor found had addressed comments on the preliminary version. The outcomes of the auditor reviews are documented in the audit tracking sheet attached to this IAA. In the course of reviewing the amended Technical Specification report, the auditor observed that the matters raised in IAA18 had been satisfactory addressed in the final version of the Technical Specification report dated 24 July 2023.

3.1 Proposed future land uses

The future land use for the AEC-4 will be limited to slab-on-grade outdoor storage. Construction of any buildings over the capped area will not be allowed. To ensure appropriate environmental management, a Long Term Environmental Management Plan (LTEMP) will be implemented and legally enforced for Proposed Lot 64.

3.2 Remedial strategy review

The proposed strategy involves constructing an engineered capping layer and implementing a legally enforceable LTEMP for ongoing management, including maintenance of the containment cap. The strategy was selected based on various factors, including the future commercial/industrial use of the site and lateral delineation of contamination within AEC-4, which poses no risk to adjacent off-site receptors (both ecological and human).

The on-site containment approach is considered effective due to the stability of the contaminated materials. The benefits of the preferred remedial strategy include mitigating direct contact risks to future on-site workers, minimising air quality issues, reducing off-site disposal volumes, and preventing surface water infiltration.

The preferred approach was selected based on the following factors:

- Consideration of the future commercial/industrial use and Viva Energy's ownership of Lot 64.
- Historical assessments confirming lateral containment of contamination within AEC-4, which has not been identified to pose an unacceptable risk to off-site receptors including the Duck River.
- Confidence in the geochemical stability of contaminated materials, supporting the on-site containment approach.
- LNAPL within groundwater is not migrating off-site and does not require active remediation.
- Unsuitability of thermal treatment of soils due to the presence of asbestos, chromium and Per- and Polyfluoroalkyl Substances (PFAS).

Other benefits included that the preferred remedial strategy mitigates direct contact risks, avoids air quality issues from material handling, reduces off-site disposal volumes, prevents surface water infiltration and manages the presence of PFAS through in-situ containment.

The implementation of the LTEMP will incorporate monitoring of groundwater conditions and management of potential exposure scenarios related to direct contact, vapor intrusion, or asbestos inhalation. Exceedances of vapour intrusion criteria and bulk ground gases are limited to the capped area's footprint, with no future indoor spaces or subsurface structures proposed for construction in Lot 64.

3.3 Hazardous ground gas assessment review

To assess the potential accumulation of hazardous ground gases in the subsurface due to the presence of LNAPL, in particular methane and carbon dioxide, two rounds of ground gas monitoring were conducted in August 2022 and March 2023. Monitoring focused on viable wells within and downgradient of the proposed AEC-4 capping footprint. The primary objective was to understand the presence and behaviour of hazardous ground gases.

Monitoring results indicated that methane concentrations in the buried waste mound (AEC-4 source) ranged from 9% to 81%, leading to generation of a CS4 classification (moderate to high risk) as per the Ground Gas Guidelines (NSW EPA 2019). The CS4 classification was based on maximum methane concentrations and flow rates. Data from downgradient wells generated a CS1 (very low risk) classification, suggesting minimal lateral gas migration due to the site's capped condition and low methane accumulation and migration potential.

Some lateral migration of methane into groundwater has historically been observed, but concentrations were lowest than within the buried waste mound and below the trigger levels listed in the Ground Gases Guidelines (NSW EPA 219), and the likelihood of re-forming into gas downstream was low. Currently, there are no exposure pathways for receptors, as the development of proposed Lot 64 prohibits enclosed spaces, thereby restricting hazardous gas build-up.

Lateral migration of bulk ground gases offsite is deemed unlikely due to the presence of barriers such as the Duck River (south) and a drainage channel (west), restricting gas flow below the ground surface.

3.4 Proposed capping design and considerations regarding ground gas hazards

The proposed capping design for the AEC-4 buried waste area includes specific measures to effectively address ground gas hazards. These considerations consist of installing an impermeable liner across the entire area to mitigate gas migration vertically and volatilisation. Additionally, the construction of enclosed spaces in direct contact with contaminated waste material will be restricted through implementation of a legally enforceable LTEMP. A utility trench with an LLDPE liner will be included in the capped area for installing services without disturbing the cap structure and reducing potential of gas migration into the trench void. Stormwater pipes and pits will be positioned above the liner to prevent gas migration into and through these features.

Despite the low likelihood of ground gas migration according to the Conceptual Site Model (CSM), monitoring of gas migration to other on-site areas will be undertaken. This will comprise monthly gas monitoring of enclosed spaces, such as stormwater pits, for a period of up to six months after cap construction ensuring prompt detection and mitigation of any unexpected gas migration to safeguard human health and the environment. Gas concentration levels will be compared with the ‘Gas Accumulation Criterion’ for enclosed structures (methane <1% v/v) and contingency actions/ notifications taken as per as per Section 5.4 of the *Solid Waste Landfill Guidelines* (NSW EPA 2016).

4. Conclusions

One of the key contamination pathways to be managed as part of the capping strategy is that of hazardous ground gas migration. The auditor concurs that overall the hazardous ground gases assessments were overall prepared in accordance with the Ground Gases Guidelines (NSW EPA 2019) and that the findings of the assessments have been incorporated into the capping design. The auditor notes that the capping design was previously reviewed by a qualified civil engineer on the auditor’s specialist support team – as documented in IAA18. Comments raised in IAA18 were addressed by ERM in revised drawings and/or addressed in the Technical Specification report.

Based on historical dataset, CSM and the most recent ground gases assessments, the auditor considers the cap and contain strategy discussed in the Technical Specification is appropriate for managing the potential human health risks identified by ERM and that following the remedial works, AEC-4 will be suitable for commercial and/or industrial land use with the implementation of an LTEMP.

The future land use will be restricted to slab-on-grade outdoor storage, and no buildings will be permitted to be constructed over the capped area. This restriction will be enforced through a legally enforceable LTEMP applicable to proposed Lot 64, as noted by the auditor.

This letter should be regarded as interim advice to the overall review and site audit process and should not be considered a Site Audit Statement under the CLM Act, 1997. This interim audit advice letter will subsequently be referred to and provided as an Annex to the final Site Audit Statement and Site Audit Report.

Sincerely

GHD Pty Ltd

Andrew Kohlrusch
NSW EPA Accredited Auditor
0447 685 055

Attachment A – Audit trackingsheet

Client Viva Energy

Project 2127799

Stage Stage 2 Area - AEC-4

Report **Clyde Western Area Remediation Project - Proposed Lot 64 - AEC-4 Capping Construction Technical Specification**

Item	Report Section	Auditor's comments on document version dated 28/10/2022	ERM's responses	Auditor's comments on amended document dated 14/04/2023	Auditor's comments on amended document dated 14/04/2023	Auditor's final review on report dated 24/07/2023
1	page iii	Please ensure that signatures and accreditation details are included in the final version of the document, as required by the Consultant Guidelines (NSW EPA, 2020).	Noted, to be provided in final version following confirmation all items are adequately addressed.	To be checked in the final version of the report.	-	Information amended and signatures included.
2	General comments	1 - The auditor acknowledges that the Tech Spec document aims to provide a technical framework for tendering remediation contractors to develop scope and costs for executing AEC-4 remediation works. However, in Section 3.7 of IAA18, the auditor noted that the capping approach presented in the Stage 2 RAP was only conceptual. To address this, ERM was suggested to prepare a letter or similar document that demonstrates how the capping strategy will minimise the potential for leachate formation and/or volatilisation. 1.1- Regarding volatilisation, the document refers to "pooling of ground gases" - which could facilitate ground gas migration following capping AEC-4 - further commentary is requried as outlined in this audit tracking sheet. 1.2 - Concerning leachate, ERM documented in the CSM (Table 1-2) that PFOS has been found in soil leachate samples in the northern part of AEC-4. However, it is unclear if the cell design considered PFOS leachate and how PFAS leachate will be monitored. 2 - The auditor in Section 4 of IAA18 recommended a notification mechanism to ensure that the capped contained areas are protected from unintentional or uncontrolled disturbance that could breach the integrity of the physical barrier. Additionally, the auditor noted that it would be beneficial to have the long-term monitoring management plan (LTEMP) for AEC 4 reviewed in parallel with the cap design to confirm that any constraints related to the capping will be covered by the LTEMP. However, a LTEMP was not presented, and the legal notification and enforceability mechanisms were not discussed in the Tech Spec document or in the IAA18 responses.Noting an EMP on a section 10.7 is not a legal enforceabilty mechanism.	1 - This information has been previously provided and reviewed by the Auditor (IAA18 response letter). 1.1 - Refer to below response to item 4.4. 1.2 - One of the key outlined objectives for the project (reduction of suface infiltration) relates to control of leachate generation from the in-situ waste to be capped (which includes PFAS). Propose minor amendment to the AEC-4 remediation objectives to clarify and an additional dot point in line with the AEC-4 ROA to note that the design has considered PFAS. "□Infiltration Reduction: Reduce potential for surface water infiltration at the ground surface, <u>therefore reducing leachate generation</u> and potential contaminant mass flux and movement of LNAPL in groundwater from the buried waste area.; In relation to PFAS leachate monitoring, The *Clyde WARP Stage 2 Groundwater Monitoring Program* (Dated 14th July 2021) includes post-remediation boundary monitoring of groundwater wells between the cap footprint and the Duck River. Monitoring for PFAS in groundwater (including PFOS) is included as part of this process. Given the proposed surface cap installation, leachate generation is limited to groundwater and will be minimised through reduction of surface infiltration. 2 - While a draft LTEMP has not been provided at this stage of the project, an outline of key constraints/ items to be addressed within the LTEMP and how it will be made legally enforceable have been added to Section 2.4 of the Technical Specification for the Auditor's review.	1 - Acceptable. 1.1 - Sorry - We can't find item 4.4. 1.2 - Noted. However, the LCSM indicates that LNAPL has minimal impact on groundwater quality and exhibits low mobility. Furthermore, the presence of a clay layer in the local geology has been demonstrated to assist in limiting the migration of LNAPL. Therefore, it is advisable to refrain from making statements suggesting the "potential contaminant mass flux and movement of LNAPL" which contradicts previous information and remedial works. PFAS comment - Table 1-2 was not prepared based on the HHERA (ERM, 2020) but also incorporated the AEC-4 ESA (ERM, 2021) which caused the misunderstanding regarding PFAS. Please include a statement that the refined CSM incorporates AEC4-ESA data too. 2 -Acceptable.	1.1 - Apologies, was supposed to refer to ERM response 4.1. 1.2 - Noted. minor amendment to wording made in second dot point relating to remedial objectives. *"**Infiltration Reduction:** Reduce potential for surface water infiltration at the ground surface, therefore reducing the potential for onoing leachate generation and reinforcing existing stability of LNAPL and groundwater impacts within the buried waste area."* Section 1.4 updated to add reference to the supplementary ESA and ground gas monitoring letter as these were undertaken after the HHERA.	Acceptable. Comment closed.
3	1.1	1 - It would be beneficial to refer to the remediation stages completed to date as part of the background information. 2 - It would be beneficial to refer to the AEC-4 ROA, as this document supports the AEC-4 Tech Spec document.	1 - Noted. Section 1 (Background) updated with text regarding completed remediation stages. 2 - Reference included to the AEC-4 ROA.	1 and 2 - Acceptable	-	Acceptable. Comment closed.
4	1.2	1 - It is necessary to clarify that AEC-4 includes Lot 64. 2 - It is unclear whether the streets connecting Lot 64 to the WARP are also part of AEC-4.	1 - The first paragraph outlines that AEC-4 is within Lot 64. Figure 2 has been added to assist in clarifying. 2 - Connecting roads and turning circle are outside of AEC-4 and Lot 64. Inclusion of Figure 2 clarifies this.	1 and 2 - Acceptable. 3 - New comment based on the amended figure - Where will temporary stockpiles be allocated within Lot 64, as it seems that the area for temporary stockpile management apart from AEC-4 is small.	3 - As discussed during call on 17/7/2023: tech spec to remove references to re-use on-site stockpiled materials given this is unlikely to be practically implemented by the contractor.	Acceptable. Comment closed.
5	Table 1-1	1 - As the proposed Lot 64 is within Part Lot 1 DP 1271927, it is necessary for the survey plan to include the coordinates of both Lot 64 and the containment cell. 2 - Could you please confirm whether the 1.1 hectare refers to the entire Lot 64 or just the containment cell? Additionally, could you provide information on the area of the containment cell?	1 - Figure 2 provides coordinates of both Lot 64 and AEC-4, as referenced in section 1.2. 2 - Table 1-1 has been updated to clarify respective areas of Lot 64 and AEC-4 (containment cell footprint).	1 and 2 - Acceptable.	-	Acceptable. Comment closed.
6	Table 1-2	1 - To improve clarity, please consider using a phrase like "existing COPC" instead of "remaining COPC", as the use of the word "remaining" in the phrase "remaining COPC" could potentially suggest that remediation was completed within AEC-4 but some COPC still remained in the area. 2 - ERM should clarify what is meant by LNAPL in soils. LNAPL refers to organic liquids that are less dense than water and do not mix with water. 3 - LNAPL in groundwater - Was LNAPL found within the proposed containment cell or down gradient of AEC-4?	1 - Updated Table heading 'Remaining COPCs' updated to 'Identified COPCs'. 2 - LNAPL in soil refers to visual evidence of free-phase petroleum hydrocarbons in unsaturated soils. 3 - LNAPL only within the proposed capped area, not identified down gradient of AEC-4. Human health SPR linkages section has been updated to clarify the LNAPL in groundwater is limited to the AEC-4 buried waste mound.	1 and 2 - Acceptable.	-	Acceptable. Comment closed.
7		4 - Potentially SPR linkage columm - The following matters require review or clarification: Soils 4.1. - If AEC-4 is proposed to be used only for car parking and temporary storage (containers), clarify why indoor vapour intrusion by commercial receptors was considered a complete SPR linkage. 4.2 - Due to the presence of asbestos, any works undertaken within Lot 64 must comply with Safety and Work Regulations, including air monitoring and the use of personal protective equipment. Therefore, clarify why this SPR linkage was not considered incomplete (that was the approach adopted for others AECs). 4.3 - ERM considered TRH F1 to F3 fractions in the existing COPC column, but only referred to TRH F2 and F3 fractions in the SPR linkage for dermal contact with impacted soils by workers and IMW. Please confirm wheter TRH F1 fraction is relevant for dermal contact exposure pathway. In addition should not this SPR linkage be incomplete as an LTEMP will be in place for any any earth works, including intrusive?	4.0 - General Clarification: The SPR linkages presented in Table 1-2 represent the CSM prior to implementation of remediation / management outlined within the technical specification. This summary has been provided prior to introduction of the remediation strategy and objectives to provide context for the proposed works. Table caption has been edited to clarify that the CSM summary is prior to the implementation of remediation/ management. 4.1 - The presentation of potential VI pathway was included within the CSM for Lot 64 consistent with the approach for the remainder of the WARP to demonstrate a potential pathway for future receptors which requires consideration (in this case via LTEMP which limits building construction over the area). Additional wording added to note that this pathway is incomplete with LTEMP implemented. 4.2 - See response to 4.0 above - SPR linkages in this table represent conditions prior to implementation of remediation/ management controls. Without a notification mechanism (LTEMP) or marker layer to warn of potential for asbestos this pathway is potentially complete (albeit unlikely - given currently site control by Viva Energy). Asbestos Management, including work practices, air monitoring and the use of PPE are the responsibility of the Contractor and will be outlined within the Asbestos Management Plan, prepared by the contractor prior to work commencement. New Section 5.3.4 'Asbestos Management has been added to reference the relevant Management and Mitigation measures outlined in the Soil and Water Management Plan (SWMP3). Wording also added to reference LTEMP restriction on digging below marker layer as future control for potential exposure. 4.3 - TRH C6-C34 Fractions are 'identified COPCs', relevant fractions for each relevant potential exposure pathway are highlighted in the SPR linkages column. Vapour intrusion - TRH C6-C10 Fractions (F1), direct contact - TRH C10-C34 Fractions. As per response 4.0 above - SPR linkages in this table represent conditions prior to implementation of remediation/management controls. Without a notification mechanism (LTEMP) or marker layer in the future to warn of potential for contaminated soils this could be a potentially complete pathway.	4 - Noted. 4.1 and 4.2 - Acceptable. 4.3 - Acceptable.	-	Acceptable. Comment closed.
8	Table 1-2 (continued)	4.4 - The CSM suggests that pooling of LNAPL in soil and groundwater is a possibility. Clarify whether historical LNAPL CSMs have been considered in preparing the AEC-4 CSM or was this potential risk was only observed for AEC-4. If LNAPL in groundwater is present and can lead to pooling of ground gases for the AEC-4, a specific RAP •The CSM suggests that pooling of LNAPL in soil and. groundwater is a possibility. Clarify whether historical LNAPL CSM have been considered to prepared the AEC-4 CSM or this potential risk was only observed for AEC-4. •If LNAPL in groundwater is present and could lead to pooling of ground gases for the AEC-4, would the capping strategy require steps to manage this risk?.	4.4 - LNAPL CSM for the site has been used to develop the CSM - key outcome is that LNAPL is confined to the extent of AEC-4, highly weathered and immobile. Wording updated. Point updated to clarify the LNAPL within AEC-4 presents a potential for staining/odours during excavation works if unmitigated during excavation. This wording has been updated consistent with other areas for the site. Separate assessment of ground gas acumulation potential has been made (no risk of accumulation in current and proposed future open air environments) New Section 1.4.1 has been added (Hazardous Ground Gass Assessment). This section provides a clear summary of source - potential migration pathways and receptors under current and future exposure scenarios. This section also outlines key aspects of the ground gas assessment which were considered in the cap design/ management strategy provided within the Tech spec.	LNAPL discussion - Acceptable. Ground gases discussion - Data from March 2023 sampling should be presented for auditor assessment. Please include a table summarising the data for both events, including weather conditions, flow rates, atmospheric pressure, sampling location, groundater levels, certificate of calibrations, laboratory reports. A comparison to previous results should also be presented.	Data from March 2023 sampling has now been provided with the requested information.	Acceptable. Comment closed.
9		Groundwater 4.5 - SPR linkages for groundwater - ERM stated that all SPR linkages for groundwater are incomplete. This statement contradicts the "pooling of LNAPL from soils and groundwater". 5 - SPR linkages for ecological off-site receptors - The following matters needs to be reviewed and/or clarified: 5.1 - ERM noted that PFOS was detected in soil and soil leachate samples collected from the northern portion of AEC-4, and given its high solubility, there is a possibility it could contribute to off-site groundwater migration in the future. However, this statement appears to contradict the CSM and mass flux calculations prepared for the WARP. If PFAS leaching and migration to the Duck River is indeed a possibility, it would be advisable to include PFAS monitoring as a COPC in the GMEs prepared for the other areas.	4.5 - The term 'Pooling of LNAPL' was not used and previously referred to potential for ground gas generation from LNAPL. This statement has been amended as per other comments relating to ground gas. SPR linkages for groundwater are incomplete given the delineation of LNAPL and dissolved phase impacts to within the AEC-4 waste mound. 5.1 - PFAS is already included as a COPC for regular monitoring as per the Stage 2 GWMP, which has been reviewed and approved previously by the auditor. Currently the CSM dues not consider a potential pathway to exist in groundwater for PFAS on the basis of monitoring results and the PFAS flux assessment previously undertaken. Wording has been updated within the CSM summary table to reference this assessment.	1 - Acceptable. 2 - Acceptable.	-	Acceptable. Comment closed.
10	1.5.1	1 - The remediation objectives for AEC-4 only address the remediation of LNAPL trapped within pore spaces of soils, but do not consider the possibility of LNAPL pooling and contributing to the formation of ground gases from groundwater as mentioned in the AEC-4 CSM. Please review and comment if necessary.	Section 1.5.1 refers to the agreed overarching remediation objectives for the WARP, which (based on risk assessment) are targeted at soil remediation (to address the source of impacts) and management of groundwater impacts. The fourth dot point "Ensuring short or long term contamination risks to the environment are removed, mitigated or managed" is applicable to ground gas hazards and does not require amendment.	Acceptable	-	Acceptable. Comment closed.

11	1.5.2	1 - ERM stated that *given the proximity of the Duck River to AEC- 4, the implementation of a designed and engineered capped surface has been proposed to provide additional confidence to project stakeholders in the ongoing stability of LNAPL and groundwater impacts remaining confined to the AEC-4 buried waste mound into the future* . Please note that the reason for the containment cell is not only the proximity of the Duck River, but the depth of impacts within fill (in some location approximately 4 mbgl) and the COPC for AEC-4 including asbestos, asbestos friable, PFAS and hexavalent chromium. 2 - ERM has stated that the containment cell will reduce the potential for surface water infiltration into the groundwater, which will reduce the potential for contaminant mass flux and movement of LNAPL in groundwater from the buried waste area. However, based on the historical LNAPL CSM, it was concluded that LNAPL in groundwater does not pose a risk, does not act as a secondary source of hydrocarbon impacts, and has low mobility, not intercepting the Duck River. Therefore, the suggestion that the containment cell will reduce the potential for movement of LNAPL in groundwater may be contradictory to the current understanding of the LNAPL CSM and most recent GME findings	1 - Depth and presence of these COPCs in fill have been added as additional rationale for the proposed cap installation, with reference to the previous assessment undertaken in the AEC-4 ROA. 2 - Propose amendment to wording of this section to emphasise that the cap installation is not to deal with an assessed risk to groundwater but provide additional long-term confidennce in the current stability of conditions. *"The historical LNAPL CSM stated that the existing asphalt cap is a factor for limiting infiltration and LNAPL migration. Noting that the asphalt surfacing is currently in a partially degraded state and ongoing degradation can be expected, potential future use of the area is also limited.* *Construction of an engineered cap with liner, improvements to drainage and the pavement at the ground surface is proposed to provide longevity and ongoing confidence in the CSM (i.e. the stability of LNAPL and groundwater impacts limited to the AEC-4 buried waste mound)."*	1 and 2 - Acceptable	-	Acceptable. Comment closed.
12	1.6	1 - Fourth bullet point – L*NAPL within groundwater has been identified to be degraded, immobile, insoluble and not migrating off-site and therefore suitable for ongoing management* seems contradictory to the above statement *therefore reducing potential contaminant mass flux and movement of LNAPL in groundwater from the buried waste area* . 2 - Last bullet point - The statement *Future vapour intrusion/ potential ground gas risks are limited to the extent of the proposed capped area, where it is understood land use will be limited to open air storage/ car parking, with no construction of permanent/ enclosed buildings within this area to be stipulated in the LTEMP. As such, no mechanism for vapour/ ground gas migration into any future indoor spaces or subsurface structures exists or is foreseeable* . This statement contradicts the CSM in regards the vapour indoor inhalation and pooling of ground gases.	General: updated this section consistent with the basis for remediation strategy presented in AEC-4 ROA 1 - Clarification as per the above point that refer to response of 1.5.2 (2) to remove the contradiction between the two points. New cap construction to improve long-term effectiveness/confidence in existing CSM (immobile LNAPL and dissolved phase) 2 - Clarification of this dot point - Removed reference to the term 'risks' and refer to exceedances to remove contradiction. *Exceedances of vapour intrusion SSTLs/ and the presence of bulk ground gases are limited to the footprint of the proposed capped area. Active remediation of this area is not proposed given the future land use will be limited to open air storage/ car parking, with no construction of permanent/ enclosed buildings within this area to be stipulated in the LTEMP. As such, no mechanism for vapour/ ground gas migration into any future indoor spaces or subsurface structures is possible.*	1 - Acceptable. 2 - Awaiting ground gases data to assess whether mitigation measures for ground gases are really not required.	2 - Ground Gas letter reissued as per above item 6	Acceptable. Comment closed.
13	2.1	Regarding the following statement *A utility trench backfilled with clean material at the top of the mound to reduce requirement for future excavation if additional service installations are required* requires clarification and/or review on two points: 1.It is not specified whether the clean material used for backfilling must be VENM or validated material generated as part of the biopiling in Stage 2 . 2.It is unclear whether the proposed utility trench can act as a preferential pathway for vapours.	1 - Point extended to clarify that clean material refers to VENM, ENM and/or soils within the Site that are confirmed to be below the site assessment criteria outlined within the Site's RAP. Update also provided in section 5.5.3.2. 2 - Top of mound clarified to mean the area above the geomembrane and geotextile layers only, and therefore does not not act as a preferential pathway for vapours.	1 - Noted - Please include a statement that validated soil proposed to be used in AEC-4 still on the VE property (for example for remediated material). In addition, given the presence of asbestos within AEC-4 any material from Lot64 within 500 mm of the surface must be laboratory tested for abestos. 2 - Acceptable.	1 - As per the above item, material re-use will be removed from the technical specification	Acceptable. Comment closed.
14	2.3	The statement regarding LNAPL mobilisation should be reviewed in light of other comments on this matter	Wording amended in line with response to item 1.5.2 (2), to remove the contradiction between the two points. New cap construction to improve long-term effectiveness/confidence in existing CSM (immobile LNAPL and dissolved phase).	Acceptable.	-	Acceptable. Comment closed.
15	Table 2-1	ERM states *minimum soil cover thickness of 0.2 m is nominated, underlain by a 'marker layer' in areas of exposed impacted soil* . It should be specified that this marker layer must consist of VENM or validated material from the biopiling in Stage 2 to ensure its suitability for the intended purpose	Marker layer refers to the marker geotextile, not overlying material. Design speficiation updated to outline that soils placed above the marker geotextile may include of VENM/ENM or site soils meeting requirements for 'General Fill' and deemed suitable for on-site re-use as per the Stage 2 RAP.	Noted - Please include a statement that validated soil proposed to be used in AEC-4 still under VE proprety (for example for remediated material). In addition, given the presence of asbestos within AEC-4 any material from Lot64 within 500 mm from the surface must be laboratory tested for abestos.	1 - As per the above item, material re-use will be removed from the technical specification	Acceptable. Comment closed.
16	Table 3-1	The responsible party for preparing the LTEMP should be identified in Table 2-1.	Validation consultant row within table 3-1 updated to clarify that an LTEMP is required to be prepared.	Acceptable.	-	Acceptable. Comment closed.
17	3.2	Given the planned redevelopment of certain areas, as well as the decommissioning of groundwater monitoring wells within AEC-4 and management waste in a limited area considering that all other areas within Stage 2 have already been remediated, please clarify why the REMPs were not proposed to be amended.	ERM notes that the proposed subdivision and redevelopment of other areas within Stage 2 will not be occurring concurrently with Lot 64 capping works. Site access, current lot/ DP boundaries remain the same as when the Stage 2 RAP and REMPs were prepared and does not warrant a change to proposed environmental mangement. ERM have conducted a review of the Stage 2 REMP and associated sub-plans. The REMP and sub-plans included the proposed Lot 64 works. Section 5.3 outlines that the currently approved Stage 2 REMP and sub-plans are considered fit for purpose in compliance with SSD-9302, noting that the specific specific construction methods are covered in the suite of remediation Contractor's Project Management Plans. The REMP subplan: air quality management plan - refers to asbestos being managed in accordance with the stage 2 RAP. Section 9.6.2 of the Stage 2 RAP outlines the asbestos management controls to be implemented during stage 2 remediation works, including friable asbestos comment in the last paragraph of 9.6.2.1: *"Should friable asbestos be identified during works, works will be required to be undertaken under friable asbestos conditions, which requires a Class A asbestos removal licence and the presence of a Licenced Asbestos Assessor (LAA) to conduct air monitoring and issue clearances prior to removal of asbestos controls".*	Noted. Regarding asbestos management - ERM states that asbestos management including ambient air sampling is the Contractor's responsibility. However, if this task is required under the Stage 2 RAP, will the LAA be an ERM employee? How ERM will attest/validate that this task was completed as per the RAP? This is an item that the auditor will need to comment in the SAR.	Noted. Intent is that ERM (or an independent LAA) conducts this monitoring. Statement included in Section 5.3.4 that the results of this monitoring are to be included in the validation report (prepared by the validation consultant) as verification of completion of this task as per the RAP.	Acceptable. Comment closed.
18	Table 3-2	Please clarify whether SWMP2 to SWMP6 and SWMP12 and GMMP3 and GMMP 4 are new plans?	These are existing approved sub-plans for the REMP prepared for Stage 2 and Lot 64 capping works. As per the above point, these are considered fit for purpose and provide a framework for items requiring inclusion in contractor management plans.	The auditor has identified potential issues associated with the management of temporary stockpiles in Lot 64, particularly given the size of the AEC-4. Additionally, it is not clear how the surface where the stockpiles are to placed will be validated, nor are there clear procedures in place to prevent cross-contamination in areas that have already been remediated and validated. Please confirm whether the REMPs address these matters.	As per the above items - sections discussing re-use of materials to be removed from final technical specification.	Acceptable. Comment closed.

19	Section 5.2	1 - ERM stated *Direct dermal contact/ ingestion of soils contaminated with heavy chain petroleum hydrocarbons (>C16) and Polycyclic Aromatic Hydrocarbons* . Clarify why TRH F1 fraction was not considered in the proposed site-specific hazards in relation to contamination to be incorporated into the contractor work method statement. 2 - ERM stated *Although not expected to be encountered at shallow depths of <0.5 m below the existing ground surface, there is potential for generation of nuisance odour or volatile organic compounds (VOCs), including Benzene, Toluene, Ethylbenzene and Xylenes in localised areas during ground preparation works* . Clarify the basis for this statement, as impacted fill was found from subsurface.	1 - No exceedances of direct contact criteria for TRH F1 fractions have been reported, as outlined within CSM summary table. Vapour intrusion risks for TRH F1 fractions are applicable to indoor air settings and not applicable to workers undertaking excavation in open air settings. 2 - Amend wording to reference the previous assessment of potential emissions within the approved WARP Stage 2 AEVR. No soil exceedances in upper 0.5m. VOC headspace readings were <1.7 ppm in 58/60 samples, 2 outlier PID screening results TP19/23 (413 ppm) and TP19/20 (32 ppm).	1 and 2 - Acceptable.	-	Acceptable. Comment closed.
20	Section 5.3	1 - Refer to the need in updating the REMPs mentioned by the auditor above. 2 - Shouldn't an Asbestos Management Plan (AMP) be prepared given the presence of friable asbestos?	1 - Refer to response to item 14. No requirement to update these documents. 2 - Preparation of an Asbestos Management Plan is within the list of contractor required documentation, as per table 3-2. Preparation of this plan by the contractor is requirement of the soil and water management plan and technical specification will be specific to the works outlined in the technical specification and design (as per framework from SWMP below). *The contractor will prepare an Asbestos Management Plan that:* *is produced in line with the Work Health and Safety Act 2011 and supporting Regulations 2017, the PoEO (Waste) Regulation 2014 and NSW EPA Waste Classification Guidelines (NSW EPA, 2014a);* *details how asbestos (i.e. in soils and unexpected materials) will be managed;* *includes an unexpected find procedure for asbestos material;* *includes management measures required for the appropriate handling of soils containing asbestos;* *identifies a dedicated area within the Project Area for storing asbestos waste prior to disposal.* New Section 5.3.4 (Asbestos Management) with a summary of the above requirements has been added to the Tech spec document for clarity and completeness	Refer to auditor's response presented in item 14.	See above response to item 14	Acceptable. Comment closed.
21	Table 5-1	1 - The GMMP should include more details, such as the sampling methodology to be used and which wells will be monitored. 2 - It is not clear where imported materials will be temporarily stored within AEC-4. 3 - Clarify why asbestos air monitoring was not considered in the AQMP. 4 - Testing of stockpiled excavated soil - This aspect contradicts ERM statement that no off-site disposal is expected. The dimensions of the services trench will be a cross secion of 1.2 square metres with a length of hundreds of metres - the excavation of this trench will generate a large volume of spoil. How will this be managed given the potential presence of substances such as friable asbestos?	1 - The GMMP is a sub-plan of the REMP produced by AECOM. This document provides a high level framework for groundwater management to meet the requirements of the consent conditions for SSD-9302. Stage 2 Groundwater Management Program (GMP - ERM, 2021) contains details of sampling methods and wells to be sampled during and post remediation of Lot 64. This document has been previously reviewed and endorsed by the Auditor. To avoid repetition of detailed information regarding a validation consultant scope item within a Contractor Technical Spec, reference has been made to the GMP within this table. 2 - This detail is to be provided by contractors within their work method statements, noting the entirety of the Stage 2 Area is available for storage of materials during works. Enviropacific has indicated the current footprint of lot 63 to the north would be utilised for temporary storage of materials (including any imported fill). 3 - Asbestos air monitoring did not form part of the required scope of the AQMP within the conditions of consent and is covered under the scope of contractor prepared Asbestos Management Plans provided in the REMP (under Mitigation Measure SWMP3). The AQMP notes that the Safework Code of Practice (2019) for asbestos removal is to be implemented throughout works. Section 5.3.4 (asbestos management) section of the Technical Specification updated to cross-reference the relevant Section of the Stage 2 RAP (9.6.2) which covers Safework NSW Requirements, minimum safety controls (including air monitoring), excavation, stockpiling and waste classification 4 - ERM notes frequency of stockpile sampling for off-site disposal is "As required". This row of the table to be left in as a contingency in the event that small volumes of soils/ asphalt require offsite disposal throughout the project.	1 - Acceptable. 2 - The management of stockpiles needs to be presented to be assessed by the auditor. Lot 63 was already validated. Any temporary stockpiling within a remediated area will require a validation program. 3 - Acceptable. 4 - The frequency for off-site disposal should be presented in the plan, demonstrating it is consistent with relevant guideline requirements.	2 - No materials from stage 2 to be re-used so addition of a stockpile management section to the tech spec is not considered to be required. As discussed in meeting on 17th July 2023, any impacted fill material from Lot 64 is not anticipated to require temporary storage outside of the mound (i.e. on clean ground) and therefore will not require validation of underlying surface. 4 - The frequency of sampling for waste classification will be as per the approach presented in the auditor endorsed Stage 2 RAP. Specific references to the relevant sections of the RAP for sample frequency and analysis have now been added to Section 5.3.2.	Acceptable. Comment closed.

22	Section 5.4.4.1	Monitoring wells BH116, MW12/01, MW20/05, MW20/06, MW20/07, and MW20/13 will be decommissioned (which were part of the GMMP for Stage 2). Please comment on whether the monitoring well network down gradient of the containment cell is adequate to monitor groundwater conditions and vapour, if required. The GMMP may therefore need to be modified.	The Stage 2 GMP (ERM 2021) and the GMMP (AECOM 2021) outline that the groundwater monitoring requirements post-remediation only includes down-gradient boundary monitoring for AEC-4, with the objectives to demonstrate groundwater at the site boundary does not represent an unacceptable risk to off-site receptors (Duck River) via mobilisation of contaminants from in-situ managed buried waste material. The GMMP (and GMP) state that only down-gradient monitoring is required and is adequate, and that wells within the capping footprint are not required for post-remediation monitoring. ERM notes that the suitability of downgradient wells for ground gas monitoring is limited given the primary intended purpose of these wells was for groundwater monitoring. From most recent groundwater gauging conducted in March 2023, 4 of 13 downgradient wells were assessed as suitable for ground gas monitoring on the basis of groundwater measured below the top of the screened interval (MW94/6, MW20/11, MW20/17, MW12/20). Vapour/ ground gas monitoring is not currently considered to be required based on the CSM presented and above responses. If required, these 4 wells could be utilised in future monitoring of ground gas downgradient of the capped area.	1 - Groundwater sampling - Acceptable. 2 - Assessment of ground gases has not been demonstrated as data from March 2023 was not presented. In addition, the auditor noted in the meeting held in March 2023 that ground gas monitoring is necessary.	March 2023 data presented as per response to item 6.	Acceptable. Comment closed.
23	Section 5.5.3.1	Please clarify why PFAS in soil and leachate was not listed in this section, as it was considered a COPC in the CSM.	PFAS in soil and leachate added to this list of contaminants.	Acceptable	-	Acceptable. Comment closed.
24	Section 5.5.3.2	Considering that general fill may be placed either above or below the LLDPE geomembrane and marker layers, site-won material from AEC-4 area deemed suitable for re-use will not be accepted as general fill (given the presence of bonded and friable asbestos, across AEC-4) and must be placed below the geomembrane and marker layers. The auditor notes that procedure for fill validation are no discussed in the Tech Spec document.	Noted regarding fill from AEC-4. Site-won fill material from other sections of Stage 2 works may be utilised where previously approved for re-use by the Auditor. Fill validation is not considered relevant to this project and therefore validation procedures have not been included.	The auditor understands that material from AEC-4 will not be placed above the geomembrane, regardless of the circumstances. Validated material from other areas of the WARP may be used, but only with the prior approval of the auditor. Furthermore, the auditor has requested clarification regarding the ownership of the land where this material is to be imported (must to be from land owned by Viva Energy).	As per the above item 4, material re-use will be removed from the technical specification	Acceptable. Comment closed.
25	Section 8.8	It was reported that *Requirement for running of lighting conduits/ additional subsurface drainage to be confirmed by the design consultant.* Clarify why consideration for lateral migration of gases were not considered?	Note: ERM assumes this comment refers to section 5.8. This statement is redundant and has been removed.	Acceptable	-	Acceptable. Comment closed.
26	Section 5.9.2	The Validation report should also be prepared as per the Consultant Guidelines, including DQOs, and a refined CSM.	These requirements have been added to the start of the second paragraph.	Acceptable	-	Acceptable. Comment closed.

Client Viva Energy
Project 2127799
Stage/Area **Stage 2 Area - AEC-4**

Item	Document	Auditor comments on 411015-00022-GE-CRS-0901 Drawings	ERM's responses	Auditor comments on Response to Interim Audit Advice 18 - Lot 64 ('AEC-4') Capping Strategy dated 26 September 2022	ERM's responses	Auditor responses - 13/07/2023
1	Drawing C10-C12.A	The cap extent shown on C12 refers to an ERM drawing. Confirmation is required that the extent of the cap is suitable.	Extent of the capped area referred to in drawing C12 is consistent with the AEC-4 area outlined within the Stage 2 RAP. The area to be capped is representative of soil materials identified during previous investigations presenting potential human health risks: - via direct contact (TRH, PAHs, Cr6) / inhalation of asbestos fibres during future excavation (if unmitigated). - via vapour intrusion into future indoor air spaces (noting no current buildings exist on the AEC-4 Area). - residual LNAPL within the soil profile and localised shallow groundwater	Noted.	-	Comment closed.
2	Drawing C10-C17.B	The cap is to limit water infiltration. Based on the HHRA, there is a potential for vapour intrusion risks for future commercial workers from impacted soils (refer to summary included in Section 2). Could there be gas/vapour build-up beneath the cap? Will subsequent vapour intrusion monitoring be required or should appropriate vapour mitigation measures be incorporated into the design?	ERM conducted a baseline ground gas monitoring event to address this query (Attachment B) On the basis of the information presented, the following is concluded in relation to the Site Auditor's query: - It is acknowledged that the installation of an impermeable geomembrane has potential to increase the lateral migration of gas generated from uncontrolled fill within the mound. However, evidence of recordable lateral gas migration to monitoring wells outside of the proposed cap extent has not been observed during the August 2022 gas monitoring event, despite the widespread coverage of the AEC-4 buried waste mound in hardstand for greater than 25 years. The proposed capped area also has no known service trenches which may act as a preferential pathway for lateral gas migration from the AEC-4 buried waste mound to adjacent areas within or outside of the proposed Lot 64 boundary into the future. - Additional gas mitigation measures, including installation of gas collection trenches and/or venting within the design for the AEC-4 cap are not considered necessary due to the characterised risk profile of the Site. The land use restrictions under a legally enforceabled LTEMP will effectively limit future human health exposure to hazardous ground gases (and petroleum hydrocarbon derived vapours) by limiting the construction of enclosed spaces or service trenches below the geomembrane. Furthermore, unsealed areas which cannot be redeveloped within the riparian corridor (as defined under SSD 10549) will border the proposed capped area to the west, south and east and provide opportunity for passive diffusion of gases in the unlikely event that gas accumulation and increased lateral migration from beneath the capped area did occur in the future.	Refer to Construction Tech Spec report comments.	Refer to tech spec report responses.	Refer to the auditor's comments presented in the Tec Spec review.
3	Drawing C10-C17.B	GCL will act as a marker layer to reduce exposure to asbestos contamination. Is the depth/type of material above the GCL sufficient for asbestos? (i.e. only 300 mm soil on the batters and will there need to be inspections/maintenance of these areas?).	Use of a LLDPE geomembrane has replaced GCL as a preferred option for liner. Use of a bright coloured geotextile marker layer has been incorporated above the liner, associated protection layers and underlying contaminated soil material to provide advance warning prior to penetration of these layers. This protection detail is provided on revised drawing C17. Battered slopes in revised design limited to eastern landscaped batter and incorporates erosion controls (geoweb/ planting of shallow rooted grasses (tubestock)/ overlain by jute mating of a minimum thickness of 300mm. With incorporation of these engineered erosion controls it is not considered that inspections or maintenance will be required to confirm 300mm cover is maintained.	Noted.	-	Comment closed.
4	Drawing C10-C17.B	Will there be any specification for the materials to be placed directly against the GCL (above and below)? e.g. maximum particle size, cation exchange capacity. Does there need to be a minimum soil layer between the contaminated fill and the GCL?	The revised detailed design specifies the use of a non-woven, heavyweight geotextile layer above and below the LLDPE liner, or the use of a 100mm sand protection layer (subject to constructability requirements determined by the Contractor). Particle size of <19mm, free of sharp or angular objects which may damage the geomembrane have been nominated within the technical specification as suitable material properties for this purpose.	Noted.	-	Comment closed.
5	Drawing C10-C17.B	The GCL is shown to pass under stormwater pipes, under roads and pavements, and behind retaining walls. It is not shown specifically to be continuous under the stormwater pits.	The geomembrane will be continuous under the stormwater pits, refer to revised detail on drawing C17.	Noted.	-	Comment closed.
6	Drawing C10-C17.B	Any water that migrates through the pavement or vegetation soil should be able to drain out, so it does not pond on the GCL. Any areas of ponded water will have higher infiltration. In particular, the anchor trench at the batter toe and at the edge of the pavement where the concrete kerb is proposed are areas where water may not be able to drain. The cross-sections also show some existing bunds around the perimeter of the works which may prevent water from draining from the capped area.	CRC 17/06/2022: The capped area has been designed with a >1% slope towards the provided drainage pits, consistent with surface grading. Any water ingress through the pavement and on top of the geomembrane will be directed towards the drainage pits and captured by the drainage trench.	Noted.	-	Comment closed.
7	Drawing CO 13919.06 – C13.A	On C13, northeast corner, near Pit 03 discharge it looks like the works interact with a large headwall.	Revised design incorporates three separate stormwater drainage outlets (Drawing C13). Design for outlets, including dissipation is shown on new Drawing C18. Separate outlets to the original headwall have been proposed as these are not reliant on the construction of the roadway and associated drainage and headwall (by others) prior to capping construction	Revised drawing C13 – Proposed shared services trench. "lined with marker layer plus GCL". Should this be geomembrane?	-	Yes, the auditor was referring to the geomembrane. Comment closed.
8	Drawing CO 13919.06 – C13.A	On C13, stormwater storm event sizing is missing (note 2).	CRC 17/06/2022: Refer to revised drawing C13. In-ground piped system has been designed for 20yr ARI or 5% AEP.			Comment closed.
9	Drawing CO 13919.06 – C14.A	C14 note 7 has instructions on moisture etc for site won fill. Is this appropriate for the contaminated soils?	Site won fill will require confirmation from ERM as validation consultant of suitability for re-use in accordance with the RAP, if placed above the marker layer. Technical specification for the works will provide key definition of material which will be suitable for placement above and below the liner/marker layer.	Noted.	-	Comment closed.

Item	Document	Auditor comments on 411015-00022-GE-CRS-0901 Drawings	ERM's responses	Auditor comments on Response to Interim Audit Advice 18 - Lot 64 ('AEC-4') Capping Strategy dated 26 September 2022	ERM's responses	Auditor responses - 13/07/2023
10	Drawing CO 13919.06 – C16.B	Is the compacted clay plug shown in the retaining wall details on C16 relevant to this project? If so, how does this interact with the GCL?	CRC 17/06/2022: Refer to revised drawing C16 showing clay plug removed.	Noted.	-	Comment closed.
11	Drawing CO 13919.06 – C16.B	C16 Pavement and road details – Will compaction of the DGB layer damage the GCL?	Refer to response above regarding material to be placed above and below the geomembrane. Revised protection detail shown on C17 (sheet 1)	Noted.	-	Comment closed.
12	Drawing CO 13919.06 – C16.B	C16 Landscape detail – Is a 300mm soil layer sufficient for the protection of GCL from desiccation for rooting of proposed vegetation? Will is be sufficient for mechanical damage (e.g. maintenance of vegetation)? Will it be stable on 1 in 3 batters (including if saturated)?	CRC 17/06/2022: With the revision of GCL to a LLDPE geomembrane, overlying moisture content is no longer a factor to maintain low permeability. As per Item 3 - slope stability has been considered with the incorporation of 'Geoweb' on battered landscaped slope to stabilise soil on LLDPE. Mechanical damage on the battered slope is not considered feasible give the proposed landscape design (i.e. no turf which would require mowing on slopes)	Noted.	-	Comment closed.
13	Drawing CO 13919.06 – C17.B	Will the handrail have its own footing? Is there enough depth above the GCL for this? Are handrails suitable for the carpark (i.e. does it need to stop cars going down the batters/retaining wall)?	CRC 17/06/2022: Handrail shall be installed on the edge restraint. Barriers, if required, shall be installed with footings located within the provided services trench zone.	Noted.	-	Comment closed.
14	Drawing CO 13919.06 – C17.B	Will there be any lighting, bollards, other poles, etc installed for the carpark that could impact the GCL? Or should this be taken into account in the design of the cap – i.e. designated areas to allow future installation of underground services without having to breach the cap.	A services trench zone has been included in the capping area to allow for future underground services to be installed without breaching the geomembrane/marker layer. A lighting design has also been undertaken, with the intention to excavate and construct footings for lightpoles outside the perimeter of the capped area prior to cap construction and this will therefore not impact on the cap integrity.	Noted.	-	Comment closed.
15		Given that the approach presented in the Stage 2 RAP for the capping of AEC 4 was conceptual, it is suggested that ERM prepare a letter or similar that demonstrates the capping strategy (as per the key requirements listed in the Auditor guidelines (Section 4.3.3.)): – Maximises the long-term stability of the capping and/or containment system(s) and any proposed structures above it (from an engineering perspective) and, where applicable, minimises the potential for leachate formation and/or volatilisation – Does not include the erection of structures on the capped and/or contained area that may result in a risk of harm to public health or the environment – Recommends a notification mechanism to ensure that the capped and/or contained areas are protected from any unintentional or uncontrolled disturbance that could breach the integrity of the physical barrier, such as recommending placing a notation or covenant on the property title or a notation on a s.149 certificate or issuing an order or placing a covenant on the title to land under the CLM Act to require ongoing maintenance under the Act. In addition, commentary should be provided that other preferred	ERM response to these Auditor Comments provided in main body of letter report response.	1 - The requirements listed in the Auditor Guidelines (Section 4.3.3) were satisfactorily addressed in Section 1.6. 2 - Site Contamination Policy Framework - Schedule A and B of NEPM - Not discussed in the document. However, it was considered in the AEC-4 ROA report.	Noted.	Comment closed.
16	IAA18	In addition, the auditor considers it would be beneficial to have the long-term monitoring management plan (LTEMP) for AEC 4 reviewed in parallel with the cap design to confirm that any constraints related to the capping will be covered by the LTEMP.	-	The LTEMP was not presented as recommended by the auditor. The following topics are relevant to the project and should have been included in the LTEMP: 1 - The auditor noted that the AEC-4 Tech Spec includes decommissioning groundwater monitoring wells within AEC-4, but there was no mention of the remaining groundwater monitoring network needed to monitor groundwater quality between the containment cell and Duck River. The CSM Table 1-2 documented the need to continue monitoring PFOS in groundwater due to its presence in soil and soil leachate samples in the northern portion of AEC-4, which could potentially migrate offsite. Therefore, ongoing monitoring is required as part of the groundwater monitoring program.	1 - The *Clyde WARP Stage 2 Groundwater Monitoring Program* prepared by ERM (Dated 14th July 2021) has considered wells which will be destroyed as part of AEC-4 capping works in the post-remediation monitoring scope (See figure 2). One of the key objectives of the GWMP is to demonstrate groundwater at the site boundary does not represent an unacceptable risk to off-site receptors (Duck River) via mobilisation of contaminants from capped buried waste material. Boundary monitoring wells between the cap footprint and the Duck River are proposed to be retained for the 'post-remediation monitoring' scope proposed within this GWMP. Monitoring for PFAS (including PFOS) is included as part of this process.	Noted. LTEMP will be further presented, and the information that the auditor considers relevant will be checked during the LTEMP review.
17		-	-	2 - The auditor acknowledges that the document is a Tech Spec; however, to endorse the containment cell project, an auditor must ensure that the legal enforceability and notification mechanisms can be archived, as per the Auditor Guidelines requirements.	2- New Section 2.4 added to the updated technical specification outlining how LTEMP will be made legally enforceable	Noted. Legal enforcability is now presented in Section 2.4 of the Tec Spec document.
18	Response to Interim Audit Advice 18 - Lot 64 ('AEC-4') Capping Strategy	-	-	1 - Table 4-1, marker layer RAP requirement. It is assmued that the density of >300 g/m3 should actually be 300 g/m2. 2 - Table 4-1, marker layer specification. Last dot point appears incomplete	1 - Noted, this will be updated within the technical specification (Table 2-1) 2 - Noted. Incomplete dot point to state "marker layer to be placed above contaminated material and LLDPE geotextile". Will review and update technical update technical specification to include this if required. This will be updated within the technical specification (Table 2-1)	Noted. Information addressed in the Tec Spec report.
19	Response to Interim Audit Advice 18 - Lot 64 ('AEC-4') Capping Strategy	-	-	1 - C13 – Proposed shared services trench. "lined with marker layer plus GCL". Should this be geomembrane? 2 - For geomembrane placement, sharp corners should all be rounded 3 - Without a specification to review, it is hard to know if the orange marker layer geotextile will provide sufficient protection during construction. The specification should require a work method statement and perhaps a trial of placement of the pavement materials on the geomembrane to ensure that the placement of the pavement materials isn't going to cause damage.	1 - Noted, this typo has been fixed, updated drawing will be provided in final tech spec 2 - Noted, detail provided for anchor trench on revised drawing C18 incorporates rounded edges to the shared services trench and will be included in final tech spec. 3 - A cushion geotextile or sand blinding layer is to be used to protect the LLDPE liner during cap construction as per Section 5.5.6 of the technical specification. There is no reliance of marker geotextile for mecahnical protection. Refer to section 5.5.8 of the Technical Specification Report.	Noted. Information addressed in the Tec Spec report.

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28 March 2024

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Interim Audit Advice 20 – Review of WARP Proposed Lot 64 Preliminary Draft of Long-Term Environmental Management Plan

Dear Adam

1. Introduction

Andrew Kohlrusch of GHD Pty Ltd (GHD) a NSW Environment Protection Authority (EPA) accredited site auditor was commissioned by Viva Energy Australia Pty Ltd (Viva Energy) to conduct an environmental site audit of the Western Area of the former Clyde Refinery (referred to as the Western Area Remediation Project or WARP), located at Durham Street, Rosehill on the Camellia Peninsula, NSW.

This audit is a statutory requirement under Consent Condition B3 for State Significant Development (SSD) No 9302. Additionally, the site has been notified by the NSW EPA under Section 60 of the *Contaminated Land Management Act 1997* (the CLM Act).

This Interim Audit Advice (IAA) has been prepared by the auditor after reviewing the following report submitted by Environmental Resources Management Australia Pty Ltd (ERM):

– *Clyde Western Area Remediation Project, Proposed Lot 64 – Long Term Environmental Management Plan* (the **proposed Lot 64 LTEMP**).

The auditor notes that the aforementioned document was submitted in a preliminary draft version without figures and survey plans.

2. Auditor commentary on the proposed Lot 64 LTEMP

The auditor has reviewed the Preliminary Draft of the Proposed Lot 64 LTEMP. While the LTEMP contains many of the elements required by the EPA Auditor Guidelines (NSW EPA, 2017) and the EPA EMP Practice Note (NSW EPA, 2022), there are some matters that require review and/or clarification. The auditor's comments are documented in **Table 1**.

Due to the deadline for the delivery of the audit, it is important that all matters listed in Table 1 are adequately addressed in an updated LTEMP. All amendments will need to be shown in tracked changes before issuing the final LTEMP.

Table 1 *Preliminary auditor review – Proposed Lot 64 LTEMP*

Report section	Auditor comments
Glossary	In the Glossary of terms, the Site was defined as the as the Viva Energy owned land *including Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is currently vacant or leased to third parties*. However, throughout the report, ERM refers to the AEC-4 area, proposed Lot 64 and the Stage 2 area as "the Site". There needs to be clarity throughout the LTEMP regarding the Site definition.
Executive Summary	In the Background Information, ERM states the following: • Ongoing management of residual contamination is required within the constructed capped area, as well as in areas outside the cap within Lot 64. The auditor notes that without a figure showing the LTEMP applicability area, it was not possible to determine which "other areas outside the cap" ERM is referring to. • The controls outlined in the LTEMP are passive mitigation measures designed to manage potential risks to human health and/or ecological receptors. Given the available data and the proposed land use for Lot 64, the auditor understands that there are no potential ecological risks for receptors either on or off-site. To which mitigation measures for potential risks to ecological receptors is ERM referring? In the Required Environmental Management Controls, the inclusion of gas monitoring is necessary.
Table 1-1	The table needs to clarify whether Part Lot 1 in DP 1271927 comprises only the cap within Lot 64 or all areas that are subject to this LTEMP (i.e. the proposed Lot 64).
1.2	The detail for ongoing gas monitoring needs to be listed in the purpose of the LTEMP.
3.2	ERM documented that ongoing management of residual contamination is required within the constructed capped area, as well as in areas outside the cap within Lot 64. The auditor notes that without a figure showing the area that is applicable for the LTEMP, it is not possible to determine to which "other areas outside the cap" ERM is referring.
Table 4-1	The auditor notes that Figure 2, showing the areas of residual contamination, was not included in the draft of the LTEMP. This figure will need to be included in the amended version of the LTEMP. Regarding remaining soil contamination, the LTEMP needs to clarify why TRH management limits exceedances were not considered. In remaining groundwater contamination (based on the Q4 2023 GME data), the following needs to be reviewed or information provided: • A discussion on mass flux and potential off-site exceedances. • Maximum benzene exceedance is 3 ug/L. To which exceedance is ERM referring? • LNAPL occurrence should be delineated and limited to the on-site area.
Table 4-2	Commentary on PFAS needs to be included in this table, given there was discussion on PFAS iin the Q4 2023 GME report. Table 4-2 indicates that LNAPL was identified in MW20/13. However, the figures in the Q4 2023 GME report (November 2023 data) do not record LNAPL at this location. The occurrence of LNAPL should be confirmed and/or the report ERM used to prepare this table should be specified.
Table 5-1	The information presented in this table outlining potential risks associated with the capped area may be misleading. The LTEMP should reflect the conditions of Lot 64 after the cap has been installed – in this regard capping of the impacted soil is the remedial approach to mitigate potential risks. ERM has inferred however that the capped area, which will be remediated to avoid risks, poses potential human and ecological risks. As the WARP is situated in a heavily industrial/commercial area, it is not clear to which ecological receptors ERM is referring in Table 5-1. If ERM decides to maintain Table 5-1, the exposure pathways need to be reviewed. For example: • **Human exposure pathways**: ✓ Soil – Benzene indoor inhalation by commercial workers. This LTEMP states that no building is to be constructed within the proposed Lot 64. It is therefore not clear how there is an the SPR linkage for indoor inhalation. ✓ Groundwater – Benzene direct contact by off-site recreational receptors of Duck River. The auditor notes that the maximum benzene concentration (3 ug/L) detected in November 2023 (Q4 2023 GME) was at MW20/03 which is below the recreational criterion (which is

Report section	Auditor comments
	not considered to be a realistic activity in the Duck River). Moreover, all other 13 samples collected between the AEC-4 and the Duck River were below the Limit of Reporting (LOR). In this regard, to which benzene recreational exceedance is ERM referring to? • **Environmental pathways:** ✓ Surface and sediment run-off to the adjacent stormwater. The design of the cell includes a drainage system around the cell to mitigate these pathways – which would only discharge dust that may accumulate on the capped surface, but not from the material that has been capped. To allow surface and design run-off to migrate to the adjacent stormwater drainage, the capping layer would need to be severally damaged.
Table 5-2	For clarity, it may be worth including in the table title "…are undertaken outside the capping area". Is there any sludge identified within the proposed Lot 64 that will not be capped? It is not clear why there was a reference to sludge. Comments on Table 5-1 regarding exposure pathways are valid for Table 5-2.
Table 6-1	Considering the information presented in Table 5-2, should the odour management during maintenance and occasional construction works be applied to all of Lot 64, and not only to the capped extent of Lot 64?
Table 6-2	Post-Construction Gas Monitoring Events – As per the Auditor Guidelines (NSW EPA, 2017) and the EMP Practice Note (NSW EPA, 2022), details regarding sampling location, frequency, parameters, and method need to be included in the LTEMP. We note that for the groundwater, all these requirements are presented in the GWMP; therefore, a reference to this document would be sufficient.
Table 7-1	Should asbestos outside the capping area be considered an unexpected find, considering that ERM identified and discussed its presence as a potential risk for intrusive workers outside the capping area in Table 5-2? The mitigation actions required if methane measurements exceed 1% v/v need to be included in the LTEMP. Simply referring to a guideline is not sufficient, as the LTEMP (as per the NSW EPA *Auditor Guidelines* should *be a self-contained document which requires little or no direct reference by the reader to other material or documents to support the audit findings or the conclusions contained in the site audit statement*.
General	A statement specifying that adherence to this LTEMP is required to ensure the site's suitability for commercial/industrial land uses, without the construction of above-ground buildings or the extraction of groundwater, needs to be included.

3. Conclusions

This letter should be regarded as interim advice to the overall review and site audit process and should not be considered a Site Audit Statement under the CLM Act, 1997. This interim audit advice letter will subsequently be referred to and provided as an Annex to the final Site Audit Statement and Site Audit Report.

Sincerely

GHD Pty Ltd

Andrew Kohlrusch
NSW EPA Accredited Auditor
0447 685 055

Client: Viva Energy
GHD project: 2127799
Site: WARP - Stage 2
Report: **Supplementary Environmental Site Assessment - Southern Buried Waste Area (AEC-4)**

Item	Report Section	Auditor Comments (version dated 10/03/21)	ERM responses	Auditor Comments (version dated 08/06/21)
1	Table 0-1	1 - It is understood that that an acid sulfate management plan is requird as part of the RAP - Stage 2.	1 - ASSMP not considered to be required based on scope of excavation works in RAP. Clarifying Statement provided within the RAP regarding this. Given the AEC-4 report does not provide information relating to remedial extents, text will be amended to defer the assessment of this requirement to this document. RAP clarifying text below for completeness: *"Characterisation of the potential for acid sulfate soils generation within the Stage 2 Area is discussed in Section 3.4. According to the City of Parramatta Council Local Environment Plan Maps, ASS Risk ratings of Class 4 are applicable to the majority of the Stage 2 Area. A small area of Class 2 is situated to the south-eastern extent of Stage 2.* *Based on the presence of excavation areas only within zones classified as Class 4 Acid Sulfate Soils, no proposed disturbance to PASS identified below the level of fill within AEC-4 and no significant lowering of the water table, it is considered that the scope of remedial works does not currently warrant the preparation of an Acid Sulfate Soils Management Plan (ASSMP).* *Should alternative remedial approaches be required as per the contingency plan outlined in Section 13, the requirement for an ASSMP should be re-visited."*	Comment closed.
		2 - The meaning of "High proportion" of LNAPL should be defined. It is noted that while LNAPL in groundwater has been recorded in two wells (MW12/1 and MW20/06), LNAPL within soils (from 0.0 to >4.0 mbgl) was recorded at five test pits/bores (TP19/20, MW12/01, TP19/77, TP18/27 and TP19/5). Additional lines of evidence supporting ERM's conclusion that the majority of LNAPL was observed in groundwater should be presented.	2- New summary table 8-1 added comparing LNAPL observation to average groundwater depth. This statement has been amended Reworded to: "LNAPL mass has been observed at the depth of groundwater and buried at depths below the water table (phreatic zone) within laterally discontinuous zones of more porous materials (higher sand content). Where LNAPL is present beneath the water table, restriction of pore-space for migration of LNAPL occurs. This stability is evidenced by there being no measurable LNAPL thickness in wells or observations at depth during installation (MW20/03, MW20/07 and MW20/13);".	Comment closed.
		3 - Clarify if the discussion regarding tidal connectivity was based on current results or considered the RSI information. If the RSI data was used, the reference should be presented. 4 - It would be beneficial to state in relation to direct contact with impacted soils that currently, the site is under Viva Energy health and safety protocol and that PPE should be used when working in this area (as relevant). For future commercial/industrial receptors, an LTEMP, including a discussion of all restrictions, is to be prepared for AEC4.	3- Discussion regarding tidal connectivity is based on current results but as mentioned throughout the main body of the report is consistent with previous assessments in other areas of the Site, including the RSI. 4 - Section 3.4 contained information relating to current safety protocols limiting exposure. Amended wording to clarify 'future' commercial/industrial receptors	Comments closed.
		5 - Clarify if the LNAPL characterisation data was used to support the statement that there is a potential for pooling of ground gases for IMW given the presence of LNAPL in soil and groundwater. The auditor noted that LNAPL composition indicated it comprised long chain hydrocarbons. In addition, as stated by ERM, LNAPL is aged, not mobile, with a high viscosity. 6 - Was a ground gas assessment conduct in the vicinity of test pits and wells where LNAPL was observed, supporting the statement about the pooling of ground gases?	5 - While LNAPL characterisation data suggests LNAPL is primarily comprised of heavier chain hydrocarbons, a component of volatile hydrocarbons (TRH (C6-C10) and BTEX) have been identified which drive potential VI risks for future workers. No specific ground gas data has been collected to confirm there is no potential for pooling of ground gases within AEC-4. Given the proposed future use of this area (open air car-park), no separate assessment is considered to be required. It is understood from project communications that the future land use within AEC-4 that the LTEMP will prevent excavation or the construction of buildings over this area - effectively mitigating any potential ground gas exposure pathway in the future. 6 - No specific ground gas data was collected as part of this ESA. As per above response, management of ground gases is addressed via passive management restrictions in LTEMP.	5 and 6 - Based on the lack of data, inclusion of soil vapour sampling in this area might be required as part of the validation works. The auditor notes that this matter was captured in the LTEMP.
2	1.2.2	It would be beneficial to state that the DPIE accepted the staged remediation approach.	Noted. Added statement regarding DPIE acceptance of Staged remediation approach.	Comment closed.
3	1.3	The Stage 1 remedial and validation works have been completed. Therefore, acid sulfate soil assessment is not necessary the entirel WARP, only Stage 2 as the previous search discussed in the RSI indicated a potential for ASS in this area.	Noted. Minor amendment to text to clarify assessment is specific to the Stage 2 Area	Comment closed.
4	1.4.3	Clarification regarding the number of wells sampled is required. ERM stated in Section 1.4.3 the existence of three monitoring wells, while in Section 1.4.3, four wells were mentioned.	26 wells total sampled (22 new, 4 existing). These sections of text will be amended accordingly for consistency	Comment closed.
5	1.4.4	It was stated that hydraulic testing was performed on 25 wells (22 new and 4 existing). A review of this statement is necessary as 22+4=26 wells, not 25 wells.	Hydraulic testing completed on 24 wells: 21 new wells which excludes MW20/06 (LNAPL present in well) 3 existing wells (BH116, BH210, MW94/6). Text of document to be updated throughout	Comment closed.
6	Table 2-1	Please note that a survey plan showing the coordinates of the site boundaries will be necessary.	Noted. Figures have been updated with recent site boundary survey. Survey plans of stage 2 area attached for completeness (Appendix I).	Comment closed.
7	2.4.1	Clarify if *elevated lead concentrations* means concentrations in excess of the adopted criteria.	Amended to clarify that "lead concentrations in excess of the adopted criteria have not been reported in soil samples analysed of waste material within the mound"	Comment closed.
8	3.2.2	Clarify if the inhalation of vapours by workers from impacted soil groundwater or LNAPL in outdoor air is a viable exposure pathway.	Removed reference to outdoor air. Vapour inhalation risk only viable via indoor air inhalation.	Comment closed.
9	Table 4-1	**Step 1** - It would be beneficial to state that previous assessments have been conducted at AEC4. The works conducted in November-December 2020 were additional.	Noted - amended to "previous investigations within the AEC-4 area.." AEC-4 area instead of Clyde Terminal	Comment closed.
10	5.3	Although 20 test pits were excavated, only 11 primary soil samples were collected. The rationale for the selection of soil samples should be presented.	22 monitoring wells (no test pits) were completed. Detailed rationale for analysis is provided within Tables 1 and 2 Footnote added to table in section 5.3 to clarify: *"Due to extensive existing soil dataset. Rationale for laboratory analysis of soils limited to:* *• lateral delineation of western extent of buried waste;* *• vertical delineation of impacts within mounded area;* *• Acid Sulfate Soils Assessment"*	Comment closed.
11	Table 7-2	A figure showing the test pits where LNAPL was observed (noting the depth) should be presented. This figure should also include information from the RSI that should be further used to discuss the nature and extent of soil impacts	Noted - new figure 6C (LNAPL Distribution) to be prepared for intervals 0-1, 1-2, 2-4m as per RSI report including the full dataset. This will be referred to within Section 7.2	Comment closed.
12	7.2.3	Although hexavalent chromium and PAHs were analysed in soil samples (as presented in Section 5.3) a discussion was not provided.	Statement added for completeness: *"Concentrations of PAHs and hexavalent Chromium were reported below adopted soil criteria for samples analysed."*	Comment closed.
13	Table 7-3	The following concentrations should be reviewed or additional clarification presented as they are different to those presented in Figures in Appendix A: - MW20/03 - 2400 mg/kg; however figure shows 2800 mg/kg - MW20/06 - 2400 mg/kg; however figure shows 4400 mg /kg - MW20/06 - 3700 mg/kg; however figure shows 9800 mg/kg	Noted. Results presented in Table 7-3 are results following completion of silica gel cleanup analysis Results presented in Figures were without SGC have been updated	Comment closed.
14	Table 7-4	MW12/03 is not shown in figures in Appendix A.	MW12/03 is a typographical error - amended to MW20/03 throughout document	Comment closed.
15	8	1 - The delineation discussion should consider all data that has been collected at/in the vicinity of AEC-04. Although figures showing asbestos results and LNAPL in groundwater results from the RSI are presented in Appendix, these results were not presented or discussed in relation to the latest data in this report. 2 - The auditor notes that PFAS was recorded in two soil samples within AEC-04 (based on information in the RSI) - but no further testing was completed as part of the 2020 sampling program. Although PFAS is not considered a CoPC in relation to human health in soils, its occurrence should be discussed in this section, as this report forms the basis of the ROA. PFAS in soils, even if at minor concentrations could (as per the NEMP) pose a risk of exposure to groundwater) and should be considered in the ROA as its occurrence supports the proposed capping remedial methodology. Groundwater testing may need to be considered as a line of evidence in relation to the migration of PFAS from this area.	1 - Delineation discussion is focused on specific data gap items which were not addressed by the existing dataset so the addition of historical data here provides little value. Historical results and Supplementary ESA results have been consolidated into the refined CSM. This refined CSM and L-CSM is also re-presented in great detail within the Stage 2 RAP as a consolidated dataset. 2 - Noted. Additional text to be incorporated into document as follows: *"PFAS (specifically PFOS) has been detected in soil and soil leachate (ASLP) samples above the laboratory Limit of reporting at two locations within the northern portion of AEC-4. Although not considered a risk to on-site human health receptors, PFAS in soils in low concentrations may contribute to groundwater impacts and future offsite groundwater migration which may pose a risk to offsite ecological receptors."* While no further PFAS characterisation was undertaken as part of this works, PFAS has been identified as a COPC requiring management and will be incorporated into the revised groundwater monitoring program for AEC-4. The ROA and RAP document have been updated accordingly with respect to benefits of in-situ management approach for PFAS in soils.	1 - CSM and LCSM accepted as base of historical results. 2 - Comment closed.
16	8.3	It was stated that anthracene, BaP and phenanthrene were detected in groundwater samples above ecological criteria. This source should be presented, as tables presented in Appendix B do not highlight any exceedances for these CoPCs.	No changes considered necessary: - anthracene, BaP and phenanthrene detections were identified as part of the supplementary ESA. These exceedances are highlighted in Section 7.3. - These exceedances are shown in Table 9.	Noted.
17	9.1	Pooling of ground gases - Please see comments presented in the executive summary item.	Noted. See previous response to comment regarding ground gases specific to the AEC-4 area	Comment closed. The auditor notes that ground gases monitoring is included in the LTEMP.

Client: Viva Energy
GHD project: 2127799
Site: WARP - Stage 2
Report: **Remediation Options Analysis – "AEC – 4"**

Item	Report Section	Auditor Comments (version dated 06/11/2020)	ERM responses	Auditor Comments (version dated 08/06/2021)
1	Front page	This date should be updated, as the Supplementary report that forms basis of the ROA was issued in March 2021.	Date of Finalised ROA will be updated in line with issue date.	Comment closed.
2	1.2	Page 2 of the PDF is blank	Noted. To be amended for final version	Comment closed.
3	1.1 and 1.3	Please note that the Supplementary report for AEC4 was issued in 2021 not in 2020 as mentioned in both sections.	Noted. Reference to the report will be updated as required, noting that fieldworks were undertaken in 2020	Comment closed.
4	Table 3-1	1 - It would be beneficial to add "AEC-04" in the Legal Description to avoid misinterpretation between AEC-04 and WARP. 2 - The previous uses for AEC-04 (a summary is sufficient) and when AEC-04 was vacated should be presented. 3 - Area 1: There is no legend for number 1.	1 - Updated *"Part Lot 100 in DP 1168951, referred to as "AEC-4", as shown on Figure 1"* 2 - Previous site uses section added to table 3 - deleted footnote reference	Comment closed.
5	4.1	Please refer to the auditor comments presented in the Supplementary report review regarding the following: 1 - The majority of LNAPL was observed in the soil at or below the water table. 2 - Nature and extent of asbestos within AEC-04 other than the figure presented in Appendix A. 3 - PAHs, benzene and hexavalent chromium exceedances and delineation not discussed in the Supplementary report. 4 - Clarify the meaning of gross contamination. 5 - Given the ASS results, an ASSMP will be required as part of the RAP Stage 2 -AEC-04. 6 - PFAS detected in soil samples from AEC-04 should be discussed (see auditor's comments on Supplementary report).	1 - Updated wording as per Supplementary ESA Report; 2 - No changes are required to asbestos characterisation undertaken and discussed in ROA, asbestos investigation was not an objective of supplementary ESA works; 3 - Discussion of these historical exceedances is not required to address specific objectives of the Supplementary ESA. These exceedances and their relevance have been included in a refined Conceptual Site Model (CSM) 4 - Amended to replace 'gross contamination' with 'LNAPL' 5 -As per response for Supplementary ESA, this is dependent on the scope of activities outlined in the RAP, and discussion on requirement for an ASSMP has been provided within the Stage 2 RAP (not required based on shallow disturbance of AEC-4 Area for capping works) 6 - Text relating to management of PFAS contining soils added. *"PFAS (specifically PFOS) has been detected in soil and soil leachate (ASLP) samples above the laboratory Limit of reporting at two locations within the northern portion of AEC-4. Although not considered a risk to on-site human health receptors in soils, or a current offsite risk based on historical groundwater results, PFAS in soils may provide future contribution to groundwater impacts which may pose a risk to offsite ecological receptors. As such, PFAS is considered a COPC for AEC-4 requiring management (via ongoing groundwater monitoring)."*	Comments closed.
6	4.2	1 - The Supplementary Report was issued in 2021, not in 2020. 2 - Clarify if groundwater results discussed in this section considered results from 2020 not yet reviewed by the auditor or all information was presented in the Supplementary report. 3 - A figure showing LNAPL in groundwater and soil (by depth, as was presented in the RSI) should be presented.	1 - Noted and amended 2 - This section considered groundwater results from the Supplementary Report as the Q4 (2020) GME results were not reported at the time of ROA preparation. However given the consistency in conclusions, reference to Q4 results will be added to the final version 3 - figures by 1m depth increments to be prepared and provided	Comments closed.
7	5	Please refer to the comments presented in the Supplementary report regarding Viva Energy health and safety protocol for IMW, future LTEMP, and if based on the LNAPL, CSM pooling of ground gases - if it is demonstrated to be an issue that needs to be managed.	Noted - CSM and nature and extent sections updated as required throughout	Comment closed.
8	General	PFAS in soils may need to be acknowledged as a CoPC that needs to be managed for AEC-04.	Noted, additional text added to this section regarding potential for PFAS impacts in soils providing potential for groundwater impact which requires monitoring and management	Comment closed.

Client: Viva Energy
Project: WARP Clyde Stage 2
Report: Proposed Lot 64 – Long Term Environmental Management Plan

Item	Location in Document	Auditor's comment of LTEMP version 21/03/2024	Consultant Responses	Auditor's comment of LTEMP version 26/04/2024	Consultant Response
1	General	-	-	Contents - There is a bookmark error in section 1.4.	Amended
2	Glossary	In the Glossary of terms, the Site was defined as the as the Viva Energy owned land including Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is currently vacant or leased to third parties. However, throughout the report, ERM refers to the AEC-4 area, proposed Lot 64 and the Stage 2 area as "the Site". There needs to be clarity throughout the LTEMP regarding the Site definition.	Definitions will be clarified in the Glossary and throughout the LTEMP as per the following: The Site: Viva Energy owned land on the Camellia Peninsula consisting of the following Lots: Lot 398 DP41324, Lots 100 and 101 of DP 1168951, Lot 101 DP809340, Lot 2 DP 224288, and Lot 1 DP 383675. It includes the Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is currently vacant or leased to third parties The Stage 2 Area: An area situated within the eastern portion of the former Process West area adjoining the current Clyde Terminal. The Stage 2 Area extends from Devon Street to the North to the Duck River at the southern boundary of the Western Area. The LTEMP applies to part of the Stage 2 Area. The Management Area: Has been removed from the glossary of terms and is referred to as Lot 64 throughout the LTEMP. AEC-4: The Southern Buried Waste Area which is located within proposed Lot 64 of the 'Stage 2' portion of the Clyde Western Area Remediation Project (WARP).	Comment closed.	Coment closed.
3	Executive Summary	In the Background Information, ERM states the following: • Ongoing management of residual contamination is required within the constructed capped area, as well as in areas outside the cap within Lot 64. The auditor notes that without a figure showing the LTEMP applicability area, it was not possible to determine which "other areas outside the cap" ERM is referring to.	Figure 1 of the LTEMP revised to show: - The capped extent within the Management Area - Areas outside of the Capped Extent that are subject to ongoing environmental management under the LTEMP (i.e. The Management Area)	1 - The proposed Lot 64 area shown in Figure F1 and Figure F2 are different. In Figure F1, it appears that the onsite cell comprises the entire proposed Lot 64, while in Figure F2, it seems that Lot 64 includes an additional parcel of land to the north of the cell. 2 - In Figure F1, information presented in the legend but not shown in the figure needs to be deleted. 3 - Does Lot 64 included part of the riparian area as shown in Figure F4?	The boundary of proposed Lot 64 presented in Figure 1 and Figure 2 in Revision 3 of the LTEMP have been amended for consistency. Proposed Lot 64 includes a parcel of land to the north of the capped extent, as well as the riparian corridor to the south.
4		• The controls outlined in the LTEMP are passive mitigation measures designed to manage potential risks to human health and/or ecological receptors. Given the available data and the proposed land use for Lot 64, the auditor understands that there are no potential ecological risks for receptors either on or off-site. To which mitigation measures for potential risks to ecological receptors is ERM referring?	ERM acknowledges the capping within the Management Area will mitigate risks to ecological receptors off-site and this section has been revised accordingly.	1 - Clarification of the response provided by ERM in the auditor tracking sheet: The auditor understands that based on the available dataset, there are no potential risks to both on and off-site ecological receptors. Therefore, it is not clear to which ecological risk mitigation ERM is referring. 2 - Comment closed.	ERM acknowledges that upon completion of remediation within proposed Lot 64, no risks to on-site and off-site ecological receptors exist. References to "potential risks" to on-site and off-site ecological receptors have been removed from the LTEMP.
5		In the Required Environmental Management Controls, the inclusion of gas monitoring is necessary.	A Ground Gas Monitoring Plan has been developed. The GMP forms part of this LTEMP and is provided in Appendix F.	This is discussed further in item 14.	
6	Table 1-1	The table needs to clarify whether Part Lot 1 in DP 1271927 comprises only the cap within Lot 64 or all areas that are subject to this LTEMP (i.e. the proposed Lot 64).	The table has been updated - the LTEMP applies to the Management Area, located within Part Lot 1 in DP 1271927.	Comment closed	
7	1.2	The detail for ongoing gas monitoring needs to be listed in the purpose of the LTEMP.	Further detail of ongoing gas monitoring requirements are provided in the GGMP.	Comment closed	
8	3.2	ERM documented that ongoing management of residual contamination is required within the constructed capped area, as well as in areas outside the cap within Lot 64. The auditor notes that without a figure showing the area that is applicable for the LTEMP, it is not possible to determine to which "other areas outside the cap" ERM is referring.	Figure 1 of the LTEMP revised to show: - The capped extent within the Management Area - Areas outside of the Capped Extent that are subject to ongoing environmental management under the LTEMP (i.e. The Management Area)	As per item 3.	Proposed Lot 64 includes the riparian corridor to the south.
9	Table 4-1	The auditor notes that Figure 2, showing the areas of residual contamination, was not included in the draft of the LTEMP. This figure will need to be included in the amended version of the LTEMP. Regarding remaining soil contamination, the LTEMP needs to clarify why TRH management limits exceedances were not considered. In remaining groundwater contamination (based on the Q4 2023 GME data), the following needs to be reviewed or information provided: • A discussion on mass flux and potential off-site exceedances. • Maximum benzene exceedance is 3 ug/L. To which exceedance is ERM referring? • LNAPL occurrence should be delineated and limited to the on-site area.	Per ASC NEPM Schedule B1, management limits are adopted for mitigation of aesthetics and damage to buried infrastructure. Exceedance of management limits do not represent a human health risk, however has been included as a consideration of aesthetics i.e. potential staining and odour as per the NEPM. ERM will revise the LTEMP to state that TRH exceedances of management limits at MW12/20 and TP19/75 are included for aesthetic considerations. Further, risk buried infrastructure is considered to be low as the locations are within the riparian corridor, and access to these impacted soils is limited due to the depths of the exceedance ranging from 1.5 to 2.0 m bgl. Discussion on mass flux potential, off-site exceedances and LNAPL delineation also included in Section 4.2 of the LTEMP.	General - LNAPL in groundwater and "LNAPL" in soils needs to be better identified/discussed in the LTEMP. Please confirm the observation that "LNAPL" in soils and asbestos between the security roads and Duck River. If it was observed, additional wording is required to support that this "LNAPL" in soils is immobile etc (perhaps the LNAPL CSM can assist in this matter). 1 - Groundwater data from the most recent sampling event (November 2023) are not included in Appendix C. 2 - A figure showing groundwater data from November 2023 needs to be presented. 3 - Residual contamination present in groundwater (Table 4-1) - Please note that benzene at 3 ug/L detected in November 2023 at MW20-3 is below recreational criterion (10 ug/L). 4 - The statement that "contaminated soil exceeding commercial vapour intrusion criteria is presented in several locations" needs to be reviewed as this only occurred at three locations. Please confirm these exceedances do not pose potential human health or ecological risks as the area is open and there has been subsequent vapour intrusion assessment. 5 - Similar discussion to the one above was presented for BaP and needs to be reviewed. 6 - The information presented in Table 4-1 differs from the Q4 2023 GME, where ERM documented that LNAPL was found at MW12/01, MW20/07, and MW20/13. 7 - PAHs exceeding ecological criteria - This statement needs to be reviewed as Q4 2023 GME results were all below the adopted ILs. 8 - Toluene - the following statement should be deleted: "Groundwater exceedances of off-site ecological identified for benzene". The auditor notes that neither benzene nor toluene exceeded ecological criteria in Q4 2023 GME.	General - ERM confirms that residual LNAPL and asbestos has been previously identified in the security road area (As per the LNAPL CSM of the Stage 2 WARP RAP) and Table 4-1 has been updated accordingly. 1 - The residual groundwater contamination table has been updated to reflect current groundwater conditions (i.e. Q4 2023 GME results) 2 - Figure 5 has been included which presents groundwater results from the Q4 2023 GME. 3 to 8 - statements revised across Table 4-1 based on Auditor comments.
10	Table 4-2	Commentary on PFAS needs to be included in this table, given there was discussion on PFAS iin the Q4 2023 GME report. Table 4-2 indicates that LNAPL was identified in MW20/13. However, the figures in the Q4 2023 GME report (November 2023 data) do not record LNAPL at this location. The occurrence of LNAPL should be confirmed and/or the report ERM used to prepare this table should be specified.	LNAPL has previously been identified in monitoring well MW20/13 in historical monitoring data (2012-2022), however not encountered during the Q4 2023 GME. ERM has clarified this within Table 4-2.	The information presented in the LTEMP (both Tables 4-1 and 4-2) should be consistent with the Q4 2023 GME. In relation to the CSM, it is considered most relevant to use the most recent data, but acknowledge previous data.	The information presented in Table 4-1 has been updated to acknowledge historical data, but reflect conditions observed during the Q4 2023 GME. Table 4-2 has been updated to reflect groundwater conditions observed in the Q4 2023 GME.
11	Table 5-1	The information presented in this table outlining potential risks associated with the capped area may be misleading. The LTEMP should reflect the conditions of Lot 64 after the cap has been installed – in this regard capping of the impacted soil is the remedial approach to mitigate potential risks. ERM has inferred however that the capped area, which will be remediated to avoid risks, poses potential human and ecological risks. As the WARP is situated in a heavily industrial/commercial area, it is not clear to which ecological receptors ERM is referring in Table 5-1. If ERM decides to maintain Table 5-1, the exposure pathways need to be reviewed. For example: • Human exposure pathways: ▯ Soil – Benzene indoor inhalation by commercial workers. This LTEMP states that no building is to be constructed within the proposed Lot 64. It is therefore not clear how there is an the SPR linkage for indoor inhalation. ▯ Groundwater – Benzene direct contact by off-site recreational receptors of Duck River. The auditor notes that the maximum benzene concentration (3 ug/L) detected in November 2023 (Q4 2023 GME) was at MW20/03 which is below the recreational criterion (which is not considered to be a realistic activity in the Duck River). Moreover, all other 13 samples collected between the AEC-4 and the Duck River were below the Limit of Reporting (LOR). In this regard, to which benzene recreational exceedance is ERM referring to? • Environmental pathways: ▯ Surface and sediment run-off to the adjacent stormwater. The design of the cell includes a drainage system around the cell to mitigate these pathways – which would only discharge dust that may accumulate on the capped surface, but not from the material that has been capped. To allow surface and design run-off to migrate to the adjacent stormwater drainage, the capping layer would need to be severally damaged.	Table 5-1 revised to elaborate on the risks following remediation of the Lot 64, making reference to: - Reference to indoor inhalation is removed as no buildings will be present within the capped area of Lot 64 - Title revised to "Potential risk of unauthorised excavation within the capped area" - Table clarified highlight that pathways only applicable if capping layer is penetrated/damaged. - References to exceedance of recreational criteria due to concentrations of benzene have been removed.	Comment closed, but check consistency with other comments on comparison of data to nominated criteria.	Coment closed.
12	Table 5-2	For clarity, it may be worth including in the table title "...are undertaken outside the capping area". Is there any sludge identified within the proposed Lot 64 that will not be capped? It is not clear why there was a reference to sludge. Comments on Table 5-1 regarding exposure pathways are valid for Table 5-2.	Title of Table 5-2 has been updated to "Potential Risks of Penetration Within the Capped Area" As per the Validation Report (ERM, 2022) LNAPL and "sludge materials" were identified at variable depths and locations throughout the fill materials within the Management Area. Reference was made to the "sludge materials" as a potential source of residual contamination for completeness.	Comment closed, but check consistency with other comments on comparison of data to nominated criteria.	Coment closed.
13	Table 6-1	Considering the information presented in Table 5-2, should the odour management during maintenance and occasional construction works be applied to all of Lot 64, and not only to the capped extent of Lot 64?	Clarification has been made to specify that odour management during maintenance and/or construction work are to be applied to the Management Area portion of Proposed Lot 64.	Comments closed.	Coment closed.
14	Table 6-2	Post-Construction Gas Monitoring Events – As per the Auditor Guidelines (NSW EPA, 2017) and the EMP Practice Note (NSW EPA, 2022), details regarding sampling location, frequency, parameters, and method need to be included in the LTEMP. We note that for the groundwater, all these requirements are presented in the GWMP; therefore, a reference to this document would be sufficient.	A Ground Gas Monitoring Program has been developed for post-construction gas monitoring events. Refer to Appendix F.	1 - Page 3 is blank. 2 - It would be beneficial to have the monitoring frequency included in Section 1. 3 - How will the GGMP provide data to achieve the following objective: "provide monitoring that will generate data for the assessment of the effectiveness of cap construction and the assumption of no additional ongoing gas accumulation potential"? The auditor understands that there is no "ongoing additional gas accumulation" within the proposed cap area. 4 - Table 2-1 - Could ERM please confirm whether the potential risks for commercial workers derived from LNAPL and Benzene and TRH F1 in the outdoor area are applicable (in case the cap is damaged, as referred to in the table)?	1 - Blank page removed. 2- Monitoring frequency ERM has amended this objective within the GGMP. The objective of the GGMP is to verify assumption that there is no additional ongoing gas accumulation potential within enclosed spaces within the capped extent.
15	Table 7-1	Should asbestos outside the capping area be considered an unexpected find, considering that ERM identified and discussed its presence as a potential risk for intrusive workers outside the capping area in Table 5-2? The mitigation actions required if methane measurements exceed 1% v/v need to be included in the LTEMP. Simply referring to a guideline is not sufficient, as the LTEMP (as per the NSW EPA Auditor Guidelines should be a self-contained document which requires little or no direct reference by the reader to other material or documents to support the audit findings or the conclusions contained in the site audit statement.	The mitigation actions in the event that methane measurements exceed 1% v/v are described in the Ground Gas Monitoring Plan provided in Appendix F.	Comment closed.	Coment closed.
16	General	A statement specifying that adherence to this LTEMP is required to ensure the site's suitability for commercial/industrial land uses, without the construction of above-ground buildings or the extraction of groundwater, needs to be included.	Statement has been added to the Executive Summary, under 'Required Environmental Management Controls'.	This statement needs to be included in other relevant sections of the report in addition to the executive summary.	Statement included in Section 6 of the LTEMP.

Client Viva Energy
Consultant ERM
Report Lot 64 Validation Report: Clyde Western Area Remediation project

Item	Report Section	Auditor comments (report dated 26 march 2024)	ERM responses (updated report dated 15/5/2024	Auditor comments (report dated 16/05/2024)	Auditor comments based on the new information presented in the report dated 12/06/2024
1	General	1 - The remediation works are to be completed within AEC-4, not within the proposed Lot 64. Please consider renaming the report to 'AEC-4 Validation Report or Stage 2 Audit Area 4', as it has been adopted in previous validation reports. 2 - Please consider adopting the proposed Lot 64.	1 - Report has been renamed 'AEC-4 Validation Report'. References to remediation of Lot 64 have been updated throughout to AEC-4 as this is the name of the extent to be remediated 2 - 'proposed Lot 64' has been adopted throughout when referring to the extent of the complete Lot	1 and 2 - Satisfactory addressed.	Closed.
2	Executive summary	1 - ERM referred to the design consultant drawings; however, no mention of the Stage 2 RAP and the Technical Specification report was presented. 2 - ERM stated that the remedial works were undertaken with the objective of managing contamination in soils and groundwater. However, it should be noted that groundwater does not require remediation. Please ensure that this matter is clarified throughout the report.	1 - Reference to RAP and Tech Spec added to exec summary as requested 2 - Clarified throughout report	1 and 2 - Satisfactory addressed.	Closed.
3	1	1 - ERM referred to SSD No. 10459 regarding Proposed Lot 64. However, there was no mention of SSD 9302 regarding the remediation. 2 - The statement 'along with benefits to the future usability of the Lot 64 area' can be misleading, as AEC-4 will not allow construction of any permanent above-ground or below-ground infrastructure.	1 - New section 2.2 (Planning Context) added to provide additional context on SSDs and relevance to the AEC-4/Lot 64 Areas 2 - this statement has been deleted	1 - Satisfactory addressed. 2 - Noted.	Closed.
4	1.1	The validation report does not demonstrate the efficacy of the capping but rather validates that the remediation was completed in accordance with the Stage 2 RAP and Technical Specification report.	This statement has been removed and objectives updated accordingly	1 - Satisfactory addressed.	Closed.
5	1.2.2	1 - Restrictions for commercial/industrial future uses need to be presented. 2 - The data monitored during remediation to comply with the SSD 9302 Consent Conditions needs to be stated. 3 - Groundwater monitoring post-work completion will not be presented in this report. Please remove the last bullet point on page 3.	1- Additional detail on land-use restrictions has been added thoughout revised report. (8.3 refined CSM, 8.4 LTEMP requirements, 9 Conclusions) 2 - Statement regarding presentation of monitoring data to comply with SSD-9302 during the remediation of AEC-4 Lot 64 has been removed from objectives. No VOC/ odour monitoring requirement as per AEVR, no GW monitoring during works as per GWMP was previously agreed due to the shallow nature of capping works in the Area. Asbestos air monitoring is a separate legal requirement 3 - Dot point removed as requested	1 - Satisfactory addressed. 2 - The information presented here regarding the REMPs and requirements of SSD 9302 needs to be captured in the report with supporting rationale and reference were discussion where previous agreed. 3 - Satisfactory amended.	Closed.
6	1.3	1 - In Step 1, ERM stated, 'Previous investigations in AEC-4 have identified soil and groundwater contamination exceeding risk-based Site Specific Target Levels (SSTLs)'. Please review this statement, as groundwater results did not exceed SSTLs and, ensure that this matter is clarified throughout the report. 2 - Please avoid duplicating information. Part of the information presented in Step was copied from Section 1.2.1. 3 - In Step 2, ERM referred to the Stage 2 RAP but not to the Technical Specification report, where essential validation information was documented. 4 - ERM stated that the capping was undertaken within proposed Lot 64. However, Lot 64 comprises more than just AEC-4. The auditor notes that this matter needs to be addressed throughout the report.	1 - Statement in Step 1 of DQOs updated to remove reference to SSTL exceedances in groundwater 2 - reference back to objectives section added 3 - Reference to both documents now added to this section in revised report 4 - Report has been updated throughout - AEC-4 is the remediation area (i.e. capping area) situated within Lot 64. Aspects of the Detailed Design and LTEMP cover the entirety of Lot 64	1 to 4 - Satisfactory amended.	Closed.
7	1.6	The soil design sampling guidelines were updated in 2022. Please amend the reference accordingly.	Reference amended as requested	Satisfactory amended.	Closed.
8	Table 2-1	The current zoning was updated in 2024. Please review accordingly.	LEP reference and permissable land-uses updated	Satisfactory amended.	Closed.
9	Table 3-1	1 - The information dataset presented is too vague. For example, what did the soil investigations comprise? What did the ground gases investigation comprise?" 2 - A summary of key findings needs to be included in Table 3-1.	Relevant Historical Investigations section, nature and extent and prelim CSM updated to provide additional information. ERM notes that many of the historical investigations have been completed as site-wide assessments and the relevant investigation locations to AEC and Lot 64 have now been specifically identified	Satisfactory amended.	Closed.

Appendix C

Tables

Appendix C-1 Tables from the AEC-4 Supplementary Assessment

				Groundwater Montioring Well Installation						Hydaulic Data					
Location ID	**Location Type**	**Site Location**	**Rationale**	**Proposed Drilling Depth (m BGL)**	**Drilling Depth Comments**	**Drilling Method**	**Proposed Well Screen Interval (m BGML)**	**Well Surface Completion**	**Well Development**	**Slug Test**	**Static Logger (Tidal Influence)**	**Survey**	**Groundwater Gauging**	**Groundwater Sampling**	**Notes**
MW20/01A	New Monitoring Well (shallow)	Transect 1 - upgradient	Upgradient groundwater characterisation (shallow)	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Flush	1	1	-	1	1	1	-
MW20/01B	New Monitoring Well (deep)	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	10	To depth of rock	Direct Push/ Solid Flight Auger	7 - 10m	Flush	1	1	-	1	1	1	-
MW20/02A	New Monitoring Well (shallow)	Transect 1 - upgradient	Upgradient groundwater characterisation (shallow)	2	-	Direct Push/ Solid Flight Auger	2 - 5m	Flush	1	1	1	1	1	1	Confirm no tidal influence on groundwater
MW20/02B	New Monitoring Well (deep)	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	10	To depth of rock	Direct Push/ Solid Flight Auger	7 - 10m	Flush	1	1	-	1	1	1	-
MW20/03	New Monitoring Well (shallow)	Transect 2 - Source Area (north)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/04	New Monitoring Well (shallow)	Transect 3 - Source Area (south)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/05	New Monitoring Well (shallow)	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	1	1	1	1	Confirm no tidal influence on groundwater
MW20/06	New Monitoring Well (shallow)	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/07	New Monitoring Well (shallow)	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/08	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	1	1	1	1	Confirm no tidal influence on groundwater
MW20/09	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/10	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/11	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/12	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/13	New Monitoring Well (shallow)	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in northern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/14	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	1	1	1	1	Confirm no tidal influence on groundwater
MW20/15	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/16	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/17	New Monitoring Well (shallow)	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	1	1	1	1	Confirm no tidal influence on groundwater
MW20/18	New Monitoring Well (shallow)	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in northern portion of source area	5	To natural soils underlying fill	Direct Push/ Solid Flight Auger	2 - 5m	Monument	1	1	-	1	1	1	-
MW20/19	New Monitoring Well (shallow)	Transect 1 - upgradient	Upgradient groundwater characterisation	5	-	Direct Push/ Solid Flight Auger	2 - 5m	Flush	1	1	-	1	1	1	-
BH341	Existing Monitoring Well (Shallow)	Transect 1 - upgradient	Upgradient groundwater characterisation	-	-	-	-	-	1	1	-	1	1	1	Redevelop 'BH series' wells as these have silted up due to infrequent sampling since install in 2010
BH210	Existing Monitoring Well (Shallow)	Transect 1 - upgradient	Upgradient groundwater characterisation	-	-	-	-	-	1	1	-	1	1	1	Redevelop 'BH series' wells as these have silted up due to infrequent sampling since install in 2010
MW12/01	Existing Monitoring Well (Shallow)	Transect 2 - Source Area (north)	Investigate the nature and extent of groundwater impacts associated with buried waste	-	-	-	-	-	-	-	-	-	1	-	Well has had LNAPL present since 2012. no slug testing or sampling proposed
MW12/20	Existing Monitoring Well (Shallow)	Transect 4 - Downgradient Boundary	Investigate the nature and extent of groundwater impacts associated with buried waste	-	-	-	-	-	-	-	-	-	1	1	Slug Testing previously conducted in 2019
BH116	Existing Monitoring Well (Shallow)	Transect 3 - Source Area (south)	Investigate the nature and extent of groundwater impacts associated with buried waste	-	-	-	-	-	1	1	-	1	1	1	Redevelop 'BH series' wells as these have silted up due to infrequent sampling since install in 2010
MW94/6	Existing Monitoring Well (Shallow)	Transect 4 - Downgradient Boundary	Investigate the nature and extent of groundwater impacts associated with buried waste	-	-	-	-	-	-	1	-	1	1	1	-
			SUM TOTAL	102	-	**-**	**-**	**-**	**24**	**25**	**5**	**25**	**27**	**26**	

Location ID	Location Type	Area ID	Site Location	Rationale	Lab Analysis (Soils)									
					TRH, BTEXN	TRH Silica Gel Clean-up	Hexavalent Chromium	PAH	Asbestos Quantification (%w/w)	Asbestos (presence/absence)	ASS/PASS Screen (pH Ox, pH fox)	ASS / PASS (CRS Suite)	QAQC - Trip Spike/ Blank TRH C6-C10, BTEXN	Notes
MW20/01A	Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation (shallow)	-	-	-	-	-	-	1	1	-	ASS/PASS sampling of natural soil
MW20/01B	Monitoring Well	4	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	-	-	-	-	-	-	1	1	-	ASS/PASS sampling of natural soil at depth
MW20/02A	Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation (shallow)	-	-	-	-	-	-	1	1	-	ASS/PASS sampling of natural soil
MW20/02B	Monitoring Well	4	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	-	-	-	-	-	-	1	1	-	ASS/PASS sampling of natural soil at depth
MW20/03	Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	2	2	2	2	-	-	-	-	1	Sample of fill and underlying natural soils
MW20/04	Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	2	2	2	2	-	-	-	-	1	Sample of fill and underlying natural soils
MW20/05	Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	-	-	-	-	Sample of underlying natural soils to achieve vertical delineation
MW20/06	Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	-	-	-	-	Sample of underlying natural soils to achieve vertical delineation
MW20/07	Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	-	1	1	-	Sample of underlying natural soils to achieve vertical delineation
MW20/08	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/09	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/10	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	1	1	-	ASS/PASS sampling of natural soil
MW20/11	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/12	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/13	Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in northern portion of source area	1	1	1	1	-	-	1	1	-	Sample of underlying natural soils to achieve vertical delineation. ASS/PASS sampling of natural soil
MW20/14	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/15	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/16	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/17	Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	-	-	-	-	-	-	-	-	-	
MW20/18	Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in northern portion of source area										
MW20/19	Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	-	-	-	-	-	-	-	-	-	-

Total Primary Samples	**8**	**8**	**8**	**8**	**0**	**0**	**7**	**7**	**2**
QAQC - Field Duplicates (10%)	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**
QAQC - Interlab Duplicates (5%)	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**

Location ID	Location Type	Area ID	Site Location	Rationale	Lab Analysis - Water					
					TRH, BTEXN	TRH Silica Gel Clean-up	Hexavalent Chromium (ultra trace)	PAHs	QAQC - Trip Spike/ Blank TRH C6-C10, BTEXN	Notes
MW20/01A	New Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	1	1	1	1	-	
MW20/01B	New Monitoring Well (deep)	4	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	1	1	1	1	-	
MW20/02A	New Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	1	1	1	1	-	
MW20/02B	New Monitoring Well (deep)	4	Transect 1 - upgradient	Upgradient groundwater characterisation (deep). Establish depth to bedrock and hydraulic conductivity data to support to support future decisions regarding upgradient cutoff wall	1	1	1	1	-	
MW20/03	New Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	1	1	1	1	1	
MW20/04	New Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical and lateral delineation of buried waste impact, groundwater characterisation in northern portion of source area	1	1	1	1	1	
MW20/05	New Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	
MW20/06	New Monitoring Well (shallow)	4	Transect 3 - Source Area (south)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	
MW20/07	New Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in southern portion of source area	1	1	1	1	-	
MW20/08	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/09	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/10	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/11	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/12	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/13	New Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Vertical delineation of buried waste impact, groundwater characterisation in northern portion of source area	1	1	1	1	-	
MW20/14	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/15	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/16	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/17	New Monitoring Well (shallow)	4	Transect 4 - Downgradient Boundary	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/18	New Monitoring Well (shallow)	4	Transect 2 - Source Area (north)	Downgradient boundary groundwater delineation, increase downgradient monitoring coverage	1	1	1	1	-	
MW20/19	New Monitoring Well (shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	1	1	1	1	-	
BH341	Existing Monitoring Well (Shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	1	1	1	1	-	
BH210	Existing Monitoring Well (Shallow)	4	Transect 1 - upgradient	Upgradient groundwater characterisation	1	1	1	1	1	
MW12/01	Existing Monitoring Well (Shallow)	4	Transect 2 - Source Area (north)	Investigate the nature and extent of groundwater impacts associated with buried waste	-	-	-	-	-	Gauge only - LNAPL present
MW12/20	Existing Monitoring Well (Shallow)	4	Transect 4 - Downgradient Boundary	Investigate the nature and extent of groundwater impacts associated with buried waste	1	1	1	1	-	
BH116	Existing Monitoring Well (Shallow)	4	Transect 3 - Source Area (south)	Investigate the nature and extent of groundwater impacts associated with buried waste	1	1	1	1	-	
MW94/6	Existing Monitoring Well (Shallow)	4	Transect 4 - Downgradient Boundary	Investigate the nature and extent of groundwater impacts associated with buried waste	1	1	1	1	-	
				Total Primary Samples	**26**	**26**	**26**	**26**	**3**	
				QAQC - Field Duplicates (10%)	**3**	**3**	**3**	**3**	-	
				QAQC - Interlab Duplicates (5%)	**2**	**2**	**2**	**2**	-	

ERM

Well ID	Gauging Date	Monitoring round	TOC Elevation (mAHD)	Total Measured Depth (mbTOC)	Depth to LNAPL (mbTOC)	Depth to Water (mbTOC)	LNAPL Thickness (m)	Corrected Depth to Water (mbTOC)	Corrected Water Elevation (mAHD)	Well Condition/Comments
BH116	21/07/2020	GME	4.391	3.995	-	1.636	-	1.636	2.755	
BH116	28/07/2020	Slug Test (pre)	4.391	3.995	-	1.217	-	1.217	3.174	
BH116	14/08/2020	Slug Test (post)	4.391	3.995	-	1.397	-	1.397	2.994	
BH210	20/07/2020	GME	3.758	6.910	-	1.049	-	1.049	2.709	
BH210	28/07/2020	Slug Test (pre)	3.758	6.910	-	0.954	-	0.954	2.804	
BH210	14/08/2020	Slug Test (post)	3.758	6.910	-	1.9	-	1.9	1.858	
MW12/20	21/07/2020	GME	2.94	3.670	-	1.683	-	1.683	1.257	
MW12/01	20/07/2020	GME	6.04	-	2.048	-	-	-	-	LNAPL Present - depth to water unable to be determined due to NAPL vicosity
MW20/01A	20/07/2020	GME	4.537	4.900	-	1.761	-	1.761	2.776	
MW20/01A	28/07/2020	Slug Test (pre)	4.412	4.900	-	1.572	-	1.572	2.84	
MW20/01A	14/08/2020	Slug Test (post)	4.412	4.900	-	1.63	-	1.63	2.782	
MW20/01B	20/07/2020	GME	4.54	9.973	-	1.684	-	1.684	2.856	
MW20/01B	28/07/2020	Slug Test (pre)	4.472	9.973	-	1.59	-	1.59	2.882	
MW20/01B	14/08/2020	Slug Test (post)	4.472	9.973	-	1.583	-	1.583	2.889	
MW20/02A	20/07/2020	GME	4.018	4.891	-	1.196	-	1.196	2.822	
MW20/02A	28/07/2020	Slug Test (post)	4.018	4.891	-	1.124	-	1.124	2.894	
MW20/02A	14/08/2020	Slug Test (post)	4.018	4.891	-	1.139	-	1.139	2.879	
MW20/02B	20/07/2020	GME	3.979	7.881	-	1.095	-	1.095	2.884	
MW20/02B	28/07/2020	Slug Test (pre)	3.979	7.881	-	0.98	-	0.98	2.999	
MW20/02B	14/08/2020	Slug Test (post)	3.979	7.881	-	0.963	-	0.963	3.016	
MW20/03	21/07/2020	GME	5.93	5.861	-	3.201	-	3.201	2.729	
MW20/03	28/07/2020	Slug Test (pre)	5.93	5.861	-	3.001	-	3.001	2.929	
MW20/03	14/08/2020	Slug Test (post)	5.93	5.861	-	3.158	-	3.158	2.772	
MW20/04	21/07/2020	GME	6.215	8.981	-	4.962	-	4.962	1.253	
MW20/04	28/07/2020	Slug Test (pre)	6.215	8.981	-	4.614	-	4.614	1.601	
MW20/04	14/08/2020	Slug Test (post)	6.215	8.981	-	4.351	-	4.351	1.864	
MW20/05	21/07/2020	GME	5.382	4.901	-	3.282	-	3.282	2.1	
MW20/05	28/07/2020	Slug Test (pre)	5.382	4.901	-	2.53	-	2.53	2.852	
MW20/05	14/08/2020	Slug Test (post)	5.382	4.901	-	2.237	-	2.237	3.145	
MW20/06	21/07/2020	GME	5.477	5.803	-	3.419	-	3.419	2.058	
MW20/06	28/07/2020	Slug Test (pre)	-	-	-	-	-	-	-	LNAPL present in well, depth not gauged
MW20/06	14/08/2020	Slug Test (post)	5.477	5.803	3.200	4.46	1.260	4.46	1.017	LNAPL present, oil-water interface potentially unreliable due to NAPL viscosity
MW20/07	21/07/2020	GME	5.725	5.843	-	3.57	-	3.57	2.155	
MW20/07	28/07/2020	Slug Test (pre)	5.725	5.843	-	3.57	-	3.57	2.155	
MW20/07	14/08/2020	Slug Test (post)	5.725	5.843	-	3.551	-	3.551	2.174	
MW20/08	20/07/2020	GME	4.876	5.980	-	3.203	-	3.203	1.673	
MW20/08	14/08/2020	Slug Test (post)	4.876	5.980	-	2.759	-	2.759	2.117	
MW20/09	20/07/2020	GME	4.864	5.926	-	4.142	-	4.142	0.722	
MW20/09	28/07/2020	Slug Test (pre)	4.864	5.926	-	3.877	-	3.877	0.987	
MW20/09	14/08/2020	Slug Test (post)	4.864	5.926	-	2.764	-	2.764	2.1	
MW20/10	20/07/2020	GME	4.697	5.941	-	2.592	-	2.592	2.105	
MW20/10	28/07/2020	Slug Test (pre)	4.697	5.941	-	2.443	-	2.443	2.254	
MW20/10	14/08/2020	Slug Test (post)	4.697	5.941	-	2.41	-	2.41	2.287	
MW20/11	20/07/2020	GME	3.949	5.977	-	3.077	-	3.077	0.872	
MW20/11	28/07/2020	Slug Test (pre)	3.949	5.977	-	3.703	-	3.703	0.246	
MW20/11	14/08/2020	Slug Test (post)	3.949	5.977	-	2.881	-	2.881	1.068	
MW20/12	20/07/2020	GME	4.368	5.961	-	3	-	3	1.368	
MW20/12	28/07/2020	Slug Test (pre)	4.368	5.961	-	2.721	-	2.721	1.647	
MW20/12	14/08/2020	Slug Test (post)	4.368	5.961	-	2.789	-	2.789	1.579	
MW20/13	21/07/2020	GME	6.016	5.867	-	2.985	-	2.985	3.031	
MW20/13	28/07/2020	Slug Test (pre)	6.016	5.867	-	2.934	-	2.934	3.082	
MW20/13	14/08/2020	Slug Test (post)	6.016	5.867	-	2.992	-	2.992	3.024	
MW20/14	20/07/2020	GME	4.81	5.912	-	2.712	-	2.712	2.098	
MW20/14	28/07/2020	Slug Test (pre)	4.81	5.912	-	1.611	-	1.611	3.199	
MW20/14	14/08/2020	Slug Test (post)	4.81	5.912	-	1.955	-	1.955	2.855	
MW20/15	20/07/2020	GME	4.825	6.032	-	4.185	-	4.185	0.64	
MW20/15	28/07/2020	Slug Test (pre)	4.825	6.032	-	3.789	-	3.789	1.036	
MW20/15	14/08/2020	Slug Test (post)	4.825	6.032	-	3.266	-	3.266	1.559	
MW20/16	20/07/2020	GME	3.482	5.955	-	3.484	-	3.484	-0.002	
MW20/16	28/07/2020	Slug Test (pre)	3.482	5.955	-	2.893	-	2.893	0.589	
MW20/16	14/08/2020	Slug Test (post)	3.482	5.955	-	2.215	-	2.215	1.267	
MW20/17	20/07/2020	GME	4.051	5.875	-	3.193	-	3.193	0.858	
MW20/17	28/07/2020	Slug Test (pre)	4.051	5.875	-	2.909	-	2.909	1.142	
MW20/17	14/08/2020	Slug Test (post)	4.051	5.875	-	2.982	-	2.982	1.069	
MW20/18	21/07/2020	GME	3.629	5.996	-	2.706	-	2.706	0.923	
MW20/18	28/07/2020	Slug Test (pre)	3.629	5.996	-	2.342	-	2.342	1.287	
MW20/18	14/08/2020	Slug Test (post)	3.629	5.996	-	2.576	-	2.576	1.053	
MW20/19	20/07/2020	GME	3.315	4.978	-	1.902	-	1.902	1.413	
MW20/19	28/07/2020	Slug Test (pre)	3.315	4.978	-	0.09	-	0.09	3.225	
MW20/19	14/08/2020	Slug Test (post)	3.315	4.978	-	0.566	-	0.566	2.749	
MW20/20	20/07/2020	GME	4.077	5.954	-	-	-	-	-	Dry or sitting on hydrosleeve at 5.212m
MW20/20	28/07/2020	Slug Test (pre)	4.077	5.954	-	2.755	-	2.755	1.322	
MW20/20	14/08/2020	Slug Test (post)	4.077	5.954	-	2.246	-	2.246	1.831	
MW94/6	20/07/2020	GME	3.669	5.070	-	3.828	-	3.828	-0.159	
MW94/6	28/07/2020	Slug Test (pre)	3.669	5.070	-	2.787	-	2.787	0.882	
MW94/6	14/08/2020	Slug Test (post)	3.669	5.070	-	2.983	-	2.983	0.686	

Notes:
TOC=Top of Casing
BTOC=Below Top of Casing
mDatum=Site Height Datum
m=Meters
NA - Not Available

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Well ID	Sample Date	Purge Volume (L)	TEMP (°C)	pH	EC (µScm-¹)	DO (mg/L)	Eh (mV)	Comments
BH210	20/07/2020	-	21.1	5.19	11,457	1	102.3	Turbid, orange, no odour
MW20/01A	20/07/2020	-	22.5	6.38	19,422	0.52	-10.9	Brown, muddy, no odour
MW20/01B	20/07/2020	-	22.5	7.26	7779	0.09	-84.6	Slightly turbid, muddy at bottom, no odour
MW20/02A	20/07/2020	-	22.2	5.51	15,104	3.58	73.7	Slightly turbid, no odour, turned blue in NaOH preserved bottle
MW20/02B	20/07/2020	-	22.2	5.98	26,250	0.65	-13.4	Turbid, cloudy, red-brown
MW20/03	21/07/2020	-	17.7	7.06	12,089	0.58	-89	Bailer used due to little water in hydrosleeve. Clear, slighty turbid, slight hydrocarbon odour, sheen
MW20/04	21/07/2020	-	19	6.3	10,580	1.08	50.4	Bailer used due to little water in hydrosleeve. Clear, no odour
MW20/05	21/07/2020	-	22.8	7.09	24,984	0.65	-58.1	Bailer used due to little water in hydrosleeve. Clear, turned blue in NaOH preserved bottle
MW20/06	21/07/2020	-	22.2	7.74	4880	0.53	-115.4	Bailer used due to little water in hydrosleeve. Light brown, strong hydrocarbon odour, sheen, small black globules of LNAPL
MW20/07	21/07/2020	-	22.6	7.66	2694	1.19	7.9	Bailer used due to little water in hydrosleeve. Slightly turbid, light brown, strong hydrocarbon odour, LNAPL present
MW20/08	20/07/2020	-	18.8	6.3	16,945	2.4	80.5	Clear, no odour
MW20/09	20/07/2020	-	18.5	6.25	16,121	2.66	93.5	Clear, no odour
MW20/10	20/07/2020	-	18.1	5.84	10,978	1.25	66.1	Orange tinge, almost clear, acetone-like odour
MW20/11	20/07/2020	-	17.4	6.37	19,257	0.98	10.4	Turbid, brown, sediment in bottom of hydrosleeve, slight odour
MW20/12	20/07/2020	-	18.4	6.54	13,798	0.75	-68.4	Clear above brown sediment, no odour
MW20/13	21/07/2020	-	21.8	7.09	17,293	0.53	-98	Slightly turbid, mostly clear, strong hydrocarbon odour, sheen, black globules of LNAPL present
MW20/14	20/07/2020	-	18.4	6.93	2711	1.53	21.1	Slight yellow tinge, clear, no odour
MW20/15	20/07/2020	-	18.5	5.91	20,674	4.04	99	Clear, no odour
MW20/16	20/07/2020	-	17.9	6.57	18,649	0.92	33.7	Slightly turbid, yellow tinge, no odour
MW20/17	20/07/2020	-	18.3	5.71	18,635	0.55	128.1	Turbid, brown, no odour
MW20/18	21/07/2020	-	16.5	7.42	4380	1.48	52.9	Clear, slight yellow tinge, no odour
MW20/19	20/07/2020	-	20.4	6.74	20,009	3.6	93	Clear, no odour
MW20/20	20/07/2020	-	18.6	5.72	29,196	1.16	55.7	Turbid, brown, no odour
MW94/6	20/07/2020	-	17.7	6.57	10,957	1.19	-70.1	Clear, no odour, turned blue in NaOH preserved bottle

Notes:

Pre	Pre Purging	Eh	Redox
Post	Post Purging	mV	millivolts
DO	Dissolved Oxygen	L	Litres
mg/L	milligrams per litre		
EC	Electrical Conductivity		
μScm^{-1}	microsiemens per centimetre		

Field Staff:
Amy Dorrington, Peter Brouwer

					BTEX							Naphthalene	TRH NEPM (2011)					TRH NEPM (2013)							TRH Silica Gel Cleanup								
					Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH >C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C10-C40 Fraction	TRH >C34-C40 Fraction	TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C10-C40 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36	TRH >C34-C40 Silica Gel Cleanup	TRH >C10-C16 Fraction SG less Naphthalene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.5	20	20	50	50	50	20	20	50	50	100	100	100	50	50	100	50	100	100	100	100	50
Clyde WARP SSTL (Direct Contact - Commercial)					400							9800							28000		17000	27000		27000									
Clyde WARP SSTL (Direct Contact - Construction Worker)					1200							67000							69000		45000	64000		64000									
Clyde WARP SSTL (Direct Contact - IMW)					15000							810000							830000		540000	770000		770000									
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m																																	
4-6m					3.2							NL							NL		NL	NL		NL									
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																																	
1-1.99m					3.2							NL							770		NL	NL		NL									
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																																	
2-3.99m					3.2							NL							NL		NL	NL		NL									
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																																	
0-0.99m					3.2							NL							600		NL	NL		NL									
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)					NL							NL							NL		NL	NL		NL									
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																										1000				3500		10000	
Field_ID	**Location_Code**	**Sample_Type**	**Sample_Depth_Range**	**Sampled_Date_Time**																													
MW20/03_0.8	MW20/03	Normal	0.7-0.9	13/07/2020	<0.1	<0.1	<0.1	0.3	2.2	2.5	-	<0.5	<20	59	100	56	215	<20	<20	<50	<50	<100	<100	<100	<50	<50	<100	-	<100	<100	<100	<100	-
MW20/03_3.0	MW20/03	Normal	2.9-3.1	13/07/2020	0.3	0.2	3.9	1	2.5	3.5	-	5 - 9.1	350	2600	5200	1600	9400	620	610	2800	2790.9	2200	5340	340	2100	2400	6800	-	3700	1500	1000	220	-
MW20/03_6.0	MW20/03	Normal	5.9-6.1	13/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	330	970	<50	1300	35	35	520	520	240	760	<100	<50	<50	<100	-	<100	<100	<100	<100	-
MW20/04_1.0	MW20/04	Normal	0.9-1.1	13/07/2020	<0.1	<0.1	<0.1	0.2	2.2	2.4	-	<0.5	<20	<20	150	<50	150	<20	<20	<50	<50	190	190	<100	<50	<50	<100	-	<100	100	<100	<100	-
MW20/04_3.5	MW20/04	Normal	3.4-3.6	13/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	52	<50	52	24	24	<50	<50	<100	<100	<100	390	590	3040	-	1700	560	950	270	-
MW20/04_4.5	MW20/04	Normal	4.4-4.6	13/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<50	<50	<100	-	<100	<100	<100	<100	-
MW20/05_3.5	MW20/05	Normal	3.4-3.6	13/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	20	160	110	290	<20	<20	<50	<50	160	160	<100	<50	<50	<100	-	<100	120	<100	<100	-
MW20/06_6.0	MW20/06	Normal	5.8-6	14/07/2020	<1	5.2	1.3	2	4	6	-	3.2 - 8.9	<200	2200	14,000	1600	17,800	<200	<200	4400	4391.1	9800	14,990	790	1500	2400	9900	-	6600	3700	1800	330	-
MW20/07_6.0	MW20/07	Normal	5.8-6	14/07/2020	<0.1	0.6	0.9	1.4	5.7	7.1	-	1.5 - 7.6	470	820	2200	710	3730	970	960	940	932.4	890	1990	160	550	590	2090	-	1100	340	440	<100	-
D01_20200714	MW20/13	Field_D	4.5-4.7	14/07/2020	<0.1	0.8	1.1	1.1	2	3.1	-	1 - 6.1	120	310	620	220	1150	230	230	360	353.9	100	460	<100	240	220	820	-	400	120	180	<100	-
MW20/13_6.0	MW20/13	Normal	5.8-6	14/07/2020	<0.1	<0.1	0.2	0.2	0.3	0.4	-	<0.5 - 2	<20	94	350	<50	444	49	48	170	168	190	360	<100	64	110	234	-	170	<100	<100	<100	-
T01_20200714	MW20/13	Interlab_D	5.8-6	14/07/2020	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	1 - 3.3	55	520	1480	540	2540	79	79	820	820	1570	2690	300	250	490	1670	1830	1010	1100	410	240	490
MW20/17_3.0	MW20/17	Normal	2.9-3.1	9/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	190	4000	340	4530	<20	<20	580	580	2900	3920	440	150	480	2780	-	2400	1200	230	240	-
Statistical Summary																																	
Number of Results					13	13	13	13	13	13	1	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	1	13	13	13	13	1
Number of Detects					1	4	5	7	7	7	0	6	4	10	12	8	12	7	7	8	8	10	10	5	8	8	8	1	8	9	7	5	1
Minimum Concentration					<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.2	<0.5	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<50	<50	<100	1830	<100	<100	<100	<100	490
Minimum Detect					0.3	0.2	0.2	0.2	0.3	0.4	ND	1	55	20	52	56	52	24	24	170	168	100	160	160	64	110	234	1830	170	100	180	220	490
Maximum Concentration					<1	5.2	3.9	2	5.7	7.1	<0.2	9.1	470	2600	14000	1600	17800	970	960	4400	4391.1	9800	14990	790	2100	2400	9900	1830	6600	3700	1800	330	490
Maximum Detect					0.3	5.2	3.9	2	5.7	7.1	ND	9.1	470	2600	14000	1600	17800	970	960	4400	4391.1	9800	14990	790	2100	2400	9900	1830	6600	3700	1800	330	490
Average Concentration					0.11	0.57	0.62	0.52	1.5	2		2	90	552	2254	408	3202	166	164	824	822	1415	2385	187	413	570	2122		1333	688	408	131	
Median Concentration					0.05	0.05	0.05	0.2	0.3	0.4	0.1	0.25	10	190	620	110	1150	35	35	360	353.9	190	460	50	150	220	820	1830	400	120	180	50	490
Standard Deviation					0.14	1.4	1.1	0.64	1.8	2.4		2.5	149	858	3889	573	5133	295	291	1313	1310	2688	4151	226	649	843	3036		1941	1038	535	109	
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	13	0	0	0	0	0	2	0	0	0	1	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	13	0	0	0	0	0	2	0	0	0	1	0	0	0

					Inorganics	Metals	PAH/Phenols																		
					Moisture Content (dried @ 103°C)	Chromium (hexavalent)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (lower bound)*	Benzo(a)pyrene TEQ (upper bound)*	Benzo(a)pyrene TEQ (medium bound)*	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total)
					%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Clyde WARP SSTL (Direct Contact - Commercial)						3600								40											
Clyde WARP SSTL (Direct Contact - Construction Worker)						1400								200											
Clyde WARP SSTL (Direct Contact - IMW)						17000								3000											
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m																									
4-6m																									
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																									
1-1.99m																									
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																									
2-3.99m																									
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																									
0-0.99m																									
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)																									
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																									
Field_ID	**Location_Code**	**Sample_Type**	**Sample_Depth_Range**	**Sampled_Date_Time**																					
MW20/03_0.8	MW20/03	Normal	0.7-0.9	13/07/2020	9.3	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW20/03_3.0	MW20/03	Normal	2.9-3.1	13/07/2020	21	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	1.4	<1	7.2
MW20/03_6.0	MW20/03	Normal	5.9-6.1	13/07/2020	22	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
MW20/04_1.0	MW20/04	Normal	0.9-1.1	13/07/2020	8.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW20/04_3.5	MW20/04	Normal	3.4-3.6	13/07/2020	22	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW20/04_4.5	MW20/04	Normal	4.4-4.6	13/07/2020	20	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW20/05_3.5	MW20/05	Normal	3.4-3.6	13/07/2020	10	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW20/06_6.0	MW20/06	Normal	5.8-6	14/07/2020	20	<1	1.2	0.6	2	5.2	2.8	4.5	4.5	4.5	2.2	1.5	0.7	10	0.7	2.4	4.4	0.5	12	8.3	57.7
MW20/07_6.0	MW20/07	Normal	5.8-6	14/07/2020	25	<1	0.6	<0.5	1.3	1.9	0.5	0.7	1.4	1	<0.5	<0.5	<0.5	2.6	<0.5	1.4	2.9	<0.5	10	3.6	26.3
D01_20200714	MW20/13	Field_D	4.5-4.7	14/07/2020	21	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1
MW20/13_6.0	MW20/13	Normal	5.8-6	14/07/2020	18	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T01_20200714	MW20/13	Interlab_D	5.8-6	14/07/2020	20.8	<0.5	0.6	<0.5	<0.5	0.6	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	0.6	<0.5	0.7	1.2	<0.5	3.3	1.8	12.1
MW20/17_3.0	MW20/17	Normal	2.9-3.1	9/07/2020	27	<1	<0.5	<0.5	0.5	1.4	1.9	3	3	3	0.8	1.8	1.3	1.3	0.6	2.2	<0.5	1.5	1.6	2.6	17.5

Statistical Summary

Number of Results					13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Number of Detects					13	0	3	1	3	4	3	3	13	13	2	2	2	4	2	4	4	2	5	4	6
Minimum Concentration					8.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Minimum Detect					8.5	ND	0.6	0.6	0.5	0.6	0.5	0.7	1.2	0.6	0.8	1.5	0.7	0.6	0.6	0.7	0.8	0.5	1.4	1.8	1
Maximum Concentration					27	<1	1.2	0.6	2	5.2	2.8	4.5	4.5	4.5	2.2	1.8	1.3	10	0.7	2.4	4.4	1.5	12	8.3	57.7
Maximum Detect					27	ND	1.2	0.6	2	5.2	2.8	4.5	4.5	4.5	2.2	1.8	1.3	10	0.7	2.4	4.4	1.5	12	8.3	57.7
Average Concentration					19	0.48	0.38	0.28	0.48	0.87	0.59	0.82	1.6	1.1	0.44	0.47	0.37	1.3	0.31	0.69	0.89	0.37	2.3	1.5	9.5
Median Concentration					20.8	0.5	0.25	0.25	0.25	0.25	0.25	0.25	1.2	0.6	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.5
Standard Deviation					5.9	0.069	0.28	0.097	0.54	1.4	0.8	1.3	1	1.2	0.55	0.53	0.31	2.7	0.15	0.79	1.3	0.35	4	2.3	17
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

					ASS		Chromium Reducible Sulfur							SPOCAS										
					pH (Fox)	Reaction Rate	acidity - Chromium Reducible Sulfur (a-22B)	acidity - Net Acid Soluble Sulfur (a-20J)	HCl Extractable Sulfur (20Be)	Net Acid Soluble Sulfur (20Je)	sulfidic - Net Acid Soluble Sulfur (s-20J)	Acid Neutralising Capacity - acidity (a-ANCbt)	HCl Extractable Sulfur Correction Factor	Acid Neutralising Capacity	ANC Fineness Factor	Chromium Reducible Sulfur	KCl Extractable Sulfur	Liming Rate	Net Acidity (acidity units)	Net Acidity (sulfur units)	pH KCl	sulfidic - Titratable Actual Acidity	sulfidic-Acid Neutral	Titratable Actual Acidity
					pH units	COMMENT	MOL H+/T	MOL H+/T	%	%	%	MOL H+/T	FACTOR	% CaCO3	FACTOR	%S	%	kg CaCO3/t	mole H+/t	%S	pH Units	%S	%S	mole H+/t
EQL					0.1		3	10	0.02	0.02	0.02	2	1	0.01		0.005	0.02	1	10	0.02	0.1	0.003	0.02	2
NSW ASSMAC 1998 Action Criteria >1000T disturbed (Fine texture soils)																			62	0.03				
NSW ASSMAC 1998 Action Criteria >1000T disturbed (Medium texture soils)																			36	0.03				
Field_ID	**Location_Code**	**Sample_Type**	**Sample_Depth_Range**	**Sampled_Date_Time**																				
MW20/01A_3.5	MW20/01A	Normal	3.4-3.5	14/07/2020	3.5	4	15	-	-	-	-	-	2	-	1.5	0.024	-	1.6	21	0.03	5.7	0.009	-	5.8
MW20/01B_6.0	MW20/01B	Normal	5.9-6.1	15/07/2020	6.6	4	4.9	-	-	-	-	95	2	0.47	1.5	0.008	-	<1	<10	<0.02	7.4	<0.003	0.15	<2
MW20/02A_2.5	MW20/02A	Normal	2.5-2.7	15/07/2020	3.9	4	3.4	21	0.07	0.05	0.03	-	2	-	1.5	0.005	0.02	140	1800	2.9	4.1	2.9	-	1800
MW20/02B_3.0	MW20/02B	Normal	2.9-3.1	15/07/2020	4.1	4	<3	26	0.11	0.06	0.04	-	2	-	1.5	<0.005	0.05	93	1200	2	4.4	1.9	-	1200
MW20/07_6.0	MW20/07	Normal	5.8-6	14/07/2020	4.6	4	93	-	-	-	-	190	2	0.97	1.5	0.15	-	<1	<10	<0.02	7.5	<0.003	0.31	<2
MW20/10_2.0	MW20/10	Normal	1.9-2.1	8/07/2020	2.8	4	280	-	-	-	-	180	2	0.9	1.5	0.45	-	12	160	0.26	6.7	<0.003	0.29	<2
MW20/13_4.5	MW20/13	Normal	4.5-4.7	14/07/2020	6.9	4	80	-	-	-	-	700	2	3.5	1.5	0.13	-	<1	<10	<0.02	8.8	<0.003	1.1	<2
Statistical Summary																								
Number of Results					7	7	7	2	2	2	2	4	7	4	7	7	2	7	7	7	7	7	4	7
Number of Detects					7	7	6	2	2	2	2	4	7	4	7	6	2	4	4	4	7	3	4	3
Minimum Concentration					2.8	4	<3	21	0.07	0.05	0.03	95	2	0.47	1.5	<0.005	0.02	<1	<10	<0.02	4.1	<0.003	0.15	<2
Minimum Detect					2.8	4	3.4	21	0.07	0.05	0.03	95	2	0.47	1.5	0.005	0.02	1.6	21	0.03	4.1	0.009	0.15	5.8
Maximum Concentration					6.9	4	280	26	0.11	0.06	0.04	700	2	3.5	1.5	0.45	0.05	140	1800	2.9	8.8	2.9	1.1	1800
Maximum Detect					6.9	4	280	26	0.11	0.06	0.04	700	2	3.5	1.5	0.45	0.05	140	1800	2.9	8.8	2.9	1.1	1800
Average Concentration					4.6	4	68					291	2	1.5	1.5	0.11		35	457	0.75	6.4	0.69	0.46	430
Median Concentration					4.1	4	15	23.5	0.09	0.055	0.035	185	2	0.935	1.5	0.024	0.035	1.6	21	0.03	6.7	0.0015	0.3	1
Standard Deviation					1.6	0	101					276	0	1.4	0	0.16		57	736	1.2	1.7	1.2	0.43	751
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Field_ID	Location_Code	Sample_Type	Sample_Depth_Range	Sampled_Date_Time	Extraneous Material				PSD						
					Extraneous Material	>2mm Fraction	<2mm Fraction	Analysed Material	<63 Micron	>2000 Micron	1000-2000 Micron	125-250 Micron	250-500 Micron	500-1000 Micron	63-125 Micron
					%	G	G	%	%W/W	%W/W	%W/W	%W/W	%W/W	%W/W	%W/W
EQL					0.1	0.005	0.005	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
MW20/01A_3.5	MW20/01A	Normal	3.4-3.5	14/07/2020	<0.1	<0.005	66	100	-	-	-	-	-	-	-
MW20/01B_0.5	MW20/01B	Normal	4.-0.6	14/07/2020	-	-	-	-	13	34	10	16	9.5	10	7.5
MW20/01B_09.0	MW20/01B	Normal	8.8-9.0	14/07/2020	-	-	-	-	77	3.7	2.2	6.1	2.1	1.5	7.2
MW20/01B_2.0	MW20/01B	Normal	1.9-2.1	14/07/2020	-	-	-	-	31	0.3	1.4	24	0.2	1.7	41
MW20/01B_5.0	MW20/01B	Normal	4.9-5.1	14/07/2020	-	-	-	-	40	18	24	5.2	1.9	2.2	8.6
MW20/01B_6.0	MW20/01B	Normal	5.9-6.1	15/07/2020	9.3	5.7	55	91	-	-	-	-	-	-	-
MW20/02A_2.5	MW20/02A	Normal	2.5-2.7	15/07/2020	<0.1	<0.005	71	100	-	-	-	-	-	-	-
MW20/02B_2.0	MW20/02B	Normal	1.9-2.1	15/07/2020	-	-	-	-	59	12	3.7	7.7	7.6	4.7	5.4
MW20/02B_3.0	MW20/02B	Normal	2.9-3.1	15/07/2020	1.2	0.77	65	99	-	-	-	-	-	-	-
MW20/02B_4.5	MW20/02B	Normal	4.4-4.6	15/07/2020	-	-	-	-	28	0.1	1.2	27	1.3	1.3	41
MW20/02B_9.0	MW20/02B	Normal	8.8-9.0	15/07/2020	-	-	-	-	60	9.1	2.3	11	2.4	2.8	13
MW20/07_6.0	MW20/07	Normal	5.8-6	14/07/2020	<0.1	<0.005	56	100	-	-	-	-	-	-	-
MW20/10_2.0	MW20/10	Normal	1.9-2.1	8/07/2020	5.3	3.1	55	95	-	-	-	-	-	-	-
MW20/13_4.5	MW20/13	Normal	4.5-4.7	14/07/2020	11	7.7	62	89	-	-	-	-	-	-	-
MW20/19_2.5	MW20/19	Normal	2.4-5.6	15/07/2020	-	-	-	-	91	3.5	0.9	1.8	1.3	0.3	1.7
MW20/19_4.0	MW20/19	Normal	3.9-4.1	15/07/2020	-	-	-	-	76	4.2	1.2	8.4	3.5	1.8	5.1

Statistical Summary

Statistical Summary	Extraneous Material	>2mm Fraction	<2mm Fraction	Analysed Material	<63 Micron	>2000 Micron	1000-2000 Micron	125-250 Micron	250-500 Micron	500-1000 Micron	63-125 Micron
Number of Results	7	7	7	7	9	9	9	9	9	9	9
Number of Detects	4	4	7	7	9	9	9	9	9	9	9
Minimum Concentration	<0.1	<0.005	55	89	13	0.1	0.9	1.8	0.2	0.3	1.7
Minimum Detect	1.2	0.77	55	89	13	0.1	0.9	1.8	0.2	0.3	1.7
Maximum Concentration	11	7.7	71	100	91	34	24	27	9.5	10	41
Maximum Detect	11	7.7	71	100	91	34	24	27	9.5	10	41
Average Concentration	3.9	2.5	61	96	53	9.4	5.2	12	3.3	2.9	15
Median Concentration	1.2	0.77	62	99	59	4.2	2.2	8.4	2.1	1.8	7.5
Standard Deviation	4.7	3.1	6.3	4.7	26	11	7.6	8.7	3.1	2.9	15
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0

					BTEX						Naphthalene							TRH NEPM (2013)						
					Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	Naphthalene	TRH >C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C15-C36 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C10-C40 Fraction	TRH >C34-C40 Fraction
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					1	1	1	1	2	1	0.05	20	50	100		50	50	20	20	50	50	100	100	100
ANZG (2018) TV - Marine (Slightly To Moderately Disturbed)					700[#1]	180[#2]	80	350[#2]	275[#2]		70[#1]													
Clyde WARP SSTL - GW VI - Commercial					5000						13000								6200		NL			
Clyde WARP SSTL - GW VI - Construction					NL						NL							-	NL	-	NL	-		-
Clyde WARP SSTL - GW VI - IMW					NL						NL							-	NL	-	NL	-		-
NEPM (2013) - Marine Water					500						50													
NEPM (2013) - Recreational					10	8000	3000			6000														
NHMRC (2008) Recreational Water - Health					10	8000	3000			6000														
Location_Code	**Field_ID**	**Sampled_Date_Time**	**Transect**	**Sample_Type**																				
BH210	BH210	20/07/2020	1 - Upgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	710	<100	-	<100	710	<20	<20	120	120	<100	120	<100
BH210	D01_20200720	20/07/2020	1 - Upgradient	Field_D	<1	<1	<1	<1	<2	<3	<1	<20	580	<100	-	<100	580	<20	<20	<50	<50	<100	<100	<100
MW20/01A	MW20/01A	20/07/2020	1 - Upgradient	Normal	<1	<1	<1	2	3	5	<10 - 2	<20	100	1600	-	500	2200	30	30	280	280	1800	2280	200
MW20/01B	MW20/01B	20/07/2020	1 - Upgradient	Normal	<1	<1	1	3	5	8	<10 - 3	50	<50	<100	-	<100	<100	80	70	<50	<50	<100	<100	<100
MW20/02A	MW20/02A	20/07/2020	1 - Upgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	420	<100	-	<100	420	<20	<20	410	410	<100	410	<100
MW20/02B	MW20/02B	20/07/2020	1 - Upgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	100	100	<20	<20	<50	<50	<100	<100	<100
MW20/19	MW20/19	20/07/2020	1 - Upgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	500	500	<20	<20	<50	<50	300	500	200
MW20/03	MW20/03	21/07/2020	2 - Source	Normal	14	<1	6	8	3	11	<1	330	3600	9400	-	1600	14,600	610	580	5100	5100	8600	14,500	800
MW20/07	MW20/07	21/07/2020	2 - Source	Normal	4	7	3	6	14	19	20 - 25	170	5500	14,000	-	4300	23,800	330	300	7300	7280	15,000	25,100	2800
MW20/13	MW20/13	21/07/2020	2 - Source	Normal	42	25	56	68	95	160	50 - 57	710	1700	4800	-	400	6900	1100	810	2100	2050	4300	6600	200
BH116	BH116	21/07/2020	3 - Source	Normal	<1	<1	<1	<1	<2	<3	<2	<20	7400	35,000	-	41,000	83,400	<20	<20	13,000	13,000	48,000	80,000	19,000
MW20/04	MW20/04	21/07/2020	3 - Source	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/05	MW20/05	21/07/2020	3 - Source	Normal	4	6	2	2	4	6	<10 - 2	<20	430	1600	-	100	2130	<20	<20	690	690	1400	2090	<100
MW20/06	MW20/06	21/07/2020	3 - Source	Normal	2	10	1	1	<2	<3	<10 - 65	60	21,000	16,000	-	3900	40,900	130	120	22,000	22,000	8200	33,400	3200
MW12/20	MW12/20	21/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/08	MW20/08	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/09	MW20/09	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	410	300	-	1900	2610	<20	<20	410	410	1600	2710	700
MW20/10	MW20/10	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	30	460	1100	-	400	1960	30	30	610	610	1000	1810	200
MW20/11	MW20/11	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	150	1300	-	700	2150	<20	<20	160	160	1000	1560	400
MW20/12	D02_20200720	20/07/2020	4 - Downgradient	Field_D	<1	<1	<1	<1	<2	<3	<1	<20	<50	300	-	100	400	<20	<20	50	50	300	350	<100
MW20/12	MW20/12	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	180	800	-	400	1380	<20	<20	140	140	1000	1240	100
MW20/14	MW20/14	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	1100	-	200	1300	<20	<20	<50	<50	800	800	<100
MW20/15	MW20/15	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	1900	1900	<20	<20	<50	<50	1300	2000	700
MW20/16	MW20/16	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/17	MW20/17	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	160	1700	-	600	2460	<20	<20	330	330	1900	2630	400
MW20/18	D01_20200721	21/07/2020	4 - Downgradient	Field_D	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/18	MW20/18	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	-	<100	<100	<20	<20	<50	<50	<100	<100	<100
MW20/20	MW20/20	20/07/2020	4 - Downgradient	Normal	<1	<1	<1	<1	<2	<3	<1	<20	3400	800	-	100	4300	<20	<20	3200	3200	600	3800	<100
MW94/6	MW94/6	20/07/2020	4 - Downgradient	Normal	<1	<1	2	4	12	16	<1	20	<50	<100	-	<100	<100	30	<20	<50	<50	<100	<100	<100

Statistical Summary

	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	Naphthalene	TRH >C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C15-C36 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C10-C40 Fraction	TRH >C34-C40 Fraction
Number of Results	29	29	29	29	29	29	29	29	29	29	0	29	29	29	29	29	29	29	29	29
Number of Detects	5	4	7	8	7	7	6	7	16	15	0	18	21	8	7	16	16	17	19	13
Minimum Concentration	<1	<1	<1	<1	<2	<3	<1	<20	<50	<100	99999	<100	<100	<20	<20	<50	<50	<100	<100	<100
Minimum Detect	2	6	1	1	3	5	20	20	100	300	ND	100	100	30	30	50	50	300	120	100
Maximum Concentration	42	25	56	68	95	160	65	710	21000	35000	0	41000	83400	1100	810	22000	22000	48000	80000	19000
Maximum Detect	42	25	56	68	95	160	65	710	21000	35000	ND	41000	83400	1100	810	22000	22000	48000	80000	19000
Average Concentration	2.7	2.1	2.8	3.6	5.4	8.9	4.6	55	1604	3121		2043	6728	88	74	1939	1936	3369	6290	1024
Median Concentration	0.5	0.5	0.5	0.5	1	1.5	0.5	10	150	300		100	1300	10	10	120	120	600	800	50
Standard Deviation	8	5	10	13	18	29	12	142	4142	7367		7572	17114	231	184	4779	4778	9213	16150	3540
Number of Guideline Exceedances	2	0	0	0	0	0	2	0	0	0	0	0	0	29	0	29	29	29	0	29
Number of Guideline Exceedances(Detects Only)	2	0	0	0	0	0	2	0	0	0	0	0	0	29	0	29	29	29	0	29

Env Stds Comments

#1:Moderate Reliability
#2:Unknown level of species protection; Unknown Reliability
#3:High Reliability
#4:Very high Reliability
#5:Low Reliability

					TRH Silica Gel Cleanup							Metals			PAH/Phenols																		
					TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36 Silica Gel Cleanup	TRH >C34-C40 Silica Gel Cleanup	Chromium (Filtered)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent) (Filtered)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total)
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL					50	50	50	100	100	50	100	1	0.5	5	0.05	0.05	0.05	0.05	0.01	1	0.05	1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2
ANZG (2018) TV - Marine (Slightly To Moderately Disturbed)																	0.01#2		0.1#2						1#2			0.6#2		
Clyde WARP SSTL - GW VI - Commercial																														
Clyde WARP SSTL - GW VI - Construction													-																	
Clyde WARP SSTL - GW VI - IMW													-																	
NEPM (2013) - Marine Water													4.4	27																
NEPM (2013) - Recreational													500																	
NHMRC (2008) Recreational Water - Health													500						0.1											
Location_Code	**Field_ID**	**Sampled_Date_Time**	**Transect**	**Sample_Type**																										
BH210	BH210	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BH210	D01_20200720	20/07/2020	1 - Upgradient	Field_D	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/01A	MW20/01A	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<1	<0.5	<5	<1	<1	<1	1	1	1	1	<1	2	1	1	<1	1	1	1	13
MW20/01B	MW20/01B	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	1	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3
MW20/02A	MW20/02A	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/02B	MW20/02B	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/19	MW20/19	20/07/2020	1 - Upgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/03	MW20/03	21/07/2020	2 - Source	Normal	940	2000	3640	2400	1800	300	<100	<2	<0.5	<5	3	6	1	<1	<1	<1	<1	<1	<1	<1	1	4	<1	6	1	22
MW20/07	MW20/07	21/07/2020	2 - Source	Normal	1700	2900	8100	4600	5000	1800	1100	<2	3.1	<5	5	1	9	15	5	3	<2	3	19	2	8	17	1	69	24	206
MW20/13	MW20/13	21/07/2020	2 - Source	Normal	<50	<50	<100	<100	<100	<100	<100	<2	1	<5	2	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	<1	2	<1	66
BH116	BH116	21/07/2020	3 - Source	Normal	5200	9400	22,800	4600	6000	13,000	11,000	<2	0.7	<5	<2	3	<2	4	3	6	4	<2	6	<2	10	<2	3	7	10	56
MW20/04	MW20/04	21/07/2020	3 - Source	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/05	MW20/05	21/07/2020	3 - Source	Normal	<50	<50	<100	<100	<100	<100	<100	1	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	3
MW20/06	MW20/06	21/07/2020	3 - Source	Normal	11,000	15,000	22,700	11,000	4800	700	700	<2	3.8	<5	20	7	5	4	3	1	<2	<1	8	1	2	38	<1	59	9	222
MW12/20	MW12/20	21/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/08	MW20/08	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	0.6	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/09	MW20/09	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/10	MW20/10	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/11	MW20/11	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	0.7	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/12	D02_20200720	20/07/2020	4 - Downgradient	Field_D	<50	<50	<100	<100	<100	<100	<100	<2	0.6	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/12	MW20/12	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	0.6	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/14	MW20/14	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/15	MW20/15	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	0.9	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/16	MW20/16	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	1.3	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/17	MW20/17	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/18	D01_20200721	21/07/2020	4 - Downgradient	Field_D	<50	<50	<100	<100	<100	<100	<100	<2	0.7	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/18	MW20/18	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW20/20	MW20/20	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW94/6	MW94/6	20/07/2020	4 - Downgradient	Normal	<50	<50	<100	<100	<100	<100	<100	<2	0.7	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Statistical Summary																														
Number of Results					29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
Number of Detects					4	4	4	4	4	4	3	3	13	0	4	5	3	4	4	4	2	1	4	3	5	4	3	7	5	8
Minimum Concentration					<50	<50	<100	<100	<100	<100	<100	<1	<0.5	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Minimum Detect					940	2000	3640	2400	1800	300	700	1	0.6	ND	2	1	1	1	1	1	1	3	2	1	1	3	1	1	1	3
Maximum Concentration					11000	15000	22800	11000	6000	13000	11000	2	3.8	<5	20	7	9	15	5	6	4	3	19	2	10	38	3	69	24	222
Maximum Detect					11000	15000	22800	11000	6000	13000	11000	2	3.8	ND	20	7	9	15	5	6	4	3	19	2	10	38	3	69	24	222
Average Concentration					671	1032	2017	822	650	588	486	1	0.68	2.5	1.5	1.1	0.98	1.3	0.84	0.81	0.67	0.6	1.6	0.6	1.2	2.6	0.62	5.4	2	21
Median Concentration					25	25	50	50	50	50	50	1	0.25	2.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Standard Deviation					2226	3245	5964	2311	1638	2412	2035	0.21	0.83	0	3.7	1.6	1.8	2.8	1	1.1	0.66	0.47	3.7	0.31	2.2	7.5	0.48	16	4.8	56
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	29	0	29	0	0	0	0	0	5	0	0	29	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	3	0	4	0	0	0	0	0	5	0	0	7	0	0

Env Stds Comments
#1:Moderate Reliability
#2:Unknown level of species protection; Unknown Reliability
#3:High Reliability
#4:Very high Reliability
#5:Low Reliability

Appendix C2 - Tables from the AEC-4 ROA

The following table summarises the assessment of relevant remedial technologies for CoPCs within AEC -4.

Technology	Matrix	Effectiveness	Timeframe	Health & Safety	Complexity	Sustainability	Relative Costs	Relative Score
		● Effective ● Limited ● Ineffective	● <1 year ● 1-5 Years ● >5 Years	● Few concerns ● Mod concerns ● Many concerns	● Low ● Moderate ● High	● Above Average ● Average ● Below Average	● Low cost ● Mod Cost ● High Cost	● 1.0 -1.5 ● 1.5 – 2.5 ● 2.5 – 3.0
Excavation and Off-site Disposal ■ Removal of contaminated soils to the extent feasible with multiple options to treat or dispose of contaminants	**Soil**	■ Offsite disposal of soil material will effectively remediate onsite contamination. ■ Material to be disposed of to landfill licenced to receive Restricted Solid Waste/ Special Waste (asbestos)	■ Remediation can be undertaken within short timeframes.	■ Health and safety concerns associated with the excavation, handling, transport and disposal of contaminated materials. ■ NSW EPA position on air emissions/quality and related health effects. ■ AEC4 is positioned close to adjacent land users on the site boundary.	Moderate complexity of excavation due to the following site-specific considerations: ■ Excavations will be >3m deep and extend beyond the water table; ■ Dewatering, management of wastewater and Potential Acid Sulfate Soils in close proximity to the Duck River will be required; ■ Increased chance of environmental incidents and mobilisation of contaminants during works; ■ Excavations to be undertaken under asbestos conditions and may require the use of an Odour Control Enclosure (OCE) to manage contaminated materials. ■	■ Low sustainability due to due to the high volume of trucks movement and use of landfill resources.	■ Estimated total fee of approximately $32,000,000 for site establishment and remedial works including excavation and offsite disposal of waste at $640/m^3$ ■ Due to the high volumes of material requiring disposal as restricted / hazardous waste, high costs due to trucking and waste levies. ■ Requirements for emissions control enclosures for excavation and handling areas.	■ 1.8
In-situ Immobilisation including Stabilisation ■ Physical and chemical form of various contaminants would strongly influence the selection of specific immobilisation approach. ■ Could include pH control, adding bonding agents, oxidising or reducing reactions.	**Soil**	■ Application of amendments can significantly decrease the mobility, toxicity and bioavailability various contaminants in soil and groundwater ■ Due to heterogeneous nature of fill materials consideration during design must consider mechanisms to ensure all contamination is effectively bound within stabilising matrix. ■ Where contaminants are immobilised through potentially reversible reactions, a change in geochemical conditions in the subsurface could remobilise contaminants. ■ Remediation trial data suggests solidification/stabilisation immobilisation for treatment of material from AEC-4 can be effective.	■ Relatively short timeframe for stabilisation to be undertaken (i.e. less than 90 days from initial treatment) however excavation, sorting and screening where required) can result in moderate timeframes for remediation being required.	■ Significant onsite equipment is required resulting in potential safety concerns associated with movement of machinery equipment within the Site. ■ It is however the opinion of ERM that these considerations can be appropriately managed via existing onsite safety permitting requirements. ■ NSW EPA position on air emissions/quality and related health effect if immobilisation completed as ex-situ method.	■ Based on the delineation and non-mobile nature of contamination within AEC-4 stabilisation may be overly complex for management of identified impact as mitigation of off mobilisation is not required. ■ Implementation of approach is considerate moderately complex due to the heterogeneous nature of subsurface fill materials. ■ Approach will require validation measures to demonstrate all contaminated materials have been bound within stabilising matrix. ■ Where material is proposed to be placed below the groundwater table, additional assessment may be required to assess potential long term leachability.	■ Limited infrastructure / power generation required	■ Estimated total fee of approximately $8,000,000 for site establishment and remedial works based on a treatment rate of $160/m^3$ ■ Moderate costs for implementation of approach, however ongoing monitoring may be required to demonstrate effectiveness.	■ 1.6

Technology	Matrix	Effectiveness	Timeframe	Health & Safety	Complexity	Sustainability	Relative Costs	Relative Score
		● Effective ● Limited ● Ineffective	● <1 year ● 1-5 Years ● >5 Years	● Few concerns ● Mod concerns ● Many concerns	● Low ● Moderate ● High	● Above Average ● Average ● Below Average	● Low cost ● Mod Cost ● High Cost	● 1.0 -1.5 ● 1.5 – 2.5 ● 2.5 – 3.0
In-Situ Thermal Treatment ■ The injection of energy into the subsurface to mobilize and recover volatile and semi-volatile organic contaminants	**Soil**	■ Destroys a broad range of hydrocarbons quickly and thoroughly ■ Calorific values of materials assessed within the ERM (2020) RSI indicate the material is significantly heterogeneous and therefore the effectiveness of the approach will vary (and may be unreliable) depending on the composition of materials. ■ Co-mingled asbestos will not be destroyed and will require ongoing management.	■ Remedial targets can be achieved within a relatively short timeframe, however project planning and equipment procurement can result in extensive lead times. ■ Due to the heterogeneous nature of materials and associated calorific values, timeframes may vary depending on underlying materials.	■ Health and Safety concerns due to site disturbance, high heat or voltage exist. ■ Requires significant infrastructure to be installed within the Site that will require safety planning. ■ Due to the presence of asbestos within the soil matrix, concerns relating to the release of asbestos fines / fibres during handling and treatment.	■ Significant design requirements for development of appropriate system.	■ High energy usage. ■ In-situ thermal requires significant infrastructure to be installed within the site and therefore High equipment costs	■ Estimated total fee of approximately $34,000,000 for site establishment and remedial works based on a treatment rate of approximately $650/m^3$ ■ In-situ thermal treatment can be expensive to deploy and operate and typically requires vapour extraction to remove vapours produced	■ 2.5
Ex-Situ Thermal Treatment ■ Excavation of material and treatment either on-site or offsite to mobilize and recover volatile and semi-volatile organic contaminants. ■ Off-site thermal treatment would involve shipping / transport to a licenced treatment facility potentially interstate)	**Soil**	■ Destroys a broad range of hydrocarbons quickly and thoroughly ■ Ex-situ approach enables screening and sorting of material prior to treatment, however this may require a significant time frame and to be undertaken within an emission control enclosure where concentrations of volatile contaminants pose a risk from air borne emissions / odour. ■ ERM notes the presence of asbestos within primary remedial areas (AEC-4) that may impact the appropriateness of thermal treatment. Co-mingled asbestos will not be destroyed and will require ongoing management regardless of treated hydrocarbon contaminants. ■ Compromised geotechnical properties post thermal treatment.	■ Due to the heterogeneous nature of materials and associated calorific values, significant time may be required to sort / screen and blend materials prior to thermal treatment. ■ Remedial targets can be achieved within a relatively short timeframe, however project planning and equipment procurement can result in extensive lead times.	■ Health and Safety concerns due to site disturbance, high heat or voltage exist. ■ Due to the presence of asbestos within the soil matrix, concerns relating to the release of asbestos fines / fibres during handling and treatment. ■ NSW EPA position on air emissions/quality and related health effects.	■ Ex-situ screening, sorting and blending may require significant site infrastructure including emissions control enclosures and site management controls associated with air emissions, odour and surface water management. ■ Ex-situ on-site treatment via thermal also requires consideration of use/placement/management of treated soils that may not be geotechnically suitable. ■ The presence of asbestos in the fill materials will potentially inhibit thermal treatment options offsite.	■ Significant costs associated with enclosures for the treatment / handling of materials [prior to treatment. ■ High energy usage. ■ High equipment costs	■ Onsite - Estimated total fee of approximately $27,500,000 for site establishment and remedial works based on a treatment rate of approximately $520/m^3$ ■ Off-Site - Estimated total fee of approximately $36,500,000 for site establishment and remedial works based on a treatment rate of approximately $725/m^3$	■ 2.5

Technology	Matrix	Effectiveness	Timeframe	Health & Safety	Complexity	Sustainability	Relative Costs	Relative Score
		● Effective ● Limited ● Ineffective	● <1 year ● 1-5 Years ● >5 Years	● Few concerns ● Mod concerns ● Many concerns	● Low ● Moderate ● High	● Above Average ● Average ● Below Average	● Low cost ● Mod Cost ● High Cost	● 1.0 -1.5 ● 1.5 – 2.5 ● 2.5 – 3.0
Engineered Capping Layer and Ongoing Management ■ Remediation would involve retaining impacted materials in-situ and construction of a constructed / engineered capping layer with no requirement for a liner at the base of waste material. ■ Engineered capping layer to restrict potential direct contact with contaminated soils ■ Capped materials would be managed under Site / Environmental Management Plans including requirements for ongoing monitoring, trigger / action levels to prevent future offsite impacts.	**Soil**	■ Investigations within the site have indicated that contamination within AEC-4 is delineated, immobilew and is unlikely to pose a risk of harm to adjacent ecological receptors through migration in groundwater. ■ Construction of a capping layer would mitigate the potential for contact for onsite workers through reducing the potential for incidental contact. ■ Following construction of the capping layer, land use planning for the Site should consider uses such as car parking or slab on grade building structures where services are not located to minimise the potential for damage to the constructed capping layer. The implementation of ongoing controls (including management of potential vapour intrusion risks) will provide further mitigation of risk to identified receptors. ■ Occurrence of PFAS in low concentrations in soils and leachate within buried waste area supports the adoption of on-site containment and reduction of surface infiltration for protection of off-site receptors, as recommended by the PFAS NEMP (HEPA, 2020).	■ Remedial / site management works can be undertaken within a short timeframe, however negotiation with DPIE / council and future land holders may be required to confirm ongoing management requirements are appropriate	■ Where material is retained –in-situ there are low health and safety concerns as materials handling will be minimised. ■ Health and safety concerns to future site users will be managed under an ongoing site management plan.	■ Low complexity associated with implementation, however strategy will require ongoing monitoring plans to be developed with defined trigger levels, action items etc. ■ Ongoing groundwater monitoring may be required to ensure potential changes to groundwater conditions (and potential mobilisation of contamination) are identified as soon as practicable ■ All management plans will require endorsement by NSW EPA accredited auditor and DPIE. ■ Restrictions on the use of the land will be required to ensure the long-term integrity of the capping layer and potential vapour intrusion risks are mitigated.	■ Limited resources required	■ Estimated total fee of approximately $1,500,000 for site establishment and construction of an engineered capping layer based on a capping rate of $110/m^2$ (cost do not include land forming or other site preparation works) ■ Strategy will require ongoing monitoring plans to be developed and implemented with defined trigger levels, action items etc. All management plans will require endorsement by NSW EPA accredited auditor and DPIE	■ 1.3

Note: Estimated remediation costings are preliminary only and do not include consulting fees, consultation with stakeholders, additional required approvals / permits, land forming / additional civil works etc.

Appendix C-3 Tables from the Ground Gases Assessment

ERM

Project:	Clyde WARP - Stage 2 - Lot 64 Capping - 0561882	
Date:	12-Aug-22	30-Mar-23
Time:	7:30 AM	7:30 AM
Barometric pressure (start):	1018 mb	1004
Barometric pressure (finish):	1020 mb	1007
Weather:	Overcast	Clear
Ground conditions:	Wet	Dry

Technician: Jack Emblen and Stephen Mulligan
Instrument: GA 5000

Location	Date	Flow	Barometric Pressure	Top of Screen Level	NAPL Level	Standing Water Level	Suitability for Gas Sampling	Pump Duration	Peak			Min	Stabilised Gas Readings							Ambient Readings			Comments
							(Top of screen > fluid Level)		CH_4	CO_2	VOC	O_2	VOC	CH_4	CO_2	O_2	Balance	CO	Relative Pressure	CH_4	CO_2	VOC	
ID number		l/hr	mb	m BTOC	mBTOC	mBTOC	y / n	Sec	% v/v	% v/v	ppm	% v/v	ppm	% v/v	% v/v	% v/v	% v/v	ppm	mb	%v/v	%v/v	ppm	
BH116	12/08/2022	0.10	1019	1.135	-	-	Y	60	0.20	0.40	11.4	20.8	7.9	0.0	0.4	20.8	78.80	0.0	0.02	0.0	0.0	-	Hydrasleeve at 0.974 m. Removed prior to sampling
BH116	30/03/2023	-0.10	1005	1.135	-	-	Y	60	0.00	9.80	4.0	3.4	-	0.0	9.8	3.4	86.70	1.0	0.00	0.0	0.1	0.0	blocked at 0.97m
MW12/01	12/08/2022	-5.30	1019	1.000	2.214	-	Y	60	48.20	13.80	1.3	3.1	1.3	48.1	13.8	3.1	34.90	3.0	1.16	0.0	0.1	-	-
MW12/01	30/03/2023	-7.40	1006	1.000	1.755	-	Y	60	32.90	19.80	56.4	9.6	-	32.9	19.8	9.6	37.70	5.0	3.03	0.0	0.1	0.0	-
MW12/20	12/08/2022	0.00	1020	1.000	-	-	Y	60	0.00	0.10	12.3	21.4	12.2	0.0	0.1	24.0	78.50	1.0	0.00	0.0	0.1	-	Cap not attached on well properly when initially found. Hydrasleeve at 0.75 m, removed prior to sampling
MW12/20	30/03/2023	-0.10	1007	1.000	-	-	Y	60	0.20	1.30	6.9	19.1	-	0.0	1.3	19.1	79.05	1.0	0.05	0.0	0.1	0.0	1.330 m
MW20/01A	30/03/2023			1.872		1.84	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/01B	30/03/2023			6.935		1.32	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/02A	30/03/2023			1.896		0.05	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/02B	30/03/2023			5.865		0.05	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/03	30/03/2023	-0.60	1005	2.979	-	3.12	Y	60	0.00	0.50	12.8	20.2	-	0.0	0.5	20.2	79.30	1.0	-0.02	0.0	0.1	0.0	-
MW20/04	12/08/2022	0.10	1020	2.986	-	4.05	Y	60	0.00	1.20	4.7	19.2	4.5	0.0	1.2	19.2	79.60	1.0	-0.02	0.0	0.1	-	-
MW20/04	30/03/2023	-0.10	1005	2.986		3.82	Y	60	0.00	1.20	8.3	19.5	-	0.0	1.2	19.5	79.30	0.0	-0.02	0.0	0.1	0.0	-
MW20/05	12/08/2022	-9.80	1018	1.897	-	2.19	Y	60	81.60	13.00	4.7	1.7	4.7	81.6	13.0	1.7	3.70	0.0	0.35	0.0	0.1	-	Strong hydrocarbon odour, sheen
MW20/05	30/03/2023	-0.10	1005	1.897	2.085		Y	120	74.60	35.70	74.5	0.4	-	57.3	28.7	4.3	9.80	2.0	5.71	0.0	0.1	0.0	
MW20/06	12/08/2022	0.00	1018	1.914	2.889	-	Y	60	28.90	1.40	16.0	14.7	4.5	8.8	0.9	17.0	63.30	1.0	0.04	0.0	0.1	-	LNAPL present - black
MW20/06	30/03/2023	-1.20	1004	1.914	2.630		Y	60	47.90	1.60	43.7	11.7	-	40.2	1.4	12.6	45.80	4.0	0.05	0.0	0.1	0.0	-
MW20/07	12/08/2022	-4.10	1020	2.893	3.520	-	Y	60	28.10	3.90	11.4	10.3	11.4	28.1	3.9	10.3	37.60	1.0	0.72	0.0	0.1	-	-
MW20/07	30/03/2023	-1.10	1006	2.893	3.450		Y	60	39.50	1.70	8.7	11.3	-	39.5	1.7	11.3	47.50	5.0	0.65	0.0	0.1	0.0	-
MW20/08	30/03/2023	-0.10	1007	2.946		2.74	N	60	0.00	0.10	1.7	20.9	-	0.0	0.0	21.1	78.90	0.0	-0.02	0.0	0.0	0.0	Not suitable for gas monitoring. Gauged water level above screen
MW20/09	30/03/2023	0.00	1006	2.993		2.70	N	60	0.00	0.10	1.9	21.0	-	0.0	0.1	21.0	78.90	0.0	0.05	0.0	0.1	0.0	Not suitable for gas monitoring. Gauged water level above screen
MW20/10	30/03/2023	0.00	1006	2.969		2.75	N	60	0.00	0.10	2.8	21.0	-	0.0	0.1	21.1	78.90	0.0	0.02	0.0	0.1	0.0	Not suitable for gas monitoring. Gauged water level above screen
MW20/11	30/03/2023	0.00	1007	2.927		3.03	Y	60	0.00	0.10	3.7	21.0	-	0.0	0.1	21.1	78.90	1.0	-0.02	0.0	0.1	0.0	-
MW20/12	30/03/2023			3.383		3.02	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/13	30/03/2023	-2.40	1006	2.920	1.990		Y	60	29.40	1.40	35.6	14.7	-	29.4	1.4	14.7	54.40	1.0	2.70	0.0	0.1	0.0	
MW20/14	30/03/2023		1006	2.974		2.97	N	60	0.00	0.10	1.8	21.0	-	0.0	0.0	21.1	78.90	0.0	0.02	0.0	0.0	0.0	Not suitable for gas monitoring. Gauged water level above screen
MW20/15	30/03/2023	-0.10	1006	2.991		2.39	N	60	0.00	0.10	2..4	21.0	-	0.0	0.1	21.0	78.90	0.0	0.02	0.0	0.1	0.0	Unable to tighten gas cap properly - likely fresh air included in sample
MW20/16	30/03/2023			2.826		2.53	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/17	30/03/2023	0.00	1007	3.039		3.21	Y	60	0.00	0.20	4.4	20.6	-	0.0	0.1	20.8	79.00	0.0	0.02	0.0	0.1	0.0	-
MW20/18	30/03/2023			3.040		2.82	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW20/20	30/03/2023			3.511		2.58	N		-	-	-	-	-	-	-	-	-	-	-	-	-	-	Not suitable for gas monitoring. Gauged water level above screen
MW94/6	12/08/2022	0.00	1020	0.447	-	2.25	Y	60	0.00	0.20	4.7	21.3	2.1	0.0	0.2	21.4	78.40	0.0	-0.02	0.0	0.1	-	-
MW94/6	30/03/2023	0.00	1007	0.447	2.670	2.67	Y	60	0.00	0.60	3.2	20.6	-	0.0	0.6	20.7	78.70	1.0	-0.02	0.0	0.1	0.0	-

Notes:
*The GA 5000 is a landfill and contaminated land portable gas analyser that uses a dual-wavelength infra-red sensor to measure CH4 to an accuracy of +-0.5 % for ranges of 0 – 70% vol (according to the Manufacturer's technical specifications).
*This meets the *"Minimum performance specification for extractive landfill gas analysers (category 1)"* as specified in Section 4.1 Extractive landfill gas analysers (category 1) - Landfill gas fugitive emissions monitoring guideline – Environmental Protection Authority Victoria (2018).
*Hence any methane readings recorded between 0 – 0.5 % vol. are within the instrument's margin of measurement error and interpretation of results should take this into consideration.

Field_ID	Area	Sampled_Date_Time	Matrix_Type	Flow Rate: Borehole Flow Rate	Flow Rate: Borehole Flow Rate (adjusted) [1]	Field (post-purge): VOC	Field (post-purge): Methane	Field (post-purge): Carbon Dioxide	Analytical Data: Methane	Analytical Data: Carbon Dioxide (free)	Analytical Data: Carbon Monoxide	Analytical Data: Helium	Analytical Data: Hydrogen	Analytical Data: Oxygen	%v/v concentrations: Methane	%v/v concentrations: Carbon Dioxide	GSV Threshold: Methane	GSV Threshold: Carbon Dioxide	Modified Wilson and Card Classification: Characteristic Situation (CS classification)	Adopted Characteristic Situation (CS classification)	Adopted Risk Classification
				L/Hr	L/Hr	ppm	%	%	MOL %	MOL %	MOL %	MOL %	MOL %	MOL %	%v/v	%v/v	L/ Hr	L/ Hr			
EQL							0.01	0.03	0.05	0.03	0.02	0.05	0.03	0.1							
BH116	Lot 64 - boundary	12/08/2022	gas	0.10	0.10	11.4	<0.1	0.4	<0.14	<0.08	<0.05	<0.14	<0.08	21	0.00	0.00	0.00	0.00	1	1	Very low risk
BH116	Lot 64 - boundary	30/03/2023	gas	-0.10	0.10	4	0	9.8	0	9.8	-	-	-	3.4	0.00	0.10	0.00	0.01	1		
MW12/20	Lot 64 - boundary	12/08/2022	gas	0.00	0.00	12.3	<0.1	0.1	<0.12	<0.07	<0.05	<0.12	<0.07	21	0.00	0.00	0.00	0.00	1	1	Very low risk
MW12/20	Lot 64 - boundary	30/03/2023	gas	-0.10	0.10	6.9	0	1.3	0	1.3	-	-	-	9.9	0.00	0.01	0.00	0.00	1		
MW20/03	Lot 64 - boundary	30/03/2023	gas	-0.60	0.60	12.8	0	0.5	0	0.5	-	-	-	20.2	0.00	0.01	0.00	0.00	1	1	Very low risk
MW20/04	Lot 64 - boundary	12/08/2022	gas	0.10	0.10	4.7	0	1.2	<0.13	0.94	<0.05	<0.13	<0.08	20	0.00	0.01	0.00	0.00	1	1	Very low risk
MW20/04	Lot 64 - boundary	30/03/2023	gas	-0.10	0.10	8.3	0	1.2	0	1.2	-	-	-		0.00	0.01	0.00	0.00	1		
MW94/6	Lot 64 - boundary	12/08/2022	gas	0.00	0.00	2.1	0	0.2	<0.12	0.6	<0.05	<0.12	<0.07	21	0.00	0.00	0.00	0.00	1	1	Very low risk
MW94/6	Lot 64 - boundary	30/03/2023	gas	0.00	0.00	3.2	0	0.6	0	0.6	-	-	-	20.7	0.00	0.01	0.00	0.00	1		
MW20/11	Lot 64 - boundary	30/03/2023	gas	0.00	0.00	3.7	0	0.1	0	0.1	-	-	-	21	0.00	0.00	0.00	0.00	1	1	Very low risk
MW20/17	Lot 64 - boundary	30/03/2023	gas	0.00	0.00	4.4	0	0.2	0	0.2	-	-	-	20.6	0.00	0.00	0.00	0.00	1	1	Very low risk
MW12/01	Lot 64 - waste mound	12/08/2022	gas	-5.30	5.30	1.3	48.1	13.8	46	15	<0.05	<0.14	<0.08	3.5	0.46	0.14	2.44	0.73	3	3	Moderate Risk
MW12/01	Lot 64 - waste mound	30/03/2023	gas	-7.40	7.40	56.4	32.9	19.8	32.9	19.8	-	-	-	3.4	0.33	0.20	2.43	1.47	3		
MW20/05	Lot 64 - waste mound	12/08/2022	gas	-9.80	9.80	4.7	81.6	13	48	8.2	<0.11	<0.27	<0.16	9.5	0.48	0.13	4.70	1.27	4	4	Moderate to High Risk
MW20/05	Lot 64 - waste mound	30/03/2023	gas	-0.10	0.10	74.5	74.6	35.7	74.6	35.7	-	-	-	11.7	0.75	0.36	0.07	0.04	2		
MW20/06	Lot 64 - waste mound	12/08/2022	gas	0.00	0.00	16	8.8	0.9	27	1.2	<0.04	<0.1	<0.06	14	0.27	0.01	0.00	0.00	2	2	Low Risk
MW20/06	Lot 64 - waste mound	30/03/2023	gas	-1.20	1.20	43.7	47.9	1.6	47.9	1.6	-	-	-	11.7	0.48	0.02	0.57	0.02	2		
MW20/07	Lot 64 - waste mound	12/08/2022	gas	-4.10	4.10	11.4	28.1	3.9	47	6.7	<0.05	<0.13	<0.08	3.7	0.47	0.04	1.93	0.16	3	3	Moderate risk
MW20/07	Lot 64 - waste mound	30/03/2023	gas	-1.10	1.10	8.7	39.5	1.7	39.5	1.7	-	-	-	11.3	0.40	0.02	0.43	0.02	2		
MW20/13	Lot 64 - waste mound	30/03/2023	gas	-2.40	2.40	35.6	29.4	1.4	29.4	1.4	-	-	-	14.7	0.29	0.01	0.71	0.03	3	3	Moderate Risk

Statistical Summary

Statistic	Borehole Flow Rate	Borehole Flow Rate (adjusted)	VOC	Methane (field)	Carbon Dioxide (field)	Methane	Carbon Dioxide (free)	Carbon Monoxide	Helium	Hydrogen	Oxygen	Methane %v/v	Carbon Dioxide %v/v	Methane GSV	Carbon Dioxide GSV	Characteristic Situation / Adopted CS	Adopted Risk Classification
Number of Results	20	20		20	20	20	20	20	20	20	19	20	20	20	20		0
Number of Detects	20	20		18	20	16	18	12	12	12	19	20	20	20	20		0
Minimum Concentration	-9.8	0		0	0.1	0	<0.07	<0.04	<0.1	<0.06	3.4	0	0.0008	0	0		99999
Minimum Detect	ND	0.1		8.8	0.1	27	0.1	ND	ND	ND	3.4	0.0012	0.0008	0.00013	0.00008		ND
Maximum Concentration	0.1	9.8		81.6	35.7	74.6	35.7	<0.11	<0.27	<0.16	21	0.746	0.357	4.704	1.4652		0
Maximum Detect	0.1	9.8		81.6	35.7	74.6	35.7	ND	ND	ND	21	0.746	0.357	4.704	1.4652		ND
Average Concentration	-1.6	1.6		20	5.4	20	5.3	0.028	0.072	0.043	14	0.2	0.054	0.66	0.19		
Median Concentration	-0.1	0.1		0.05	1.25	0.0675	1.25	0.025	0.065	0.04	14	0.00135	0.0125	0.000065	0.00215		
Standard Deviation	2.8	2.8		27	9.1	24	9	0.011	0.026	0.016	6.9	0.24	0.091	1.3	0.44		
Number of Guideline Exceedances	0	0		0	0	0	0	0	0	0	0	0	0	0	0		0
Number of Guideline Exceedances(Detects Only)	0	0		0	0	0	0	0	0	0	0	0	0	0	0		0

Notes:

1 Borehole flow rates recorded as negative due to atmospheric pressure to well pressure differential at time of monitoring, therefore flow has been adjusted assuming positive flow of the same magnitude may also occur.

Appendix C-5 Tables from the Baseline GME

Well ID	Stage	Gauging Date	TOC Elevation (mAHD)	Total Measured Depth (mbTOC)	Depth to LNAPL (mbTOC)	Depth to Water (mbTOC)	LNAPL Thickness (m)	Corrected Depth to Water (mbTOC)	Corrected Water Elevation (mAHD)	Well Condition/Comments
BH210	2	23-Nov-23	3.758	-	-	1.462	-	1.462	2.296	No odour
MW12/01	2	23-Nov-23	6.040	-	2.085	-	-	-	-	LNAPL on probe
MW20/01A	2	23-Nov-23	4.412	-	-	2.055	-	2.055	2.357	
MW20/01B	2	23-Nov-23	4.472	9.985	-	2.616	-	2.616	1.856	
MW20/02A	2	23-Nov-23	4.018	-	-	0.518	-	0.518	3.500	
MW20/02B	2	23-Nov-23	3.979	7.580	-	1.868	-	1.868	2.111	
MW20/03	2	23-Nov-23	5.930	5.865	-	3.254	-	3.254	2.676	Hydrocarbon odour
MW20/04	2	23-Nov-23	6.215	5.970	-	5.201	-	5.201	1.014	No odour
MW20/05	2	23-Nov-23	5.382	-	-	3.313	-	3.313	2.069	Bubbling in gatic water. LNAPL on probe.
MW20/06	2	23-Nov-23	5.477	-	3.270	-	-	-	-	LNAPL on probe
MW20/07	2	23-Nov-23	5.725	-	3.721	-	-	-	-	LNAPL on probe
MW20/08	2	23-Nov-23	4.876	-	-	3.386	-	3.386	1.490	No odour
MW20/09	2	23-Nov-23	4.864	-	-	3.575	-	3.575	1.289	No odour
MW20/10	2	23-Nov-23	4.697	-	-	2.983	-	2.983	1.714	No odour
MW20/11	2	23-Nov-23	3.949	-	-	3.533	-	3.533	0.416	No odour
MW20/12	2	23-Nov-23	4.368	-	-	3.425	-	3.425	0.943	No odour
MW20/13	2	23-Nov-23	6.016	-	-	3.009	-	3.009	3.007	Hydrocarbon odour, LNAPL on probe.
MW20/14	2	23-Nov-23	4.810	-	-	3.524	-	3.524	1.286	No odour
MW20/15	2	23-Nov-23	4.825	-	-	3.556	-	3.556	1.269	No odour
MW20/16	2	23-Nov-23	3.482	-	-	3.076	-	3.076	0.406	No odour
MW20/17	2	23-Nov-23	4.051	-	-	3.554	-	3.554	0.497	No odour
MW20/18	2	23-Nov-23	3.629	-	-	2.953	-	2.953	0.676	No odour
MW94/6	2	23-Nov-23	2.566	-	-	3.170	-	3.170	-0.604	No odour. Well cap

Notes:

TOC = Top of Casing

BTOC = Below Top of Casing

mAHD = metres Australian Height Datum

m = meters

NA - Not Available

"-" = No Survey Data

Well ID	Stage	Sample Date/Time	pH	EC (μScm-¹)	TEMP (°C)	DO (mg/L)	Eh (mV)	Comments
MW20/01A	2	23/11/2023 11:19	7.04	6395	24.4	2.03	-122.2	low to medium turbidity, brown-grey, no odour, no sheen.
MW20/02A	2	23/11/2023 12:17	4.93	9941	25.3	8.73	103.1	low turbidity, clear, and brown to bottom, no odour, no sheen.
MW20/03	2	24/11/2023 11:48	7.31	11153	20.6	1.48	-134.1	high quantity of suspended solids, hydrocarbon odour, sheen.
MW20/04	2	24/11/2023 11:56	6.57	15617	19.8	2.8	-97.8	low turbidity, black suspended solids, yellow brown, no odour, no sheen.
MW20/08	2	23/11/2023 15:06	6.06	26544	21.9	2.87	-54.4	low turbidity, clear, organic odour, no sheen. Limited sample volume.
MW20/09	2	23/11/2023 15:41	5.96	27467	20.8	1.37	-59.9	low turbidity, pale yellow brown, organic smell, no sheen.
MW20/10	2	24/11/2023 09:20	5.90	25577	19.9	1.04	-78.6	low turbidity, pale yellow, organic odour, no sheen
MW20/11	2	24/11/2023 10:21	6.42	25487	19.9	2.02	-60.2	medium turbidity, pale yellow, organic odour, no sheen, silt at bottom of sleeve.
MW20/12	2	24/11/2023 10:57	6.58	32163	21.0	2.26	-72.2	high turbidity, brown, no odour, no sheen, bailed sample.
MW20/14	2	23/11/2023 15:39	6.56	7784	21.3	3.20	-99.6	low turbidity, clear, black suspended solids, no sheen, organic odour.
MW20/15	2	24/11/2023 09:09	5.04	30423	20.5	2.63	24.2	low turbidity, pale orange, no sheen, organic odour.
MW20/16	2	24/11/2023 09:57	6.70	35933	20.8	1.05	-112.7	medium turbidity, brown yellow, organic odour, no sheen.
MW20/17	2	24/11/2023 10:33	6.14	11872	20.9	0.98	-20.0	medium turbdity, dark grey/light silt at bottom, organic odour, no sheen.
MW20/18	2	24/11/2023 11:02	6.78	26172	21	1.08	-75.5	clear to pale yellow, organic odour, no sheen, sediment at bottom of sleeve.
BH210	2	23/11/2023 13:35	4.13	18315	22.6	2.68	273.2	low to medium turbidity, light brown, no odour, no sheen.
MW94/6	2	24/11/2023 00:00	-	-	-	-	-	Limited sample volume for parameters. Low turbidity, pale yellow, black suspended solids, organic odour, no sheen.

Notes:

Pre	Pre Purging	Eh	Redox
Post	Post Purging	mV	millivolts
DO	Dissolved Oxygen	L	Litres
mg/L	milligrams per litre	-	No Data
EC	Electrical Conductivity		
μScm^{-1}	microsiemens per centimetre		

						MNA				TRH Silica Gel Cleanup									BTEX							Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)						
						Ferrous Iron - Fe2+	Methane	Nitrate (as N)	Sulphate (Filtered)	TRH >C10-C16 Fraction SG less Naphthalene	TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C10-C40 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36	TRH >C34-C40 Silica Gel Cleanup	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH (NEPM) C>10-40 Sum	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C34-C40 Fraction
						mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	MG/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						0.05	0.01	0.01	1	100	50	100	50	100	100	100	50	100	1	1	1	1	2	2	1	0.004	20	50	100	50	50	0.1	20	20	50	50	100	100
ANZG (2018) Marine Water - Slightly to moderately disturbed ecosystems																			500	180	80	350				50												
Clyde WARP SSTL - GW VI - Commercial																			5000							13000								6200		NL		
Clyde WARP SSTL - GW VI - Construction																			NL							NL							-	NL	-	NL	-	-
Clyde WARP SSTL - GW VI - IMW																			NL							NL							-	NL	-	NL	-	-
NEPM (2013) - Marine Water																			500							50												
NEPM (2013) - Recreational									5000										10	8000	3000			6000														
Field_ID	Lab_Report_Number	Sample_Type	Location_Code	Alternative_Name	Sampled_Date_Time																																	
BH210	ES2340937	Normal	BH210	Road alignment - AA3	23/11/2023	3.31	<0.01	<0.01	706	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<5 - 0.009	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
T01-231123	1047979	Normal	BH210	Road alignment - AA3	23/11/2023	3.5	<0.05	<0.01	1300	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1	<2	<3	-	<0.02	<20	220	400	200	820	0.82	<20	<20	220	220	600	<100
MW20/01A	ES2340937	Normal	MW20/01A	Lot 64	23/11/2023	6.79	3.36	0.02	50	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	320	<50	320	0.26	<20	<20	<100	<100	260	<100
MW20/02A	ES2340937	Normal	MW20/02A	Lot 64	23/11/2023	68.4	<0.01	<0.01	495	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
D01_231123	ES2340937	Field_D	MW20/02A	Lot 64	23/11/2023	74.8	0.012	<0.01	464	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<5 - 0.006	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW20/03	ES2340937	Normal	MW20/03	Lot 64	24/11/2023	3.31	12.1	<0.01	9	<100	<50	<100	<50	<100	<100	<100	<50	<100	3	<2	4	2	6	8	15	4.73 - 19	120	240	2070	<50	2310	2.39	150	140	640	620	1750	<100
MW20/04	ES2340937	Normal	MW20/04	Lot 64	23/11/2023	119	0.272	0.03	744	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	110	560	<50	670	0.71	<20	<20	200	200	510	<100
MW20/08	ES2340937	Normal	MW20/08	Lot 64	23/11/2023	62.1	0.072	0.04	1940	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW20/09	ES2340937	Normal	MW20/09	Lot 64	23/11/2023	359	0.014	<0.01	2450	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	260	<50	260	0.27	<20	<20	<100	<100	270	<100
MW20/10	ES2340937	Normal	MW20/10	Lot 64	24/11/2023	196	0.318	<0.01	603	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW20/11	ES2340937	Normal	MW20/11	Lot 64	24/11/2023	40.6	0.034	<0.01	4460	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	80	250	<50	330	0.3	<20	<20	110	110	190	<100
MW20/12	ES2340937	Normal	MW20/12	Lot 64	24/11/2023	22.8	<0.01	<0.01	1420	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	220	<50	220	0.2	<20	<20	<100	<100	200	<100
MW20/14	ES2340937	Normal	MW20/14	Lot 64	23/11/2023	22.7	0.014	<0.01	1620	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	520	<50	520	0.52	<20	<20	<100	<100	520	<100
MW20/15	ES2340937	Normal	MW20/15	Lot 64	24/11/2023	136	0.032	<0.01	2880	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW20/16	ES2340937	Normal	MW20/16	Lot 64	24/11/2023	54.6	0.192	<0.01	2270	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<60	<100	<60	<60	<0.1	<20	<20	<100	<100	<100	<100
MW20/17	ES2340937	Normal	MW20/17	Lot 64	24/11/2023	11.9	0.101	<0.01	742	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW20/18	ES2340937	Normal	MW20/18	Lot 64	24/11/2023	11.3	<0.01	0.11	1420	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
MW94/6	ES2340937	Normal	MW94/6	Lot 64	24/11/2023	39.9	0.19	0.27	1700	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	120	<50	120	0.12	<20	<20	<100	<100	120	<100

Statistical Summary

Number of Results	18	18	18	18	17	17	17	17	17	17	17	17	17	18	18	18	18	18	18	17	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Number of Detects	18	13	5	18	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	3	1	4	9	1	9	9	1	1	4	4	9	0
Minimum Concentration	3.31	<0.01	<0.01	9	<100	<50	<100	<50	<100	<100	<100	<50	<100	<1	<1	<1	<1	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20	<100	<100	<100	<100
Minimum Detect	3.31	0.012	0.02	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	3	ND	4	2	6	8	15	4.73	120	80	120	200	120	0.12	150	140	110	110	120	ND
Maximum Concentration	359	12.1	0.27	4460	<100	<50	<100	<50	<100	<100	<100	<50	<100	3	<2	4	2	6	8	15	19	120	240	2070	200	2310	2.39	150	140	640	620	1750	<100
Maximum Detect	359	12.1	0.27	4460	ND	ND	ND	ND	ND	ND	ND	ND	ND	3	ND	4	2	6	8	15	19	120	240	2070	200	2310	2.39	150	140	640	620	1750	ND
Average Concentration	69	0.93	0.03	1404	50	25	50	25	50	50	50	25	50	0.64	0.97	1.1	1	1.3	1.4	1.4	0.8	16	56	287	35	322	0.34	18	17	104	103	271	50
Median Concentration	40.25	0.033	0.005	1360	50	25	50	25	50	50	50	25	50	0.5	1	1	1	1	1	0.5	0.002	10	25	85	25	75	0.085	10	10	50	50	85	50
Standard Deviation	90	2.9	0.065	1119	0	0	0	0	0	0	0	0	0	0.59	0.12	0.72	0.27	1.2	1.6	3.5	2.8	26	67	477	41	553	0.57	33	31	144	139	412	0
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	18	18	18
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	18	18	18

ERM

	Metals					
	Chromium	Chromium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	1	1	5	1	5	1
ANZG (2018) Marine Water - Slightly to moderately disturbed ecosystems	4.4|27	4.4|27				
NEPM (2013) - Marine Water			4.4	4.4	27	27
NEPM (2013) - Recreational			500	500		
NHMRC (2008) Recommended Recreational Guidelines - Health	500	500	500	500		

Field_ID	Lab_Report_Number	Sample_Type	Location_Code	Alternative_Name	Sampled_Date_Time	Chromium	Chromium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)
BH210	ES2340937	Normal	BH210	Road alignment - AA3	23/11/2023	-	<1	-	<1	-	<1
T01-231123	1047979	Normal	BH210	Road alignment - AA3	23/11/2023	<1	-	<5	-	<5	-
MW20/01A	ES2340937	Normal	MW20/01A	Lot 64	23/11/2023	-	6	-	<1	-	6
MW20/02A	ES2340937	Normal	MW20/02A	Lot 64	23/11/2023	-	<1	-	<1	-	<1
D01_231123	ES2340937	Field_D	MW20/02A	Lot 64	23/11/2023	-	<1	-	<1	-	<1
MW20/03	ES2340937	Normal	MW20/03	Lot 64	24/11/2023	-	4	-	<1	-	4
MW20/04	ES2340937	Normal	MW20/04	Lot 64	23/11/2023	-	1	-	<1	-	1
MW20/08	ES2340937	Normal	MW20/08	Lot 64	23/11/2023	-	<1	-	<1	-	<1
MW20/09	ES2340937	Normal	MW20/09	Lot 64	23/11/2023	-	3	-	<10	-	<10
MW20/10	ES2340937	Normal	MW20/10	Lot 64	24/11/2023	-	<1	-	<10	-	<10
MW20/11	ES2340937	Normal	MW20/11	Lot 64	24/11/2023	-	<10	-	<1	-	<10
MW20/12	ES2340937	Normal	MW20/12	Lot 64	24/11/2023	-	<10	-	<1	-	<10
MW20/14	ES2340937	Normal	MW20/14	Lot 64	23/11/2023	-	1	-	2	-	<1
MW20/15	ES2340937	Normal	MW20/15	Lot 64	24/11/2023	-	<10	-	<10	-	<10
MW20/16	ES2340937	Normal	MW20/16	Lot 64	24/11/2023	-	<10	-	<1	-	<10
MW20/17	ES2340937	Normal	MW20/17	Lot 64	24/11/2023	-	1	-	<1	-	1
MW20/18	ES2340937	Normal	MW20/18	Lot 64	24/11/2023	-	7	-	<1	-	7
MW94/6	ES2340937	Normal	MW94/6	Lot 64	24/11/2023	-	<10	-	<1	-	<10

Statistical Summary

	Chromium	Chromium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)
Number of Results	1	17	1	17	1	17
Number of Detects	0	7	0	1	0	5
Minimum Concentration	<1	<1	<5	<1	<5	<1
Minimum Detect	ND	1	ND	2	ND	1
Maximum Concentration	<1	<10	<5	<10	<5	<10
Maximum Detect	ND	7	ND	2	ND	7
Average Concentration		3		1.4		3.3
Median Concentration	0.5	3	2.5	0.5	2.5	5
Standard Deviation		2.4		1.8		2.4
Number of Guideline Exceedances	0	0	1	3	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0

	Benzo(b+j) & Benzo(k)fluoranthene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total)
	PAH/Phenols																					
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.004	0.002	0.004	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.004	0.002	0.004	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001
ANZG (2018) Marine Water - Slightly to moderately disturbed ecosystems						0.01		0.1									1			0.6		
NHMRC (2008) Recommended Recreational Guidelines - Health				20000		1500		0.1										10000|100000		1500	1500	

Field_ID	Lab_Report_Number	Sample_Type	Location_Code	Alternative_Name	Sampled_Date_Time	Benzo(b+j) & Benzo(k)fluoranthene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total)
BH210	ES2340937	Normal	BH210	Road alignment - AA3	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	0.009
T01-231123	1047979	Normal	BH210	Road alignment - AA3	23/11/2023	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
MW20/01A	ES2340937	Normal	MW20/01A	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/02A	ES2340937	Normal	MW20/02A	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
D01_231123	ES2340937	Field_D	MW20/02A	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	0.006
MW20/03	ES2340937	Normal	MW20/03	Lot 64	24/11/2023	<0.004	1.22	<0.004	0.284	0.411	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	0.017	<0.002	<0.002	<0.001	5.44
MW20/04	ES2340937	Normal	MW20/04	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/08	ES2340937	Normal	MW20/08	Lot 64	23/11/2023	<0.004	0.006	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	0.006	<0.001	0.006
MW20/09	ES2340937	Normal	MW20/09	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/10	ES2340937	Normal	MW20/10	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/11	ES2340937	Normal	MW20/11	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/12	ES2340937	Normal	MW20/12	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/14	ES2340937	Normal	MW20/14	Lot 64	23/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/15	ES2340937	Normal	MW20/15	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/16	ES2340937	Normal	MW20/16	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/17	ES2340937	Normal	MW20/17	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW20/18	ES2340937	Normal	MW20/18	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
MW94/6	ES2340937	Normal	MW94/6	Lot 64	24/11/2023	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001

Statistical Summary

Statistical Summary	Benzo(b+j) & Benzo(k)fluoranthene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Phenanthrene	Pyrene	PAHs (Sum of total)
Number of Results	17	17	17	18	18	18	18	18	17	17	17	18	18	18	18	18	18	18	18	18	18	18
Number of Detects	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	4
Minimum Concentration	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001
Minimum Detect	ND	0.006	ND	0.284	0.411	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND	0.006	ND	0.006
Maximum Concentration	<0.004	1.22	<0.004	0.284	0.411	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.017	<0.01	<0.01	<0.01	5.44
Maximum Detect	ND	1.22	ND	0.284	0.411	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND	0.006	ND	5.44
Average Concentration	0.002	0.073	0.002	0.017	0.024	0.00075	0.0012	0.00075	0.0005	0.0005	0.0005	0.0022	0.0012	0.0022	0.00075	0.00075	0.00075	0.0021	0.0012	0.0015	0.00075	0.3
Median Concentration	0.002	0.001	0.002	0.001	0.001	0.0005	0.001	0.0005	0.0005	0.0005	0.0005	0.002	0.001	0.002	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.0005	0.0005
Standard Deviation	0	0.3	0	0.067	0.097	0.0011	0.00094	0.0011	0	0	0	0.00071	0.00094	0.00071	0.0011	0.0011	0.0011	0.0038	0.00094	0.0015	0.0011	1.3
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Field_ID	Lab_Report_Number	Sample_Type	Location_Code	Alternative_Name	Sampled_Date_Time	PFAS - Fluorotelomer Sulfonates				PFAS - Long Chain PFCA						
						4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						0.01	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
ANZG (2023) Draft Marine - High ecological/conservation value (99% LOSP)																
ANZG (2023) Draft Marine - Slightly to moderately disturbed (95% LOSP)																
NHMRC (2019) HBGV - Recreational Water										10						
BH210	ES2340937	Normal	BH210	Road alignment - AA3	23/11/2023	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
D01_231123	ES2340937	Field_D	MW20/02A	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/01A	ES2340937	Normal	MW20/01A	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/02A	ES2340937	Normal	MW20/02A	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/03	ES2340937	Normal	MW20/03	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.03	0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/04	ES2340937	Normal	MW20/04	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	0.04	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/08	ES2340937	Normal	MW20/08	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/09	ES2340937	Normal	MW20/09	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/10	ES2340937	Normal	MW20/10	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/11	ES2340937	Normal	MW20/11	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.09	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/12	ES2340937	Normal	MW20/12	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/14	ES2340937	Normal	MW20/14	Lot 64	23/11/2023	<0.05	<0.05	<0.05	<0.05	0.01	0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/15	ES2340937	Normal	MW20/15	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.06	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/16	ES2340937	Normal	MW20/16	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.08	0.03	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/17	ES2340937	Normal	MW20/17	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.13	0.06	<0.02	<0.02	<0.02	<0.05	<0.02
MW20/18	ES2340937	Normal	MW20/18	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02
MW94/6	ES2340937	Normal	MW94/6	Lot 64	24/11/2023	<0.05	<0.05	<0.05	<0.05	0.04	0.02	<0.02	<0.02	<0.02	<0.05	<0.02
T01-231123	1047979	Normal	BH210	Road alignment - AA3	23/11/2023	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Field_ID	PFAS - Long Chain PFSA							PFAS - Short Chain PFCA			
	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorononanesulfonic acid (PFNS)	Perfluorodecanesulfonic acid (PFDS)	Perfluoropropanesulfonic acid (PFPrS)	Sum of PFHxS and PFOS	Perfluorobutanoic acid	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.01	0.01	0.01
ANZG (2023) Draft Marine - High ecological/conservation value (99% LOSP)			**0.0091**								
ANZG (2023) Draft Marine - Slightly to moderately disturbed (95% LOSP)			0.48								
NHMRC (2019) HBGV - Recreational Water	2		2				2				
BH210	<0.01	<0.02	**<0.01**	-	<0.02	-	<0.01	<0.1	<0.02	<0.02	<0.02
D01_231123	<0.01	<0.02	**<0.01**	-	<0.02	-	<0.01	<0.1	<0.02	<0.02	<0.02
MW20/01A	0.03	<0.02	**0.03**	-	<0.02	-	0.06	<0.1	<0.02	<0.02	<0.02
MW20/02A	<0.01	<0.02	**<0.01**	-	<0.02	-	<0.01	<0.1	<0.02	<0.02	<0.02
MW20/03	0.06	<0.02	**0.1**	-	<0.02	-	0.16	<0.1	<0.02	0.03	<0.02
MW20/04	0.81	<0.02	**0.09**	-	<0.02	-	0.9	<0.1	<0.02	0.22	0.06
MW20/08	0.1	<0.02	**0.02**	-	<0.02	-	0.12	<0.1	<0.02	0.04	0.02
MW20/09	0.06	<0.02	**<0.01**	-	<0.02	-	0.06	<0.1	<0.02	0.02	<0.02
MW20/10	<0.01	<0.02	**<0.01**	-	<0.02	-	<0.01	<0.1	<0.02	<0.02	<0.02
MW20/11	0.9	<0.02	**<0.01**	-	<0.02	-	0.9	<0.1	0.1	0.19	0.11
MW20/12	0.08	<0.02	**0.04**	-	<0.02	-	0.12	<0.1	<0.02	<0.02	<0.02
MW20/14	0.06	<0.02	**0.11**	-	<0.02	-	0.17	<0.1	<0.02	<0.02	<0.02
MW20/15	0.3	<0.02	**<0.01**	-	<0.02	-	0.3	<0.1	0.08	0.1	0.07
MW20/16	0.69	<0.02	**0.08**	-	<0.02	-	0.77	<0.1	<0.02	0.24	0.08
MW20/17	0.8	<0.02	**0.41**	-	<0.02	-	1.21	<0.1	<0.02	0.18	0.13
MW20/18	0.08	<0.02	**0.1**	-	<0.02	-	0.18	<0.1	<0.02	0.02	<0.02
MW94/6	0.3	<0.02	**0.08**	-	<0.02	-	0.38	<0.1	<0.02	0.04	0.02
T01-231123	<0.01	<0.01	**<0.01**	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01

Field_ID	PFAS - Short Chain PFSA		PFAS - Sulfonamides							PFAS Sums			
	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (N-Me-FOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorooctanesulfonamide (PFOSA)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of US EPA PFAS (PFOS + PFOA)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.01	0.01	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.01	0.01	0.01	0.01
ANZG (2023) Draft Marine - High ecological/conservation value (99% LOSP)													
ANZG (2023) Draft Marine - Slightly to moderately disturbed (95% LOSP)													
NHMRC (2019) HBGV - Recreational Water													
BH210	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-
D01_231123	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-
MW20/01A	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.07	0.07	-
MW20/02A	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-
MW20/03	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.24	0.22	-
MW20/04	0.12	0.11	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.45	1.34	-
MW20/08	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.19	0.19	-
MW20/09	0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.11	0.11	-
MW20/10	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-
MW20/11	0.2	0.12	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.71	1.59	-
MW20/12	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.12	0.12	-
MW20/14	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.2	0.18	-
MW20/15	0.06	0.03	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.7	0.67	-
MW20/16	0.08	0.07	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.35	1.25	-
MW20/17	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.71	1.65	-
MW20/18	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.22	0.22	-
MW94/6	0.04	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.54	0.52	-
T01-231123	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.1	<0.05	<0.01

Statistical Summary

Statistical Summary	4:2 FTS	6:2 FtS	8:2 FTS	10:2 FTS	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFTeDA	PFTrDA
Number of Results	18	18	18	18	18	18	18	18	18	18	18
Number of Detects	0	0	0	0	12	5	0	0	0	0	0
Minimum Concentration	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Minimum Detect	ND	ND	ND	ND	0.01	0.02	ND	ND	ND	ND	ND
Maximum Concentration	<0.05	<0.05	<0.05	<0.05	0.13	0.06	<0.02	<0.02	<0.02	<0.05	<0.02
Maximum Detect	ND	ND	ND	ND	0.13	0.06	ND	ND	ND	ND	ND
Average Concentration	0.024	0.025	0.024	0.024	0.031	0.015	0.0097	0.0097	0.0097	0.024	0.0097
Median Concentration	0.025	0.025	0.025	0.025	0.01	0.01	0.01	0.01	0.01	0.025	0.01
Standard Deviation	0.0047	0	0.0047	0.0047	0.036	0.013	0.0012	0.0012	0.0012	0.0047	0.0012
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0

Statistical Summary	PFHxS	PFHpS	PFOS	PFNS	PFDS	PFPrS	Sum of PFHxS and PFOS	Perfluorobutanoic acid	PFPeA	PFHxA	PFHpA
Number of Results	18	18	18	1	18	1	18	18	18	18	18
Number of Detects	13	0	10	0	0	0	13	0	2	10	7
Minimum Concentration	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01
Minimum Detect	0.03	ND	0.02	ND	ND	ND	0.06	ND	0.08	0.02	0.02
Maximum Concentration	0.9	<0.02	0.41	<0.01	<0.02	<0.01	1.21	<0.1	0.1	0.24	0.13
Maximum Detect	0.9	ND	0.41	ND	ND	ND	1.21	ND	0.1	0.24	0.13
Average Concentration	0.24	0.0097	0.061		0.0097		0.3	0.049	0.019	0.064	0.033
Median Concentration	0.07	0.01	0.025	0.005	0.01	0.005	0.14	0.05	0.01	0.02	0.01
Standard Deviation	0.32	0.0012	0.096		0.0012		0.38	0.0059	0.026	0.083	0.039
Number of Guideline Exceedances	0	0	18	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	10	0	0	0	0	0	0	0	0

Statistical Summary	PFBS	PFPeS	NEtFOSA	EtFOSE	MeFOSA	N-Me-FOSE	N-Ethyl ... sulfonamidoacetic acid	N-Methyl ... sulfonamidoacetic acid	PFOSA	Sum of enHealth PFAS	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of US EPA PFAS
Number of Results	18	18	18	18	18	18	18	18	18	1	18	18	1
Number of Detects	6	4	0	0	0	0	0	0	0	0	13	13	0
Minimum Concentration	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
Minimum Detect	0.02	0.03	ND	ND	ND	ND	ND	ND	ND	ND	0.07	0.07	ND
Maximum Concentration	0.2	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	1.71	1.65	<0.01
Maximum Detect	0.2	0.12	ND	ND	ND	ND	ND	ND	ND	ND	1.71	1.65	ND
Average Concentration	0.035	0.026	0.025	0.025	0.025	0.025	0.011	0.011	0.011		0.48	0.45	
Median Concentration	0.01	0.01	0.025	0.025	0.025	0.025	0.01	0.01	0.01	0.005	0.195	0.185	0.005
Standard Deviation	0.052	0.036	0	0	0	0	0.0035	0.0035	0.0035		0.62	0.58	
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0

Chem_Group	ChemName	Units	EQL	ES2340937 MW20/02A 23/11/2023 11:59	ES2340937 D01_231123 23/11/2023 11:59	RPD	ES2340937 BH210 23/11/2023 13:37	1047979 T01-231123 23/11/2023 13:37	RPD
			Lab Report Number / Field ID / Sampled Date/Time						
MNA	Ferrous Iron - Fe2+	mg/l	0.05 : 0.5 (Interlab)	68.4	74.8	9	3.31	3.5	6
	Methane	mg/l	0.01 : 0.05 (Interlab)	<0.01	0.012	18	<0.01	<0.05	0
	Nitrate (as N)	mg/l	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Sulphate (Filtered)	mg/l	1	495	464	6			
PFAS - Fluorotelomer Sulfonates	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05 : 0.01 (Interlab)	<0.05	<0.05	0	<0.05	<0.01	0
	6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	8:2 Fluorotelomer sulfonate	µg/L	0.05 : 0.01 (Interlab)	<0.05	<0.05	0	<0.05	<0.01	0
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05 : 0.01 (Interlab)	<0.05	<0.05	0	<0.05	<0.01	0
PFAS - Long Chain PFCA	Perfluorooctanoate (PFOA)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Perfluorononanoic acid (PFNA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluorodecanoic acid (PFDA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluorododecanoic acid (PFDoA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05 : 0.01 (Interlab)	<0.05	<0.05	0	<0.05	<0.01	0
	Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
PFAS - Long Chain PFSA	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Sum of PFHxS and PFOS	µg/L	0.01	<0.01	<0.01	0	<0.01	<0.01	0
PFAS - Short Chain PFCA	Perfluorobutanoic acid	µg/L	0.1 : 0.05 (Interlab)	<0.1	<0.1	0	<0.1	<0.05	0
	Perfluoropentanoic acid (PFPeA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluorohexanoic acid (PFHxA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
PFAS - Short Chain PFSA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02 : 0.01 (Interlab)	<0.02	<0.02	0	<0.02	<0.01	0
PFAS - Sulfonamides	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	N-Methyl perfluorooctane sulfonamidoethanol (N-Me-FOSE)	µg/L	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.02 : 0.05 (Interlab)	<0.02	<0.02	0	<0.02	<0.05	0
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.02 : 0.05 (Interlab)	<0.02	<0.02	0	<0.02	<0.05	0
	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02 : 0.05 (Interlab)	<0.02	<0.02	0	<0.02	<0.05	0
PFAS Sums	Sum of PFAS	µg/L	0.01 : 0.1 (Interlab)	<0.01	<0.01	0	<0.01	<0.1	0
	Sum of PFAS (WA DER List)	µg/L	0.01 : 0.05 (Interlab)	<0.01	<0.01	0	<0.01	<0.05	0
TRH Silica Gel Cleanup	TRH >C10-C16 Fraction SG less Naphthalene	µg/L	100	<100	<100	0			
	TRH >C10-C14 Silica Gel Cleanup	µg/L	50	<50	<50	0			
	TRH >C10-C16 Silica Gel Cleanup	µg/L	100	<100	<100	0			
	TRH >C10-C36 Silica Gel Cleanup	µg/L	50	<50	<50	0			
	TRH >C10-C40 Silica Gel Cleanup	µg/L	100	<100	<100	0			
	TRH >C15-C28 Silica Gel Cleanup	µg/L	100	<100	<100	0			
	TRH >C16-C34 Silica Gel Cleanup	µg/L	100	<100	<100	0			
	TRH >C29-C36	µg/L	50	<50	<50	0			
	TRH >C34-C40 Silica Gel Cleanup	µg/L	100	<100	<100	0			
BTEX	Benzene	µg/L	1	<1	<1	0	<1	<1	0
	Toluene	µg/L	2 : 1 (Interlab)	<2	<2	0	<2	<1	0
	Ethylbenzene	µg/L	2 : 1 (Interlab)	<2	<2	0	<2	<1	0
	Xylene (o)	µg/L	2 : 1 (Interlab)	<2	<2	0	<2	<1	0
	Xylene (m & p)	µg/L	2	<2	<2	0	<2	<2	0
	Xylene Total	µg/L	2 : 3 (Interlab)	<2	<2	0	<2	<3	0
	BTEX	µg/L	1	<1	<1	0			
Naphthalene	Naphthalene	µg/L	5 : 10 (Interlab)	<5	<5	0	<5	<0.02	0
	Naphthalene	µg/L	0.004 : 10 (Interlab)	<0.004	0.006	40	0.009	<0.02	0
TRH NEPM (1999)	TRH C6-C9 Fraction	µg/L	20	<20	<20	0	<20	<20	0
	TRH >C10-C14 Fraction	µg/L	50	<50	<50	0	**<50**	**220**	**126**
	TRH >C15-C28 Fraction	µg/L	100	<100	<100	0	**<100**	**400**	**120**
	TRH >C29-C36 Fraction	µg/L	50 : 100 (Interlab)	<50	<50	0	**<50**	**200**	**120**
	TRH >C10-C36 Fraction	µg/L	50 : 100 (Interlab)	<50	<50	0	**<50**	**820**	**177**
TRH NEPM (2013)	TRH (NEPM) C>10-40 Sum	mg/l	0.1	<0.1	<0.1	0	**<0.1**	**0.82**	**157**
	TRH C6-C10 Fraction	µg/L	20	<20	<20	0	<20	<20	0
	TRH C6-C10 less BTEX	µg/L	20	<20	<20	0	<20	<20	0
	TRH >C10-C16 Fraction	µg/L	100 : 50 (Interlab)	<100	<100	0	<100	220	75
	TRH >C10-C16 Fraction less N	µg/L	100 : 50 (Interlab)	<100	<100	0	<100	220	75
	TRH >C16-C34 Fraction	µg/L	100	<100	<100	0	**<100**	**600**	**143**
	TRH >C34-C40 Fraction	µg/L	100	<100	<100	0	<100	<100	0
Metals	Chromium (Filtered)	µg/l	1	<1	<1	0			
	Chromium (hexavalent) (Filtered)	µg/l	1	<1	<1	0			
	Chromium (Trivalent) (Filtered)	µg/l	1	<1	<1	0			
PAH/Phenols	Benzo(b+j) & Benzo(k)fluoranthene	µg/L	0.004	<0.004	<0.004	0			
	2-methylnaphthalene	µg/L	0.002	<0.002	<0.002	0			
	3-methylcholanthrene	µg/L	0.004	<0.004	<0.004	0			
	Acenaphthene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Acenaphthylene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Anthracene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	Benz(a)anthracene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Benzo(a) pyrene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	Benzo(a)pyrene TEQ (half LOR)	µg/L	0.001	<0.001	<0.001	0			
	Benzo(a)pyrene TEQ (LOR)	µg/L	0.001	<0.001	<0.001	0			
	Benzo(a)pyrene TEQ (zero)	µg/L	0.001	<0.001	<0.001	0			
	Benzo(b&j)fluoranthene	µg/L	0.004 : 0.01 (Interlab)	<0.004	<0.004	0	<0.004	<0.01	0
	Benzo(g,h,i)perylene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Benzo(k)fluoranthene	µg/L	0.004 : 0.01 (Interlab)	<0.004	<0.004	0	<0.004	<0.01	0
	Chrysene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	Dibenz(a,h)anthracene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	Fluoranthene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	Fluorene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Indeno(1,2,3-c,d)pyrene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Phenanthrene	µg/L	0.002 : 0.01 (Interlab)	<0.002	<0.002	0	<0.002	<0.01	0
	Pyrene	µg/L	0.001 : 0.01 (Interlab)	<0.001	<0.001	0	<0.001	<0.01	0
	PAHs (Sum of total)	µg/L	0.001 : 0.01 (Interlab)	**<0.001**	**0.006**	**143**	0.009	<0.02	0
SVOC	7,12-dimethylbenz(a)anthracene	µg/L	0.001	<0.001	<0.001	0			
	Benzo(e)pyrene	µg/L	0.001	<0.001	<0.001	0			
	Coronene	µg/L	0.002	<0.002	<0.002	0			
	Perylene	µg/L	0.002	<0.002	<0.002	0			

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 100 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table 11. Trip Blanks and Rinsate Results Summary
Clyde WARP - Stage 2
Q4 2023 - 0712976

Chem_Group	ChemName	Units	EQL			
			Lab Report Number	ES2340937	ES2340937	ES2340937
			Field ID	R01_231123	Trip Blank	Trip Blank
			Sampled_Date/Time	23/11/2023 15:49	20/11/2023 10:34	20/11/2023 10:34
			Sample Type	Rinsate	Trip_B	Trip_B
BTEX	Benzene	µg/L	1	<1	<1	<1
	Toluene	µg/L	2	<2	<2	<2
	Ethylbenzene	µg/L	2	<2	<2	<2
	Xylene (o)	µg/L	2	<2	<2	<2
	Xylene (m & p)	µg/L	2	<2	<2	<2
	Xylene Total	µg/L	2	<2	<2	<2
	BTEX	µg/L	1	<1	<1	<1
Metals	Chromium (Filtered)	µg/l	0.001	<1		
	Chromium (hexavalent) (Filtered)	µg/l	0.001	<1		
	Chromium (Trivalent) (Filtered)	µg/l	1	<1		
MNA	Ferrous Iron - Fe2+	mg/l	0.05			
	Methane	mg/l	0.01			
	Nitrate (as N)	mg/l	0.01			
	Sulphate (Filtered)	mg/L	1			
Naphthalene	Naphthalene	µg/L	0.004	<5	<5	<5
PAH/Phenols	Benzo(b+j) & Benzo(k)fluoranthene	ug/L	0.004	**0.017**		
	2-methylnaphthalene	µg/L	0.002	**0.089**		
	3-methylcholanthrene	µg/L	0.004	**0.004**		
	Acenaphthene	µg/L	0.002	**0.013**		
	Acenaphthylene	µg/L	0.002	**0.004**		
	Anthracene	µg/L	0.001	**0.018**		
	Benz(a)anthracene	µg/L	0.002	**0.064**		
	Benzo(a) pyrene	µg/L	0.001	**0.017**		
	Benzo(a)pyrene TEQ (half LOR)	µg/L	0.001	**0.033**		
	Benzo(a)pyrene TEQ (LOR)	µg/L	0.001	**0.033**		
	Benzo(a)pyrene TEQ (zero)	µg/L	0.001	**0.033**		
	Benzo(b&j)fluoranthene	µg/L	0.004	**0.013**		
	Benzo(g,h,i)perylene	µg/L	0.002	**0.006**		
	Benzo(k)fluoranthene	µg/L	0.004	**0.004**		
	Chrysene	µg/L	0.001	**0.067**		
	Dibenz(a,h)anthracene	µg/L	0.001	**0.007**		
	Fluoranthene	µg/L	0.001	**0.04**		
	Fluorene	µg/L	0.002	**0.054**		
	Indeno(1,2,3-c,d)pyrene	µg/L	0.002	**0.006**		
	Phenanthrene	µg/L	0.002	**0.205**		
	Pyrene	µg/L	0.001	**0.076**		
	PAHs (Sum of total)	µg/L	0.001	**0.594**		
PFAS - Fluorotelomer Sulfonates	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05	<0.05		
	6:2 Fluorotelomer Sulfonate (6:2 FtS)	µg/L	0.05	<0.05		
	8:2 Fluorotelomer sulfonate	µg/L	0.05	<0.05		
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05	<0.05		
PFAS - Long Chain PFCA	Perfluorooctanoate (PFOA)	µg/L	0.01	<0.01		
	Perfluorononanoic acid (PFNA)	µg/L	0.02	<0.02		
	Perfluorodecanoic acid (PFDA)	µg/L	0.02	<0.02		
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.02	<0.02		
	Perfluorododecanoic acid (PFDoA)	µg/L	0.02	<0.02		
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	<0.05		
	Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	<0.02		
PFAS - Long Chain PFSA	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.01	<0.01		
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02	<0.02		
	Perfluorooctanesulfonic acid (PFOS)	µg/L	0.01	<0.01		
	Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02	<0.02		
	Sum of PFHxS and PFOS	µg/L	0.01	<0.01		
PFAS - Short Chain PFCA	Perfluorobutanoic acid	µg/L	0.1	<0.1		
	Perfluoropentanoic acid (PFPeA)	µg/L	0.02	<0.02		
	Perfluorohexanoic acid (PFHxA)	µg/L	0.02	<0.02		
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	<0.02		
PFAS - Short Chain PFSA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.02	<0.02		
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02	<0.02		
PFAS - Sulfonamides	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)	µg/L	0.05	<0.05		
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE	µg/L	0.05	<0.05		
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05	<0.05		
	N-Methyl perfluorooctane sulfonamidoethanol (N-Me-FOSE)	µg/L	0.05	<0.05		
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.02	<0.02		
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.02	<0.02		
	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.02	<0.02		
PFAS Sums	Sum of PFAS	µg/L	0.01	<0.01		
	Sum of PFAS (WA DER List)	µg/L	0.01	<0.01		
SVOC	7,12-dimethylbenz(a)anthracene	µg/L	0.001	<0.001		
	Benzo(e)pyrene	µg/L	0.001	**0.018**		
	Coronene	µg/L	0.002	<0.002		
	Perylene	µg/L	0.002	**0.002**		
TRH NEPM (1999)	TRH C6-C9 Fraction	µg/L	20	<20	<20	<20
	TRH >C10-C14 Fraction	µg/L	50	<50		
	TRH >C15-C28 Fraction	µg/L	100	<100		
	TRH >C29-C36 Fraction	µg/L	50	<50		
	TRH >C10-C36 Fraction	µg/L	50	<50		
TRH NEPM (2013)	TRH (NEPM) C>10-40 Sum	mg/l	0.1	<0.1		
	TRH C6-C10 Fraction	µg/L	20	<20	<20	<20
	TRH C6-C10 less BTEX	µg/L	20	<20	<20	<20
	TRH >C10-C16 Fraction	µg/L	100	<100		
	TRH >C10-C16 Fraction less N	µg/L	100	<100		
	TRH >C16-C34 Fraction	µg/L	100	<100		
	TRH >C34-C40 Fraction	µg/L	100	<100		
TRH Silica Gel Cleanup	TRH >C10-C16 Fraction SG less Naphthalene	µg/L	100			
	TRH >C10-C14 Silica Gel Cleanup	µg/L	50			
	TRH >C10-C16 Silica Gel Cleanup	µg/L	100			
	TRH >C10-C36 Silica Gel Cleanup	µg/L	50			
	TRH >C10-C40 Silica Gel Cleanup	µg/L	100			
	TRH >C15-C28 Silica Gel Cleanup	µg/L	100			
	TRH >C16-C34 Silica Gel Cleanup	µg/L	100			
	TRH >C29-C36	µg/L	50			
	TRH >C34-C40 Silica Gel Cleanup	µg/L	100			

ERM

SampleCode	Field_ID	Sampled_Date_Time	ChemName	Concentration	Output Unit	Control	Recovery (%)	Within Acceptable Range?	Lab_Report_Number	Sample_Type	Matrix_Type	Matrix_State
ES2340643010	TS10_231122-1	21/11/2023 11:18	Ethylbenzene	17	µg/L	20	85%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Xylene (m & p)	19	µg/L	20	95%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Toluene	18	µg/L	20	90%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Xylene Total	40	µg/L	40	100%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Benzene	17	µg/L	20	85%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Naphthalene	18	µg/L	20	90%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	Xylene (o)	21	µg/L	20	105%	Yes	ES2340643	Trip_S	water	liquid
ES2340643010	TS10_231122-1	21/11/2023 11:18	BTEX	92	µg/L	100	92%	Yes	ES2340643	Trip_S	water	liquid

Well ID	Benzene	TRH C6-C9 Fraction	TRH C10-C36 Silica Gel
BH210	ND	Decreasing Trend #4	ND
MW20/01A	ND	ND	ND
MW20/02A	ND	ND	ND
MW20/03	No Trend #2	No Trend #2	No Trend #4
MW20/04	ND	ND	No Trend #4
MW20/08	ND	ND	ND
MW20/09	ND	ND	No Trend #4
MW20/10	ND	No Trend #4	No Trend #4
MW20/11	ND	ND	No Trend #4
MW20/12	No Trend #4	No Trend #4	ND
MW20/14	ND	ND	ND
MW20/15	ND	ND	ND
MW20/16	ND	ND	ND
MW20/17	ND	ND	No Trend #4
MW20/18	ND	ND	ND
MW94/6	ND	No Trend #4	ND

Notes	
#1	Historical Maximum concentration noted
#2	Concentrations less than historical maximum
#3	First detection of this COPC
#4	Concentrations of this analyte were not detected above the laboratory limit of reporting during the Q4 2023 WARP Stage 2 GME
#5	Increasing trends were reported based on an overall upward trend in the dataset. However, reported concentrations during recent GME were below the historical maximum of the dataset and generally consistent with recent events.
ND	Concentrations have been consistently reported below the laboratory limit of reporting throughout the period of data collection

Appendix C-4 Tables from the Stage 2 AA4 Validation

Level 14
207 Kent Street
Sydney, NSW, 2000

T: +61 2 8584 8888
erm.com

Adam Speers

Viva Energy Australia

DATE
24 April 2024

SUBJECT
Lot 64 – Asbestos Clearance Certificate

REFERENCE
0561182 – Lot 64 Validation Report

Dear Adam,

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Viva Energy Australia Pty Ltd (Viva Energy) to prepare this Asbestos Clearance Certificate for the 'Proposed Lot 64' Site, located, located at 9 Devon Street, Rosehill (Herein referred to as 'the Site'.

Asbestos Clearance Certificate	
Requested By	Mr Adam Speers
Inspection Details	Asbestos Clearance – Visual Inspection and Air Monitoring
Site Address	9 Devon St, Rosehill, NSW. Refer to *Figure 1, Attachment A.*
Work Areas	Proposed Lot 64 capping area. Refer to *Figure 2, Attachment A.*

Removal Work Details	
Date of Removal Works	15 to 22 April 2024
What type of asbestos removal was undertaken?	Excavation and reworking of contaminated soil material suspected to contain bonded asbestos containing materials (ACM) based on historical waste burial activities within the Site. Refer to *Attachment C – Photolog.*
Details of specific asbestos remediation works area(s)	The excavation of anchor trenches and stormwater pits into asbestos contaminated fill and reworking into the southern battered edge of the Proposed Lot 64. Site details have been provided in *Figure 3, Attachment A.*
Name of Licensed Asbestos Removalist	EnviroPacific Services Pty Ltd (EPS).

Removal Work Details	
Name and Contact Details of Removal Supervisor	Dane Magnus EnviroPacific Services 0408 012 107

Inspection Details	
Type of Clearance being issued	Asbestos Clearance Certification – Suitable to reoccupy area
Date and time of Final Clearance inspection	22 April 2024 5:00:00 PM
Details of person undertaking clearance inspection	Shane Williams of ERM Services – Licensed Asbestos Assessor (No. LAA000128) Ph: 0412 804 841
Details of Inspection Methodologies	Visual inspection of area

Visual Inspection	YES	NO
The transit route and waste routes are free from any visible asbestos?	X	
Inspection of the specified asbestos works area found no visible asbestos to be present following asbestos removal works?	X	
Can the area be safely accessed?	X	

Asbestos Removal Documents	YES	NO
Did you receive a copy of the asbestos removal control plan (ARCP)?	X	
Did you receive a copy of the regulatory notification form? (SafeWork NSW)	X	
Is the asbestos removal work consistent with the ARCP and notification form?	X	

Airborne Asbestos Fibre Monitoring	YES	NO
Was air monitoring undertaken by a Competent person or a qualified asbestos assessor?	X	
Has the air monitoring sample been analysed by a NATA accredited laboratory? Refer to *Attachment B – Air Monitoring Reports*	X	
Were the results of the air monitoring below 0.01 fibres/ml?	X	

Airborne Asbestos Fibre Monitoring	**YES**	**NO**
Is the air monitoring report included in the Asbestos Clearance Report?	X	
Is the area suitable for access?	X	

On completion of the asbestos excavation and filling works by the asbestos contractor on 23 April 2024, ERM undertook an asbestos clearance inspection in accordance with SafeWork NSW, Section 3.10 "Clearance Inspection" in the *How to Safely Remove Asbestos Code of Practice* (2022) to visually clear the work area within the Proposed Lot 64 area as presented in *Attachment C - Photolog*.

Following excavation and landforming of asbestos contaminated fill beneath the Proposed Lot 64 area, visual inspection for asbestos materials was undertaken at the ground surface, with no visible asbestos containing materials identified.

Airborne asbestos monitoring was undertaken during excavation works and following completion on the 23rd April 2024 and is presented as *Attachment B. A*ll monitoring results are satisfactory and indicative of background concentrations. The area can now be accessed without risk to health or the environment generally.

Yours sincerely

Shane Williams
Senior Consultant
Licensed Asbestos Assessor
– LAA000128

Stephen Mulligan
Project Manager

Appendix D

Data Quality Evaluation

Appendix D - Quality Assurance and Quality Control Review
Client: Viva Energy
Site: WARP AEC-4
Report: Supplementary Environmental Site Assessment - Southern Buried Waste Area (AEC-4)

Item	AEC-4 Supplemtary ESA
Quality Assurance Program	
Statement of pre-determined DQOs for field and laboratory procedures, including quantitative DQOs	Yes, in Section 4.
DQOs state the problem, identify the goals of the study, identify information inputs, define the boundaries of the study, develop an analytical approach, specify performance or acceptance criteria and outline the plan for obtaining data	Yes, in Section 4, Table 4-1.
Quality plan designed to achieve DQOs assessing accuracy, precision, comparability, representativeness, and completeness of data	Quality assurance/quality control are discussed in Section 4.1 and deviations in Appendix E (not Appendix A as noted in the report).
Procedures for assessing chemical data to determine if DQOs are met, including quantitative DQOs (e.g. standard deviation, % recovery, RPDs)	Yes, in Appendix E (not Appendix A as noted in the report).
Procedures that describe the actions if DQOs not met	Decision rule presented in Appendix E.
Sampling and Analytical Program	
Site investigation objectives and a brief background provided	Yes, site investigation objectives are presented in Section 1.3. Site background is presented in Section 1.2 and site history in Section 2.2. A summary of the previous investigation is presented in Section 1.2.2.
Summary of CSM provided	Yes, preliminary CSM is presented in Section 3. Refined CSM is presented at the conclusion of the assessment of data in Section 8.5.
Data gap analysis provided that reviews existing information	Summary of previous site characterissation provided in Section 2.4.
Preparation of a site-specific health and safety plan and other necessary pre-mobilisation tasks	Project preliminaries mentioned in Section 1.4.1 under Scope of Works. No further details provided, however, the auditor questions why this is relevant to the audit given the audit is not of health and safety procedures.
Assessment includes all relevant environmental media (e.g. soil, dust, surface water, groundwater, air, sediments, and biota)	Yes, both soil and groundwater assessment was undertaken.
Sampling is representative of the site, based on the selection of appropriate sampling points stated in the sampling plan. Included are details of analytes to be monitored, sampling pattern/frequency, number of samples, location, and depth of sampling points	Yes, key areas of concern as well as site coverage are incorporated into the sampling design.

Item	AEC-4 Supplemtary ESA
Acceptability of sample collection, handling, and transportation in accordance with written procedures	Yes, standard industry methods were used.
Sample analyses use appropriate methodologies in NATA (or equivalent) accredited laboratories for each analyte & matrix	Yes, samples were sent to NATA accredited laboratories for analysis.
Appropriate sampling methods & procedures, field screening methods, and analysis methods are outlined	Yes.
Detection limits for each chemical of potential concern are appropriate for use in the assessment of risk	Yes, detection limits were appropriate fo assessment however, PAH compounds including anthracene, benzo(a)pyrene, fluroranthene and phenanthrene were reported marginally above the ANZG (2018) Criterion for all groundwater samples analysed. ERM recommends that despite this, it is recommended that future GMEs utilise lower default LORs for these COPC.
For dynamic/reactive sampling, methods for analysing and interpreting field data are outlined	Not applicable.
Field QA/QC	
Use of standardised field sampling forms	Chain of custody forms (Appendix H) and borehole logs (Appendix B) are provided. Field documentation is presented in Appendix C.
Sampling team	Section 5 notes, fieldworks were undertaken by suitably qualified ERM environmental scientists Details noted on field records ad COC forms.
Sampling methods include the type of container used, labeling process, order and degree of filling, preservation, labeling, logging, custody	Yes, in Section 4.1. Sampling methods were described along with sample handling and chain of custody protocols.
Decontamination procedures between sampling	Yes, in Section 4.1. Decontamination procedures were implemented between sampling locations where disposable consumables were utilised when collecting samples. Rinsate samples were collected from re-usaeable equipment between sampling location. The processes followed were considered suitable for minimising cross-contamination during sampling.
Logs for each sample, including time, date, location, sampler, duplicate location & type, chemical analyses to be performed, sample preservation method, site observations & weather	Details are provided on borehole logs in Appendix B and field records in Appendix C.
COC for each sample, including a sampler, sample nature, collection date, analyses to be performed, preservation method, dispatch time, condition of samples at dispatch, and courier(s)	Yes, in Appendix H. Samples were collected, handled, and transported following using standard methods. The adopted procedures are considered appropriate to meet the project objectives. Field records describing the site conditions, media sampled, indications of potential contamination (e.g. staining, discoloration, odour or sheen), duplicate samples, and sampling locations were completed (refer to field records in Appendix C and borelogs in Appendix B).

Item	AEC-4 Supplemtary ESA
	Soil and groundwater samples for chemical analysis were collected into laboratory-supplied sample containers and stored in a chilled cooler on ice. All samples were forwarded to the NATA accredited laboratory under Chain of Custody conditions. The methods used to collect the samples, the types of sample containers, preservation techniques, and custody protocols were documented appropriately. Samples were received by the laboratory intact and with cooling media present.
Sample duplication/splitting techniques	Not stated.
Quality control samples, including:	-
background samples	Not applicable.
field duplicate samples	Yes, Laboratory reports in Appendix H and Data quality evaluation Section E4.1.1 (Appendix H). Field intra-laboratory duplicates (2 soil, 1 water) and 2 field inter-laboratory duplicate (1 soil, 1 water) were submitted to the laboratory. Three duplicates were transported and submitted with the groundwater samples to the laboratory.
split samples	Not applicable.
rinsate blanks	Yes, Laboratory reports in Appendix H and Data quality evaluation Section E4.1.3 (Appendix H).
field blanks	No; however, rinsate blanks, spiked trip samples, laboratory method blanks were collected and results were acceptable.
trip blanks	Yes, Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). One trip spike was transported and submitted with the soil samples to the laboratory. Three trip spikes were transported and submitted with the groundwater samples to the laboratory. Target analytes were not detected in the trip blanks indicating that cross contamination of samples is unlikely to have occurred during shipping and handling.
laboratory prepared trip spike samples	Yes, Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). One trip spike was transported and submitted with the soil samples to the laboratory. Three trip spikes were transported and submitted with the groundwater samples to the laboratory. Trip spikes submitted batches were all reported within the acceptable recovery range (70-130%) indicating that there is a low likelihood for the loss of volatiles to have occurred during shipping and handling.
Background sample results	Not applicable.

Item	AEC-4 Supplemtary ESA
Results of QC samples eg field blanks, background, rinsates, trip blanks	Yes, summarised in Section 7.4. Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). During the course of the sampling events, a total of 11 primary soils samples and 26 primary groundwater samples were collected for chemical analysis of BTEXN, Napthalene, TRH C6-C40 Fractions, TRH C10-C40 Silica Gel Clean-up, PAH, Hexavalent Chromium and Acid Sulfate Soils (Screening & CRS) (soil). Soil samples were also assessed for particle size distribution. Intra- and inter-laboratory duplicates were collected at a ratio of at least one duplicate to ten primary samples, with 3 intra-laboratory duplicates (two soil and one water) and two inter-laboratory duplicates (one soil and one water) 37 primary samples. The relative percent differences (RPDs) generated between the field duplicate samples, field triplicate samples and the parent samples were generally within acceptable ranges with exception to a few exceedances. These high RPDs are a result of concentrations being reported <10 x the laboratory LOR. In the instance of RPD exceedances, concentrations of these COPCs do not exceed applicable screening levels. Therefore, this apparent lack of accuracy and/or precision represented by the RPD analysis is not considered to adversely affect interpretation of the results.
Laboratory prepared trip spikes for volatile analytes and accompanying results	Yes, in Laboratory reports in Appendix H.
Field instrument calibrations (when used)	Yes, in Appendix D.
Tabulate field parameter measurements	Yes, Table 5 in Annex 'Tables'.
Laboratory QA/QC	
Copy of completed COC including acknowledgment of receipt, conditions of samples on receipt and identity of samples included in shipments	Yes, listed on sample receipt acknowledgment and the analytical reports in Appendix H.
Record of holding times and compliance with methods	Yes.
Analytical methods used	Yes. Sample of LNAPL product MW20/06 was fingerprint tested using hydrocarbon identification method for soil and water that is non-NATA (USEPA method 3510 as the extraction procedure for the water portion of this method and NEPM Schedule B3 for soil). Laboratory report with discussion of theanalysis methodology is provided in Appendix H.
Laboratory accreditation for methods used	Yes, in Appendix H. The primary laboratory used for the analysis of primary and intra-laboratory soil and groundwater samples was NATA accredited Eurofins (NATA Registration No. 1261). The secondary laboratory used for the analysis of inter-laboratory soil samples was NATA accredited ALS (NATA Registration No. 825). All laboratory reports were NATA stamped and signed by a NATA signatory. All methodologies were considered appropriate for the identified COPCs.

Item	AEC-4 Supplemtary ESA
Description & % recovery of surrogates & spikes	Yes.
Instrument detection limits and MDLs	Not supplied by analysing laboratory. Absence has no material effect.
Matrix or PQLs and limit of reporting for each analyte in each media	Yes. The laboratory LOR for each analyte is presented in the laboratory reports (Appendix H) and laboratory analytical result summary tables (Tables 6-9 of the Annex 'Tables'). All sample results were reported with LORs below the adopted assessment criteria with the exception sof PAH compounds including anthracene, benzo(a)pyrene, fluroranthene and phenanthrene that were reported marginally above the ANZG (2018) Criterion for all groundwater samples analysed.
Quality control samples:	-
duplicates	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
method blanks	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
surrogates	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
matrix spikes	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits.
Laboratory standard charts	Not supplied by analysing laboratory. Absence has no material effect.
◗ **QA/QC Data Evaluation**	
Evaluation of QA/QC with DQOs including: documentation completeness, data completeness, data comparability (see below), data representativeness	Yes.
Precision & accuracy of sampling & analysis for each analyte in each matrix, advising reliability, unreliability or qualitative value of data	Yes.
Data comparability including bias assessment, e.g. different personnel, methodologies, times, spatial and temporal changes etc	No.
Results of intra and interlaboratory QC checks	Yes.
Names of laboratories and details of their accreditation	Yes.
Discussion of appropriateness of non-standard test methods (incl. sample prep; method source and validation)	All analytical methods were standard methods.
PQLs and MDLs for all relevant matrices	Yes.
Acceptance limit(s) for each QC test (e.g. RPDs, recoveries) included	Listed on certificates of analysis.

Item	AEC-4 Supplemtary ESA
Acceptance limits for each calibration standard	Details reported by the laboratories.
Results for all data tabulated according to each type of soil, fill, groundwaters, surface water and sediments, with appropriate statistical analysis.	Yes, in Annex 'Tables'
QC results relevant to the sample analyses	Yes.
QA/QC ANALYTICAL METHODS	-
Field Methods	-
Applicability and appropriateness of field screening methods discussed.	Appropriateness of field screening methods mentioned.
Adequacy of calibration of field monitoring equipment and validation of field measurements	Yes, in Appendix D.
Laboratory screening methods	
Applicability and limitations of analytical screening techniques appropriately discussed	Yes. Laboratory report with discussion of the analysis methodology for LNAPL product in MW20/06 is provided in Appendix H.
Analytical screening method performance expressed and based on the acceptable false negative rate	Not applicable.
Methods specific for contaminants	
Sensitivity of analytical methods appropriate for assessment of risk	Yes.
Precision and accuracy criteria in the quality plan meet the performance of 95% of laboratories in recognised inter-laboratory trials	Not presented and rarely is, unless requested.

Appendix D - Quality Assurance and Quality Control Review
Client: Viva Energy
Site: WARP AEC-4
Report: Q4 2023 GME (Stage 2 AA4 baseline GME)

Item	AEC-4 Supplemtary ESA
Quality Assurance Program	
Statement of pre-determined DQOs for field and laboratory procedures, including quantitative DQOs	Yes, in Section 4.
DQOs state the problem, identify the goals of the study, identify information inputs, define the boundaries of the study, develop an analytical approach, specify performance or acceptance criteria and outline the plan for obtaining data	Yes, in Section 4, Table 4-1.
Quality plan designed to achieve DQOs assessing accuracy, precision, comparability, representativeness, and completeness of data	Quality assurance/quality control are discussed in Section 4.1 and deviations in Appendix E (not Appendix A as noted in the report).
Procedures for assessing chemical data to determine if DQOs are met, including quantitative DQOs (e.g. standard deviation, % recovery, RPDs)	Yes, in Appendix E (not Appendix A as noted in the report).
Procedures that describe the actions if DQOs not met	Decision rule presented in Appendix E.
Sampling and Analytical Program	
Site investigation objectives and a brief background provided	Yes, site investigation objectives are presented in Section 1.3. Site background is presented in Section 1.2 and site history in Section 2.2. A summary of the previous investigation is presented in Section 1.2.2.
Summary of CSM provided	Yes, preliminary CSM is presented in Section 3. Refined CSM is presented at the conclusion of the assessment of data in Section 8.5.
Data gap analysis provided that reviews existing information	Summary of previous site characterissation provided in Section 2.4.
Preparation of a site-specific health and safety plan and other necessary pre-mobilisation tasks	Project preliminaries mentioned in Section 1.4.1 under Scope of Works. No further details provided, however, the auditor questions why this is relevant to the audit given the audit is not of health and safety procedures.
Assessment includes all relevant environmental media (e.g. soil, dust, surface water, groundwater, air, sediments, and biota)	Yes, both soil and groundwater assessment was undertaken.
Sampling is representative of the site, based on the selection of appropriate sampling points stated in the sampling plan. Included are details of analytes to be monitored, sampling pattern/frequency, number of samples, location, and depth of sampling points	Yes, key areas of concern as well as site coverage are incorporated into the sampling design.

Item	AEC-4 Supplemtary ESA
Acceptability of sample collection, handling, and transportation in accordance with written procedures	Yes, standard industry methods were used.
Sample analyses use appropriate methodologies in NATA (or equivalent) accredited laboratories for each analyte & matrix	Yes, samples were sent to NATA accredited laboratories for analysis.
Appropriate sampling methods & procedures, field screening methods, and analysis methods are outlined	Yes.
Detection limits for each chemical of potential concern are appropriate for use in the assessment of risk	Yes, detection limits were appropriate fo assessment however, PAH compounds including anthracene, benzo(a)pyrene, fluroranthene and phenanthrene were reported marginally above the ANZG (2018) Criterion for all groundwater samples analysed. ERM recommends that despite this, it is recommended that future GMEs utilise lower default LORs for these COPC.
For dynamic/reactive sampling, methods for analysing and interpreting field data are outlined	Not applicable.
Field QA/QC	
Use of standardised field sampling forms	Chain of custody forms (Appendix H) and borehole logs (Appendix B) are provided. Field documentation is presented in Appendix C.
Sampling team	Section 5 notes, fieldworks were undertaken by suitably qualified ERM environmental scientists Details noted on field records ad COC forms.
Sampling methods include the type of container used, labeling process, order and degree of filling, preservation, labeling, logging, custody	Yes, in Section 4.1. Sampling methods were described along with sample handling and chain of custody protocols.
Decontamination procedures between sampling	Yes, in Section 4.1. Decontamination procedures were implemented between sampling locations where disposable consumables were utilised when collecting samples. Rinsate samples were collected from re-usaeable equipment between sampling location. The processes followed were considered suitable for minimising cross-contamination during sampling.
Logs for each sample, including time, date, location, sampler, duplicate location & type, chemical analyses to be performed, sample preservation method, site observations & weather	Details are provided on borehole logs in Appendix B and field records in Appendix C.
COC for each sample, including a sampler, sample nature, collection date, analyses to be performed, preservation method, dispatch time, condition of samples at dispatch, and courier(s)	Yes, in Appendix H. Samples were collected, handled, and transported following using standard methods. The adopted procedures are considered appropriate to meet the project objectives. Field records describing the site conditions, media sampled, indications of potential contamination (e.g. staining, discoloration, odour or sheen), duplicate samples, and sampling locations were completed (refer to field records in Appendix C and borelogs in Appendix B).

Item	AEC-4 Supplemtary ESA
	Soil and groundwater samples for chemical analysis were collected into laboratory-supplied sample containers and stored in a chilled cooler on ice. All samples were forwarded to the NATA accredited laboratory under Chain of Custody conditions. The methods used to collect the samples, the types of sample containers, preservation techniques, and custody protocols were documented appropriately. Samples were received by the laboratory intact and with cooling media present.
Sample duplication/splitting techniques	Not stated.
Quality control samples, including:	-
background samples	Not applicable.
field duplicate samples	Yes, Laboratory reports in Appendix H and Data quality evaluation Section E4.1.1 (Appendix H). Field intra-laboratory duplicates (2 soil, 1 water) and 2 field inter-laboratory duplicate (1 soil, 1 water) were submitted to the laboratory. Three duplicates were transported and submitted with the groundwater samples to the laboratory.
split samples	Not applicable.
rinsate blanks	Yes, Laboratory reports in Appendix H and Data quality evaluation Section E4.1.3 (Appendix H).
field blanks	No; however, rinsate blanks, spiked trip samples, laboratory method blanks were collected and results were acceptable.
trip blanks	Yes, Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). One trip spike was transported and submitted with the soil samples to the laboratory. Three trip spikes were transported and submitted with the groundwater samples to the laboratory. Target analytes were not detected in the trip blanks indicating that cross contamination of samples is unlikely to have occurred during shipping and handling.
laboratory prepared trip spike samples	Yes, Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). One trip spike was transported and submitted with the soil samples to the laboratory. Three trip spikes were transported and submitted with the groundwater samples to the laboratory. Trip spikes submitted batches were all reported within the acceptable recovery range (70-130%) indicating that there is a low likelihood for the loss of volatiles to have occurred during shipping and handling.
Background sample results	Not applicable.

Item	AEC-4 Supplemtary ESA
Results of QC samples eg field blanks, background, rinsates, trip blanks	Yes, summarised in Section 7.4. Laboratory reports in Appendix H and data quality evaluation Section E4.1.3 (Appendix H). During the course of the sampling events, a total of 11 primary soils samples and 26 primary groundwater samples were collected for chemical analysis of BTEXN, Napthalene, TRH C6-C40 Fractions, TRH C10-C40 Silica Gel Clean-up, PAH, Hexavalent Chromium and Acid Sulfate Soils (Screening & CRS) (soil). Soil samples were also assessed for particle size distribution. Intra- and inter-laboratory duplicates were collected at a ratio of at least one duplicate to ten primary samples, with 3 intra-laboratory duplicates (two soil and one water) and two inter-laboratory duplicates (one soil and one water) 37 primary samples. The relative percent differences (RPDs) generated between the field duplicate samples, field triplicate samples and the parent samples were generally within acceptable ranges with exception to a few exceedances. These high RPDs are a result of concentrations being reported <10 x the laboratory LOR. In the instance of RPD exceedances, concentrations of these COPCs do not exceed applicable screening levels. Therefore, this apparent lack of accuracy and/or precision represented by the RPD analysis is not considered to adversely affect interpretation of the results.
Laboratory prepared trip spikes for volatile analytes and accompanying results	Yes, in Laboratory reports in Appendix H.
Field instrument calibrations (when used)	Yes, in Appendix D.
Tabulate field parameter measurements	Yes, Table 5 in Annex 'Tables'.
Laboratory QA/QC	
Copy of completed COC including acknowledgment of receipt, conditions of samples on receipt and identity of samples included in shipments	Yes, listed on sample receipt acknowledgment and the analytical reports in Appendix H.
Record of holding times and compliance with methods	Yes.
Analytical methods used	Yes. Sample of LNAPL product MW20/06 was fingerprint tested using hydrocarbon identification method for soil and water that is non-NATA (USEPA method 3510 as the extraction procedure for the water portion of this method and NEPM Schedule B3 for soil). Laboratory report with discussion of theanalysis methodology is provided in Appendix H.
Laboratory accreditation for methods used	Yes, in Appendix H. The primary laboratory used for the analysis of primary and intra-laboratory soil and groundwater samples was NATA accredited Eurofins (NATA Registration No. 1261). The secondary laboratory used for the analysis of inter-laboratory soil samples was NATA accredited ALS (NATA Registration No. 825). All laboratory reports were NATA stamped and signed by a NATA signatory. All methodologies were considered appropriate for the identified COPCs.

Item	AEC-4 Supplemtary ESA
Description & % recovery of surrogates & spikes	Yes.
Instrument detection limits and MDLs	Not supplied by analysing laboratory. Absence has no material effect.
Matrix or PQLs and limit of reporting for each analyte in each media	Yes. The laboratory LOR for each analyte is presented in the laboratory reports (Appendix H) and laboratory analytical result summary tables (Tables 6-9 of the Annex 'Tables'). All sample results were reported with LORs below the adopted assessment criteria with the exception sof PAH compounds including anthracene, benzo(a)pyrene, fluroranthene and phenanthrene that were reported marginally above the ANZG (2018) Criterion for all groundwater samples analysed.
Quality control samples:	-
duplicates	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
method blanks	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
surrogates	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits, with the exception of the outliers outlined in the laboratory documentation.
matrix spikes	Yes, in Appendix H. All laboratory quality control sample results were within the specified acceptable limits.
Laboratory standard charts	Not supplied by analysing laboratory. Absence has no material effect.
◗ **QA/QC Data Evaluation**	
Evaluation of QA/QC with DQOs including: documentation completeness, data completeness, data comparability (see below), data representativeness	Yes.
Precision & accuracy of sampling & analysis for each analyte in each matrix, advising reliability, unreliability or qualitative value of data	Yes.
Data comparability including bias assessment, e.g. different personnel, methodologies, times, spatial and temporal changes etc	No.
Results of intra and interlaboratory QC checks	Yes.
Names of laboratories and details of their accreditation	Yes.
Discussion of appropriateness of non-standard test methods (incl. sample prep; method source and validation)	All analytical methods were standard methods.
PQLs and MDLs for all relevant matrices	Yes.
Acceptance limit(s) for each QC test (e.g. RPDs, recoveries) included	Listed on certificates of analysis.

Item	AEC-4 Supplemtary ESA
Acceptance limits for each calibration standard	Details reported by the laboratories.
Results for all data tabulated according to each type of soil, fill, groundwaters, surface water and sediments, with appropriate statistical analysis.	Yes, in Annex 'Tables'
QC results relevant to the sample analyses	Yes.
QA/QC ANALYTICAL METHODS	-
Field Methods	-
Applicability and appropriateness of field screening methods discussed.	Appropriateness of field screening methods mentioned.
Adequacy of calibration of field monitoring equipment and validation of field measurements	Yes, in Appendix D.
Laboratory screening methods	
Applicability and limitations of analytical screening techniques appropriately discussed	Yes. Laboratory report with discussion of the analysis methodology for LNAPL product in MW20/06 is provided in Appendix H.
Analytical screening method performance expressed and based on the acceptable false negative rate	Not applicable.
Methods specific for contaminants	
Sensitivity of analytical methods appropriate for assessment of risk	Yes.
Precision and accuracy criteria in the quality plan meet the performance of 95% of laboratories in recognised inter-laboratory trials	Not presented and rarely is, unless requested.

Appendix E

Stage 2 AA4 LTEMP

PREPARED FOR

Clyde Western Area Remediation Project

Proposed Lot 64 – Long Term Environmental Management Plan

Viva Energy Australia Pty Ltd

DATE
12 June 2024

REFERENCE
0561882

DOCUMENT DETAILS

DOCUMENT TITLE	Clyde Western Area Remediation Project
DOCUMENT SUBTITLE	Proposed Lot 64 – Long Term Environmental Management Plan
PROJECT NUMBER	0561882
Date	12 June 2024
Version	Final
Author	Theresa Nguyen
Client name	Viva Energy Australia Pty Ltd

DOCUMENT HISTORY

				ERM APPROVAL TO ISSUE		
VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	COMMENTS
Draft	0	Theresa Nguyen	Stephen Mulligan / Peter Lavelle	Peter Lavelle	21/03/2024	Preliminary Draft for Viva Energy Review
Final	1	Theresa Nguyen	Stephen Mulligan / Peter Lavelle	Peter Lavelle	12/04/2024	Final - incorporation of Site Auditor's comments
Final	2	Theresa Nguyen	Stephen Mulligan / Peter Lavelle	Peter Lavelle	26/04/2024	Final - incorporation of Site Auditor's comments
Final	3	Theresa Nguyen	Stephen Mulligan / Peter Lavelle	Peter Lavelle	7/05/2024	
Final	4	Theresa Nguyen	Peter Lavelle	Peter Lavelle	12/06/2024	

SIGNATURE PAGE

Clyde Western Area Remediation Project

Proposed Lot 64 – Long Term Environmental Management Plan

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CONTENTS

LIST OF TABLES

GLOSSARY

Glossary Terms	Definition
AEC-4	The Southern Buried Waste Area which is located within proposed Lot 64 of the 'Stage 2' portion of the Clyde Western Area Remediation Project (WARP).
the Site	Land located on the Camellia Peninsula, owned by VE Property Pty Ltd. The Site is currently identified as part Lot 57 DP 1280734.
the Western Area	A largely vacant area of land, approximately 25 ha in size, located in the south western part of the Site. The land previously contained a variety of refinery assets that have now been removed.
the Project	The proposal to remediate the contaminated soils in the Western Area to a commercial/industrial standard
the Stage 2 Area	An area situated within the eastern portion of the former Process West area adjoining the current Clyde Terminal. The Stage 2 Area extends from Devon Street in the North to the Duck River at the southern boundary of the Western Area. The LTEMP applies to part of the Stage 2 Area.
Proposed Lot 64	Part of Lot 57 DP 1280734, located within the southern portion of the Stage 2 Area, as Approved under SSD 10459. Proposed Lot 64 is shown on *Figure 1, Appendix A* and in the Site Survey (*Appendix B*). The area of proposed Lot 64 totals 23,500 m^2 and includes the capped extent.
the Land Custodian	The legal owner(s) of the site identified as proposed Lot 64 of the Stage 2 Area, from time to time.

Glossary Terms	Definition
Site Operator	The entity in occupation of (or portions of) Proposed Lot 64 who is responsible for day-to-day operations. This will include any contractors carrying out works on the site and tenants of Proposed Lot 64 from time to time.
Suitably Qualified Environmental Specialist	An environmental specialist deemed to be suitably qualified per the New South Wales Environment Protection Authority's *Contaminated Land Consultant Certification Policy* (NSW EPA, 2022).

EXECUTIVE SUMMARY

Introduction

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Viva Energy Australia Pty Ltd (Viva Energy) to prepare this Long-Term Environmental Management Plan (LTEMP) to outline required environmental management procedures and controls for the ongoing use of part of Proposed Lot 64 within the 'Stage 2' portion of the Clyde Western Area Remediation Project (WARP) was approved under SSD9302. The portion of proposed Lot 64 that is subject to the ongoing environmental management requirements contained in this LTEMP are referred to as 'Proposed Lot 64'. Proposed Lot 64 is shown on *Figure 1, Appendix A.*

Background Information

Ongoing management of residual contamination is required within the constructed capped area, as well as areas outside of the cap within Proposed Lot 64 upon completion of remediation and validation works, in accordance with the LTEMP. The Layout of Lot 64 is shown within *Figure 1, Appendix A*.

The LTEMP applies to works within Proposed Lot 64, including but not limited to maintenance, operational use of Proposed Lot 64, construction, and any other work that may have the potential to penetrate the liner of the capped area. Additionally, the LTEMP outlines monitoring works that are to be undertaken following remediation, including post works verification monitoring of capping surface integrity, ground gases, and groundwater.

The controls outlined within this plan are intended as passive mitigation measures to manage potential risks to human health. ERM considers Proposed Lot 64 will be suitable for use under a commercial / industrial land use scenario, given that appropriate controls are implemented to manage potential gas/ vapour accumulation in enclosed air spaces of future buildings.

Application of this LTEMP

This LTEMP documents the nature and extent of residual contamination on-site and outlines the mechanisms required for managing potential residual risks into the future. This LTEMP also outlines the monitoring requirements of the capping layer integrity and groundwater conditions. The monitoring requirements of this LTEMP must be complied with at all times, including throughout routine maintenance and/or construction works.

Residual Contamination Following Remediation Works

Residual contamination is considered to be contained within the capped area and is not accessible to future receptors under regular Site operations.

The capped area within Lot 64 is in place to control risks of the following exposure pathways to residual contamination:

- Hydrocarbon and chromium impacted soils that present a potential risk to commercial workers and constructions workers directly contacting soils, as shown on *Figure 2, Appendix A.*
- Hydrocarbon impacted soils beneath the capping layer that present a potential risk to commercial receptors via vapour intrusion, as shown on *Figure 2, Appendix A.*

- Friable asbestos and bonded asbestos containing materials in subsurface soils at several locations throughout the Management Area, as shown on *Figure 2, Appendix A*.
- LNAPL in groundwater, as shown on *Figure 3, Appendix A.*

A description of the residual contamination and the associated risks is presented within Sections 4 and 5.

Required Environmental Management Controls

Adherence to this LTEMP is required to ensure the suitability for commercial/industrial land uses within the Site and Proposed Lot 64. Design of future buildings to include appropriate management controls and measures assessed consistent with the Hazardous Ground Gas Guidelines. At this stage no enclosed buildings exist or are proposed within Proposed Lot 64. However, should any future buildings be proposed, the design must include appropriate management controls and measures assessed consistent with the *Hazardous Ground Gas Guidelines*[1].

Based on the nature and extent of residual contamination identified within the Management Area, the following controls are required under various operational scenarios:

- Where intrusive excavation works are proposed – the environmental management controls detailed in *Sections 6* of this LTEMP must be implemented.
- Where works involve no intrusive excavation (i.e. normal site operations) – management controls are applicable following completion of remediation and validation of Proposed Lot 64.
- As per Development Consent SSD9302, the conditions B22 (d) to B22 (g) outline requirements for ongoing passive management and mitigation of groundwater risks, including monitoring of natural attenuation, trigger levels for investigation of adverse impacts to Duck River, contingency actions and monitoring of effectiveness of management measures. These requirements are addressed within *Section 6* of this LTEMP, and the Stage 2 Groundwater Monitoring Program (GWMP) prepared by ERM in 2021.

[1] NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*. May 2020.

1. INTRODUCTION AND BACKGROUND

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Viva Energy Australia Pty Ltd (Viva Energy) to prepare this Long-Term Environmental Management Plan (LTEMP) for a portion of the Clyde Western Area, referred to as 'Proposed Lot 64' to outline required environmental management procedures and controls for future Site Operators that may have control of Proposed Lot 64.

The portion of Proposed Lot 64 subject to this LTEMP formed part of 'Stage 2' of the Clyde Western Area Remediation Project (WARP) and is referred to as 'Proposed Lot 64' in this LTEMP.

The extent of Proposed Lot 64 subject to this LTEMP is shown on Figure 1, Appendix A. This extent is defined by the boundaries of those parts of Lot 57 DP 1280734 forming Proposed Lot 64, as authorised for subdivision under State Significant Development Consent 10459.

This LTEMP must be implemented following completion of remediation and validation works.

Prior to the commencement of any operational, maintenance or construction works, all site personnel / contractors are to be inducted into the requirements of this LTEMP.

1.1 BACKGROUND AND SITE IDENTIFICATION

The Western Area is an approximately 25 hectare (ha) parcel of land currently owned by VE Property Pty Ltd within the footprint of the wider Clyde Terminal Site and is bordered to the south by the Duck River, to the east by current Clyde Terminal Operations and to the north and west by other Industrial zoned properties. Proposed Lot 64 is situated within the Western Area, as presented in *Figure 1, Appendix A*. Proposed Lot 64 was historically a portion of vacant land and a security road located within the Site.

Specific site identification details are summarised in *Table 1-1*, below.

TABLE 1-1 – SITE IDENTIFICATION

Item	Description
Site Owner	VE Property Pty Ltd
Site Occupier	VE Property Pty Ltd
Site Address	13 Devon Street, Rosehill NSW
Coordinates	33°49'57.85"S, 151° 1'54.98"E
Current Legal Description	Part Lot 57 DP 1280734 (Referred to in this LTEMP as Proposed Lot 64).
Local Government Authority	City of Parramatta Council
Current Zoning	E5 – Heavy Industrial under the Parramatta Council Local Environmental Plan 2011
Current Land Uses	Vacant site

Item	Description
Future Proposed Land Use	• Commercial / Industrial. • Upon completion of remediation and validation works, the Site is suitable for commercial / industrial land uses with no enclosed above ground infrastructure for occupation, basement structures or beneficial re-use of groundwater.
Permissible Land Use(s) [1]	Noting the post-remediation restrictions on enclosed above ground infrastructure for occupation, basement structures and beneficial re-use of groundwater, permissible uses under the site zoning (with consent) includes: Agricultural produce industries; Building identification signs; Business identification signs; Depots; Freight transport facilities; General industries; Hardware and building supplies; Hazardous storage establishments; Heavy industries; Horticulture; Kiosks; Medical centres; Offensive storage establishments; Pubs; Roads; Rural supplies; Sawmill or log processing works; Take away food and drink premises; Timber yards; Warehouse or distribution centres; Water storage facilities.
Area [2]	The area of the Proposed Lot 64 totals 23,500 m^2, as per subdivision survey plans provided as Attachment B.
Elevation	Between approximately 3 to 6 metres relative to Australian Height Datum (m AHD)

Source:
1. City of Parramatta Council Local Environmental Plan (2011).
2. Plan of Proposed Subdivision of Lot 100 DP1168951, (Landpartners Pty Ltd). Sheet 4 of 44.

1.2 PURPOSE OF THE LTEMP

The specific objectives of this LTEMP are to:

- summarise background environmental information, known and likely conditions within Proposed Lot 64, to inform the Land Custodian, workers and managers of the potential risks to human health and / or the environment arising from contact with residual contamination;
- outline methods and procedures to avoid and / or mitigate potential adverse effects on human health and / or the environment associated with the residual contaminated soil and groundwater;
- provide a recommended methodology for the appropriate environmental management of construction works that may encounter residual contaminated soil and groundwater;
- provide detail on the re-instatement of the capping layer following damage or intrusion;
- detail the ongoing monitoring requirements of the capping layer;
- detail ongoing groundwater monitoring requirements;
- detail ongoing management requirements to perform inspection and monitoring of the remediated Management Area;
- provide environmental requirements for the sourcing and placement of backfill material;
- discuss safety measures / considerations for dealing with potentially contaminated soil and groundwater; and
- outline restrictions to potential future land uses under current zoning as detailed within Table 1-1.

All work related to excavation, movement, handling, importation and placement of fill and soil materials and / or groundwater within the Site, and Proposed Lot 64 should be carried out in accordance with this LTEMP and in compliance with relevant legislation detailed within Section 2.

This LTEMP is considered to represent an active management approach, involving ongoing monitoring of groundwater conditions and integrity of the capping layer reducing access and surface water infiltration to below ground contamination.

1.3 LIMITATIONS TO THIS LTEMP

This LTEMP is land-use specific and applies to commercial / industrial uses, excluding enclosed above ground infrastructure for occupation, or underground basement structures, such as underground car parks.

Groundwater is not to be extracted for use within Proposed Lot 64 and future beneficial re-uses of groundwater have not been considered as part of this LTEMP. Additionally, consideration must be made of any activities or change in use for Proposed Lot 64 which is likely to significantly alter groundwater infiltration and / or groundwater flow direction. If activities which may affect groundwater conditions or extractive use of groundwater is proposed, further assessment of the suitability of groundwater must be completed by a Suitably Qualified Environmental Specialist with the findings reviewed and endorsed by a New South Wales Environment Protection Authority (NSW EPA) accredited Site Auditor. Other limitations are outlined in *Section 1.3* of this document.

If, in the future, any land uses differ from the commercial / industrial use described above (including above ground / basement infrastructure) reflected in ERM (2020) Human Health and Ecological Risk Assessment (HHERA), this LTEMP will need to be reviewed and updated in accordance with the procedures contained in *Section 2.4*.

1.4 DOCUMENTS RELEVANT TO THE APPLICATION OF THIS LTEMP

The *Clyde Western Area Remediation Project – Proposed Lot 64-AEC-4 Capping Construction Technical Specification,* dated 12 March 2024 (ERM, 2024) is considered to be relevant to the application of this LTEMP. It is the responsibility of the Site Operator to manage Proposed Lot 64, and the capped area in compliance with this document.

2. STATUTORY REQUIREMENTS

2.1 LEGAL ENFORCEABILITY AND PUBLIC NOTIFICATION OF THIS EMP

Condition B10 of State significant development consent 9302 granted under the Environmental Planning and Assessment Act 1979 (the 'EP&A Act') provides as follows:

> ***B10. Upon completion of the Site Audit Statement and Site Audit Report, the Applicant must:***
>
> ***(a) Implement the approved LTEMP***
>
> ***(b) Provide evidence to the Planning Secretary that the LTEMP is listed on the relevant planning certificate for the land, issued under section 10.7 of the EP&A Act***

In addition, condition A9 of State significant development consent 10459 provides as follows:

> ***A9. The Applicant must implement the Long Term Environmental Management Plan (LTEMP) approved under condition B8 of SSD 9302 and provide evidence to the Planning Secretary that the LTEMP is listed on the relevant planning certificate(s) issued under section 10.7 of the EP&A Act for each lot created by Stages 1A and B, 2 and 3 as shown in the 'Subdivision Drawings prepared by Land Partners' in Appendix 1***

Accordingly:

- This LTEMP was prepared in accordance with development consent SSD 9302. It is also enforceable under development consent SSD 10459, granted under the EP&A Act.
- As per conditions B10(b) and A9 and relevant NSW EPA requirements, Parramatta Council will be provided with a copy of this LTEMP and requested to add a notation on the planning certificates issued for Proposed Lot 64 under section 10.7 of the EP&A Act confirming that they are subject to this LTEMP.

No other planning controls are required for future development that may interact with remaining contamination at depth.

2.2 LICENCE AND APPROVAL REQUIREMENTS

The Site Operator is responsible for controlling works within Proposed Lot 64. Under the LTEMP, intrusive works including excavation works which penetrate beneath the depth of the 'marker geotextile' layer is generally prohibited to protect the underlying LLDPE liner. Should intrusive works be required within Proposed Lot 64, the contingency actions associated with reinstatement of the cap outlined in *Section 7* of this LTEMP will apply.

2.3 REGULATORY FRAMEWORK

All operational personnel carrying out any intrusive works or monitoring works in Proposed Lot 64 must comply with the applicable environmental regulatory requirements in NSW.

2.4 DOCUMENT REVISION

This LTEMP may be reviewed and updated as necessary from time to time. Therefore, it is the responsibility of the reader of this document to ensure they have the current version of the LTEMP.

Any updates to this LTEMP must be reviewed and endorsed by a NSW EPA Accredited Site Auditor.

The master document, with the up-to-date version of the LTEMP will be available from the Land Custodian.

The current version of this LTEMP is detailed within the Table 2-1 below. Any subsequent revisions of this LTEMP must include a clear date / revision identifier to enable the most recent to be readily identified.

TABLE 2-1 – LTEMP REVISION

Document Name	Document Revision Number	Date
Clyde Western Area Remediation Project: Proposed Lot 64 – Long Term Environmental Management Plan	Draft – Revision 0	12/4/2024

3. APPLICATION AND RESPONSIBILITIES

Adherence to this LTEMP is required to ensure the suitability for commercial/industrial land uses within the Site and Proposed Lot 64. Design of future buildings to include appropriate management controls and measures assessed consistent with the Hazardous Ground Gas Guidelines. At this stage no enclosed buildings exist or are proposed within Proposed Lot 64. However, should any future buildings be proposed, the design must include appropriate management controls and measures assessed consistent with the *Hazardous Ground Gas Guidelines*[2].

Based on the nature and extent of residual contamination identified within the Management Area, the following controls are required under various operational scenarios:

- Where intrusive excavation works are proposed – the environmental management controls detailed in *Sections 6* of this LTEMP must be implemented.
- Where works involve no intrusive excavation (i.e. normal site operations) – management controls are applicable following completion of remediation and validation of Proposed Lot 64.
- As per Development Consent SSD9302, the conditions B22 (d) to B22 (g) outline requirements for ongoing passive management and mitigation of groundwater risks, including monitoring of natural attenuation, trigger levels for investigation of adverse impacts to Duck River, contingency actions and monitoring of effectiveness of management measures. These requirements are addressed within *Section 6* of this LTEMP, and the Stage 2 Groundwater Monitoring Program (GWMP) prepared by ERM in 2021.

3.1 IMPLEMENTATION OF THIS LTEMP

No works involving any intrusive excavations are to be undertaken within Proposed Lot 64 until all relevant personnel / contractors have been inducted into the requirements of this LTEMP.

The LTEMP should be acknowledged in relevant management plans prepared for any intrusive investigations. For smaller intrusive works this is likely to take the form of a safe work method statement while a Construction Environmental Management Plan (CEMP) may be required for more significant development and construction activities.

3.2 AREA TO WHICH THIS LTEMP APPLIES

This LTEMP applies to the entire Management Area.

Specific mitigation measures if excavation works are required to be undertaken apply to the extent of Capped Area and areas outside of the cap extent, as shown on on Figure 2, Appendix A, which are described within Section 4 of this LTEMP.

[2] NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*. May 2020.

3.3 APPLICATION OF LTEMP

Under regular operational conditions, the controls in this LTEMP that are applicable include the ongoing periodic monitoring requirements of the capping layer integrity and groundwater conditions.

Further controls are required immediately upon the initiation of any works that involve construction or maintenance that may have the potential to affect the capping layer. This includes the following activities within Proposed Lot 64:

- intrusive works which may alter the integrity of the capping layer;
- excavation of fill and natural soil materials to facilitate removal, realignment or construction of any subsurface infrastructure near the boundary of the capping layer;
- maintenance and / or upgrade of utility services;
- temporary stockpiling of excavated material resulting from on-site intrusive works; and
- off-site disposal of any waste contaminated soil / groundwater (if required).

Due to the historical land uses within Proposed Lot 64 (i.e. former refinery), all intrusive excavation works must be undertaken in consideration of potential unexpected finds of contamination. Where unexpected finds are encountered during works, they are to be managed in accordance with the requirements outlined within Section 6.1 of this LTEMP.

Where future beneficial use of groundwater, or future activities which may influence groundwater infiltration rates and / or flow direction is proposed, an assessment of suitability must be undertaken by a suitably qualified environmental professional. The assessment and any recommendations for re-use must be reviewed and endorsed by a NSW EPA accredited Site Auditor.

3.4 ROLES AND RESPONSIBILITIES

The following Table 3-1 summarises the requirements to be implemented within Proposed Lot 64.

TABLE 3-1 – LTEMP ROLES AND RESPONSIBILITIES

Position / Company	Responsibility
The Land Custodian and Site Auditor	• Approve the LTEMP
The Land Custodian	• Ensure all workers and contractors conducting intrusive works are aware of the requirements of this LTEMP. • Maintain records of all works undertaken within the Management Area as required within this LTEMP.
Site Operator (including Contractors and Subcontractors)	• Implement the LTEMP. • Provide adequate training in this LTEMP for all employees and contractors during site induction, and as required on an ongoing basis during the works. • Require any contractors conducting intrusive works to comply with this LTEMP. • Conduct monitoring as required in the LTEMP. • Complete all necessary registers, databases and records required in the LTEMP. • Assess any potentially contaminating unexpected finds in consideration of the use of Proposed Lot 64. • Undertake inspections and monitoring of operations within Proposed Lot 64 to ensure they are carried out in an environmentally responsible manner and meet the requirements of this LTEMP. • Notify the Land Custodian / nominated representative of any environmental issues arising. • Assess the requirement and (where necessary) engage a Suitably Qualified Environmental Specialist to undertake additional monitoring of unexpected finds. • Engage a Suitably Qualified Environmental Specialist to undertake the required ongoing monitoring requirements, including capping layer integrity inspections and groundwater conditions assessments.
Qualified Environmental Specialist	• Where required, a Suitably Qualified Environmental Specialist is to be engaged to manage, monitor and evaluate environmental controls, demonstrate compliance with this LTEMP and assess specific requirements associated with works within areas of known residual contamination and / or unexpected finds.

4. RESIDUAL CONTAMINATION SUMMARY

4.1 SITE GEOLOGY AND HYDROGEOLOGY

A detailed assessment of geology and hydrogeology at the Site which is relevant to Proposed Lot 64 is provided within the Lot 64 Validation Report (ERM, 2024). A summary of the geology of Proposed Lot 64 during historical investigations is detailed below:

- Heterogeneous fill materials were identified to a depth of 4.0 m Below Ground Level (BGL). ERM notes that previous test pitting was terminated within fill materials in AEC-4 and as such the potential for deeper fill was noted to exist.
- The fill material is described as an uncompacted mixture of silt, clay and gravel, with localised areas of slag, furnace ash, black sludge, concrete, bricks, timber, metal pipes, tiles and glass.
- LNAPL and "sludge materials" were identified at variable depths and locations throughout the fill materials.
- Field observations (and subsequent laboratory analysis) identified Asbestos Containing Material (ACM) and fibrous asbestos at a number of locations. Based on the nature and extent of fill within AEC-4, it was considered asbestos may be widely distributed throughout the fill matrix.

The majority of residual hydrocarbon contamination requiring management has been encountered within coarser grained fill materials and/or sandy lenses within residual clay and may appear as visibly stained dark brown, grey or black.

Groundwater is present within fill and anthropogenic structures, such as backfill around drainage features at depths between approximately 0.2 – 5 m BGL and generally flows towards the Duck River in the south to south-east; however, has been observed to flow to the south-west in the western portion due to localised groundwater mounding following rainfall events.

4.2 RESIDUAL CONTAMINATION REQUIRING MANAGEMENT

Remediation works involving installation of a capping layer have been completed within Proposed Lot 64. The capping layer eliminates exposure pathways through physical separation between contaminants and on-site commercial/industrial and off-site ecological receptors.

Asbestos impacted soils are managed *in-situ* within the former security access road portion of Proposed Lot 64 which extends along the southern and south-eastern portions of the Management Area (as shown on *Figure 1, Appendix A*). The area forms part of a Riparian Corridor which cannot be disturbed to preserve established vegetation. It is therefore considered that risk to on-site commercial industrial receptors is limited due to lack of access. The location of *in-situ* asbestos impacted materials is presented in *Figure 2, Appendix A*. A summary of residual contamination both within, and outside of the capped area is provided in *Table 4-1.*

TABLE 4-1 – TYPES OF RESIDUAL CONTAMINATION PRESENT

Known Residual Contamination	Description
Soil	
Asbestos	• Bonded ACM and friable asbestos in soils have been identified in several locations (see *Figure 2, Appendix A* and detailed in *Appendix D*). • Exceedances of NEPM HSL-D (Asbestos) remain present in the riparian corridors, historically identified in two locations which are not within the footprint of the ACC (TP19/21 and TP19/68)[3]. • Given the long history of industrial land use and surrounding industries, the possibility of discovering further asbestos impacted soils in the subsurface on-site cannot be discounted. • If asbestos is identified during intrusive works, any finds should be investigated as per the unexpected finds methodology detailed within *Section 6.1* and appropriate health & safety and waste management measures implemented.
Benzene	• Contaminated soil exceeding commercial vapour intrusion criteria are present in three locations (see *Figure 2, Appendix A*). • These exceedances are not considered to pose a risk to human health or ecological receptors based on the risk profile of future site uses, which are proposed to be limited to open air storage/ car parking by this LTEMP. • Furthermore, no mechanism for ground gas migration into any future indoor spaces or subsurface structures nearby to proposed Lot 64.
Carcinogenic Polycyclic Aromatic Hydrocarbons (PAH) – benzo(a)pyrene Toxic Equivalent Quotient (TEQ)	• Contaminated soil exceeding direct contact criteria for commercial workers are present one location (see *Figure 2, Appendix A*). • This exceedances is not considered to pose a risk to human health or ecological receptors based on the risk profile of future site uses, which are proposed to be limited to open air storage/ car parking by this LTEMP. • Furthermore, no mechanism for ground gas migration into any future indoor spaces or subsurface structures nearby to proposed Lot 64.
Hexavalent chromium	• Contaminated soil exceeding direct contact criteria for construction workers and commercial vapour intrusion criteria are present in several locations (see *Figure 2, Appendix A*).
Light Non-Aqueous Phase Liquids (LNAPL)	• Contaminated soil exceeding direct contact criteria for commercial workers and commercial vapour intrusion criteria are present in several locations (see *Figure 2, Appendix A*). • Residual Light Non-Aqueous Phase Liquids (LNAPL) or soil contamination exceeding 'TRH Management Limits' are present in several locations (see *Figure 2, Appendix A*).
Groundwater	
Benzene	• Contaminated groundwater exceeding off-site recreational (human health) criteria is present within on-site areas during historical investigations. • Concentrations of benzene detected in November 2023 at MW20-3 was noted to be below the adopted recreational criterion (10 ug/L), therefore these impacts have been demonstrated to be stable and immobile through previous environmental assessments. • Groundwater monitoring requirements with contingencies are outlined in the GWMP.

[3] ERM (2021), *Clyde Western Area Remediation Project, Stage 2 – Detailed Remediation Action Plan,* Final, Revision 2, Dated 08 July 2021.

Known Residual Contamination	Description
LNAPL	• Historical investigations have identified LNAPL groundwater present in several locations (see *Figure 3, Appendix A*). • Groundwater monitoring of nearby wells have demonstrated no down gradient migration of LNAPL from these isolated areas. Associated dissolved phase concentrations are limited in extent and are delineated to within the Stage 2 boundary of the WARP[2]. • LNAPL was identified at MW12/01, MW20/06 and MW20/07 during the Q4 2023 GME, as presented in *Figure 5, Appendix A*. An updated LNAPL CSM developed for the Stage 2 WARP area identifies that there is a low potential for residual LNAPL to act as an ongoing source of impact to groundwater[4]. • Current and historical monitoring data has demonstrated that LNAPL impacts are appropriately characterised, stable, and delineated to the Site.
PAHs including anthracene, benzo(a)pyrene, fluoranthene, naphthalene and phenanthrene	• Contaminated groundwater exceeding off-site ecological criteria present during historical investigations, however PAH concentrations were below the adopted site criteria during the Q4 2023 GME. • Therefore, the impact has been demonstrated to be stable and immobile through previous environmental assessments.

PFAS	• Historical monitoring data has identified contaminated groundwater present at the Site which exceeds ecological and recreational screening criteria.
	• In 2023, an assessment of potential off-site mass contributions of PFAS from the Site with the following conclusions:
	  ○ Potential offsite ecological impacts of PFOS exceeding ecological direct toxicity criteria in individual downgradient wells from AEC-4 are considered consistent with the magnitude of concentrations assessed via mass flux estimates of groundwater at the site boundary for other areas of Stage 2 (ERM 2018).
	  ○ Potential direct toxicity risks to offsite receptors were unlikely considering low mass contribution and overall volume of receiving water body. Offsite assessment of bioaccumulative effects of PFAS in waterways are unlikely to provide meaningful input into site-based PFAS management given magnitude of other offsite contributions to these systems.

4.3 LOCATION AND EXTENT OF RESIDUAL CONTAMINATION

As outlined in *Section 3.2*, this LTEMP applies to Proposed Lot 64 where residual contaminated materials are present beneath the Management Area's surface, as indicated in *Figure 2, Appendix A*. The following residual sources of contamination are known to exist within Proposed Lot 64, including beneath the capped area and outside of the capped extent:

[4] ERM (2024), *Clyde Western Area Remediation Project - Quarter 4 (2023) Stage 2 Groundwater Monitoring Project,* Final Revision 1, Dated 14 March 2024.

TABLE 4-2 – LOCATION OF RESIDUAL CONTAMINATION

Type of Residual Contamination	Criteria Exceeded	Within Capped Area	Outside of Capped Area
Soil			
Asbestos impacted soil (bonded and/or friable)	Commercial / industrial human health criteria	• TP19/21 (2.0 m) • TP19/81 (1.0 m)	• TP19/68 (1.0 m) • TP19/74 (1.5 m) • TP19/76 (2.2 m)
Benzene	Commercial / industrial vapour intrusion criteria	• TP19/19 (0.6 m) • TP19/23 (1.5 m) • TP19/77 (4.0 m)	N/A
Carcinogenic Polycyclic Aromatic Hydrocarbons (PAH) – benzo(a)pyrene Toxic Equivalent Quotient (TEQ)	Commercial / industrial direct contact criteria	• TP19/25 (1.3 m)	N/A
Hexavalent chromium impacted soil	Commercial / industrial direct contact criteria	• SB5B (1.0 m)	N/A
Hydrocarbon impacted soil	• Commercial / industrial direct contact criteria • Commercial / industrial vapour intrusion criteria	• MW12/01 (2.0 m) • TP18/27 (1.2 to 3m) • TP19/19 (0.6 m) • TP19/21 (2.8 m) • TP19/23 (1.5 m) • TP19/25 (1.3 m) • TP19/77 (1. 4 to 4 m)	• N/A
	Management limits exceeded	Depths between 0.6 and 6m BGL: • MW12/01 • MW20/03 • MW20/06 • MW20/07 • MW20/13 • TP18/27 • TP19/19 • TP19/21 • TP19/23 • TP19/24 • TP19/25 • TP19/77 • TP19/83 • TP19/84 • TP19/85 • TP19/87 • SB5B	• MW12/20 (2.0 m) • TP19/75 (1.5 m)
Groundwater (2023)			
LNAPL impacted groundwater	Observed presence in groundwater monitoring wells	• MW12/01 • MW20/06 • MW20/07	N/A
PFOS	Ecological criteria (off-site) 95% protection	N/A	• MW20/17

5. POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

5.1 RISKS WHERE NO INTRUSIVE EXCAVATION WORKS ARE UNDERTAKEN

There are no identified risks to human health or the environment associated with residual contamination if not disturbed. Ongoing monitoring of the capping layer integrity and groundwater conditions as outlined in *Section 6* is required to confirm no risks to human health or the environment exist in the future.

5.2 POTENTIAL RISKS - EXCAVATION WITHIN CAPPED AREA

Excavation into the capped area (shown on Figure 2) is to avoided and not undertaken without the prior engagement and advice of a Qualified Environmental Specialist, as per the contingency measures outlined in *Section 7* of this LTEMP.

The construction on a capping layer was undertaken to mitigate risks to future receptors via the following pathways:

- **Physical Separation:** Mitigate against potential for inadvertent direct contact with contaminated soils or disturbance of asbestos in soils by future on-site workers conducting excavations, via installation of separation layers, including geotextile and LLDPE geomembrane liners over contaminated materials;
- **Infiltration Reduction:** Mitigate against surface water infiltration at the ground surface, via installation of an impermeable LLDPE liner, therefore reducing potential contaminant mass flux and LNAPL in groundwater from the buried waste area. The constructed liner also serves as a barrier for vertical migration of vapour and gas from underlying hydrocarbon contaminated soil materials.

The following table outlines the potential risk to human health and the environment if the capping layer is penetrated and material beneath is disturbed. These risks may result from unauthorised excavation and/or works, where the risk of encountering residual contamination is summarised in *Table 5-1*.

TABLE 5-1 – POTENTIAL RISKS OF DAMAGE TO THE CAPPING LAYER

Contaminant	Source	Potential Human Health Risks	Potential Environmental Risks	Potential Exposure Pathways
Asbestos	Fibre cement fragments containing asbestos and loose asbestos bundles in soils	Asbestos fibres can cause asbestosis, lung cancer and mesothelioma if inhaled	Asbestos is inert within the environment and therefore poses no known environmental risk	**Human Health:** Inhalation of asbestos fibres could occur via soil disturbance of friable asbestos containing soils. Potential for this exposure pathway may exist if capping is penetrated. **Ecological:** Nil
Benzene	Residual contamination within soils and groundwater	Inhaling benzene vapours can result in dizziness, drowsiness and unconsciousness, and in the long term can effect tissues that form blood cells, especially bone marrow, and can cause cancer	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Soil –direct contact and/or inhalation by commercial workers. Potential for this exposure pathwaymay exist if capping is penetrated. **Ecological**: Surface water / sediment run-off to adjacent storm water drains. Uncontrolled release of dust / odours / impacted soils or groundwater may occur if capping layer severely damaged.

Contaminant	Source	Potential Human Health Risks	Potential Environmental Risks	Potential Exposure Pathways
Carcinogenic PAH - benzo(a)pyrene TEQ	Residual contamination within soils	Direct contact with benzo(a)pyrene can cause a skin rash and skin, lung and bladder cancer	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Direct contact by commercial workers. Potential for this exposure pathway may exist if capping is penetrated. **Ecological**: Surface water / sediment run-off to adjacent storm water drains. Uncontrolled release of dust / odours / impacted soils or groundwater may occur if capping layer severely damaged.
Hexavalent chromium	Residual contamination within soils	Direct contact with hexavalent chromium can cause dermatitis, skin ulcers and permanent eye damage	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Direct contact by on-site commercial / industrial receptors. Potential for this exposure pathway may exist if capping is penetrated. **Ecological**: Surface water / sediment run-off to adjacent storm water drains. Uncontrolled release of dust / odours / impacted soils or groundwater if capping layer severely damaged.
PAHs including anthracene, benzo(a)pyrene, fluoranthene, naphthalene and phenanthrene	Residual contamination in groundwater	Direct contact with PAHs can cause a skin rash and skin, lung and bladder cancer	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Direct contact by off-site recreational receptors. **Ecological**: Surface water / sediment run-off to adjacent storm water drains. Uncontrolled release of dust / odours / impacted soils or groundwater if capping layer severely damaged.
Total Recoverable Hydrocarbons (C6-C10) and LNAPL	Residual contamination within soils and groundwater	Inhaling hydrocarbon vapours can result in irregular heartbeats, shortness of beat, neurological problems and can cause cancer	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Soil – indoor inhalation of vapours by commercial workers. Pooling of ground gases. Potential for this exposure pathway if capping is penetrated. **Ecological**: Surface water / sediment run-off to adjacent storm water

Contaminant	Source	Potential Human Health Risks	Potential Environmental Risks	Potential Exposure Pathways
				drains. Uncontrolled release of dust / odours / impacted soils or groundwater if capping layer severely damaged.
Total Recoverable Hydrocarbons (C10-C16, C16-C34) and LNAPL	Residual contamination within soils	Direct contact with total recoverable hydrocarbons can cause skin irritation, tissue breakdown, chemical burns which can lead to absorption and acute toxic systemic manifestations	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Health:** Direct contact by commercial workers. Potential for this exposure pathway if capping is penetrated. **Ecological**: Surface water / sediment run-off to adjacent storm water drains. Uncontrolled release of dust / odours / impacted soils or groundwater if capping layer severely damaged.

5.3 POTENTIAL RISKS - EXCAVATION WORKS OUTSIDE OF CAP EXTENT

The following table outlines the potential risk to human health and the environment if excavation works are undertaken outside of the capped extent and the material is disturbed without proper management controls.

Planned excavations outside of the capped area to be undertaken following the advice of a Qualifed Environmental Specialist to determine potential interaction with capped area and ensure preferential pathways are not introduced through via service trenches/utilities installed within the vicinity of the Cap.

These risks may result from excavation works, including the installation of services, stockpiling of excavated materials and works that encounter residual contamination identified within *Figures 2* or *3, Appendix A* or additional unexpected finds.

TABLE 5-2 – POTENTIAL RISKS OF INTRUSIVE WORKS UNDERTAKEN OUTSIDE THE CAPPED AREA

Contaminant	Source	Human Health Risks	Environmental Risks	Exposure Pathways
Total Recoverable Hydrocarbons (C10-C16, C16-C34) and LNAPL	Residual contamination within soils and oily water / sludge	Limited to generation of nuisance odours during subsurface intrusive works resulting from degraded hydrocarbons within open excavations	Risks associated with contamination transported to potentially sensitive receptors (see exposure pathways)	**Human Exposure Pathways:** Limited to aesthetic considerations including potential for generation of odours during subsurface intrusive works

Contaminant	Source	Human Health Risks	Environmental Risks	Exposure Pathways
				Environmental Exposure Pathways: Surface water / sediment run-off to adjacent stormwater drains. Uncontrolled release of dust / odours generated during excavation works.
Asbestos	Asbestos in soils (as identified in Appendix D)	Asbestos fibres can cause asbestosis, lung cancer and mesothelioma if inhaled	Asbestos is inert within the environment and therefore poses no known environmental risk	**Human Exposure Pathways:** Inhalation of liberated asbestos fibres could occur via breakage or disturbance of asbestos containing materials during excavation works. **Environmental Exposure Pathways:** Nil

6. ENVIRONMENTAL MANAGEMENT

Adherence to this LTEMP is required to ensure the suitability for commercial/industrial land uses within the Site and Proposed Lot 64. Design of future buildings to include appropriate management controls and measures assessed consistent with the Hazardous Ground Gas Guidelines. At this stage no enclosed buildings exist or are proposed within Proposed Lot 64. However, should any future buildings be proposed, the design must include appropriate management controls and measures assessed consistent with the *Hazardous Ground Gas Guidelines*[5].

Based on the nature and extent of residual contamination identified within the Management Area, the following controls are required under various operational scenarios:

- Where intrusive excavation works are proposed – the environmental management controls detailed in *Sections 6* of this LTEMP must be implemented.
- Where works involve no intrusive excavation (i.e. normal site operations) – management controls are applicable following completion of remediation and validation of Proposed Lot 64.
- As per Development Consent SSD9302, the conditions B22 (d) to B22 (g) outline requirements for ongoing passive management and mitigation of groundwater risks, including monitoring of natural attenuation, trigger levels for investigation of adverse impacts to Duck River, contingency actions and monitoring of effectiveness of management measures. These requirements are addressed within *Section 6* of this LTEMP, and the Stage 2 Groundwater Monitoring Program (GWMP) prepared by ERM in 2021.

6.1 ENVIRONMENTAL MANAGEMENT REQUIREMENTS

Within Proposed Lot 64, the future construction of enclosed spaces will not be in direct contact with contaminated waste material (service trenches, pits and buildings) and potential for ground gas accumulation will be limited through implementation of design controls on future buildings within the AEC-4 footprint under this legally enforceable LTEMP.

As outlined above, the overall objective of this LTEMP are to mitigate risk associated with residual contamination within Proposed Lot 64 so that:

- the assessed risks to human health and the environment arising from direct contact with and inhalation of residual contamination is understood by all workers and managers of Proposed Lot 64;
- prior to the commencement of any construction and maintenance works, appropriate systems and controls are put in place to mitigate the potential risks posed by residual contamination; and
- all ongoing operational, monitoring and maintenance requirements are adhered to by the Site Operator.

[5] NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*. May 2020.

Due to the capping layer creating physical separation to subsurface residual soil contamination and reducing the potential of surface water infiltration, ongoing monitoring of the capping layer integrity is required to confirm the capping layer continues to serve these purposes. Following the initial 18-month period of inspections and monitoring, if no major issues have been identified, inspections of Proposed Lot 64 should be conducted in perpetuity on an annual basis subject to the requirements of this LTEMP and observations from previous inspections, management actions and results of environmental monitoring. Should no major actions be required following the first 18 months, it is intended that inspections will be undertaken in line with the environmental monitoring works described within this LTEMP.

Although the groundwater contamination has been shown to be stable and immobile, ongoing monitoring of groundwater conditions is required to confirm that contamination is not migrating off-site. Following remediation, it is proposed at monitoring will occur biannually (every 6 months) following completion of a post remediation sampling event

The Requirement for ongoing sampling is to be reviewed annually (ie every two GMEs) based on trend analysis and reported concentrations, as detailed in the GWMP. These monitoring requirements are summarised in Table 6-1.

Prior to the commencement of any works, it is the responsibility of the Site Operator to identify whether works within Proposed Lot 64 will require intrusive excavation. Where any intrusive works are undertaken within Management Area, the controls within the following table must be implemented.

TABLE 6-1 – SITE ENVIRONMENTAL MANAGEMENT REQUIREMENTS

Item	Requirements
All Intrusive Works Undertaken within Proposed Lot 64	
Training and Competence	The Site Operator is to establish that all workers are suitably qualified to undertake required works and inducted into all relevant requirements stipulated within this LTEMP. • The induction will include outlining all requirements within this LTEMP and other relevant documentation, the location of known residual contamination (as per *Figures 2* and *3, Appendix A*) and the identification of unexpected finds of contamination (via visual and olfactory means).

Item	Requirements
Health and Safety Plan	The Site Operator or contactor carrying out the works is to prepare a task specific health and safety plan that includes suitable protection measures for working with residual hydrocarbon, hexavalent chromium and asbestos contamination including but not limited to: • training requirements; • air / dust / odour monitoring procedures; • respiratory protection; • minimum Personnl Protective Equipment (PPE) requirements; • signage requirements; • security within the Site and Proposed Lot 64; • exposure mitigation measures (dust suppression etc.); • vehicle / machinery / plant safety; and • general occupational health and safety.
Engagement of Environmental Specialist	**Where excavation works are required to be undertaken outside of the capped area of Lot 64, or within the services trench and shallow footings of the capped area:** The Site Operator or nominated representative is to engage a Suitably Qualified Environmental Specialist prior to undertaking intrusive works, to undertake a review of health and safety management procedures, manage, monitor and evaluate environmental controls and demonstrate compliance with this LTEMP. **Excavation works are not to be undertaken at Proposed Lot 64 within the footprint of the capped area**. In the event that the membrane of the capped area is accidentally penetrated, the Site Operator or nominated representative is to consult with a Suitably Qualified Environmental Specialist to assess: • Whether contaminated materials below the marker layer have been exposed. • The extent of potential damage to the installed geotextile marker layer or LLDPE geomembrane. • Where disturbance/ damage to the marker layer/ LLDPE geomembrane is identified, contingency actions associated with damage to the cap outlined in Section 7 of this LTEMP will apply.
Environmental Monitoring	Environmental monitoring is to be undertaken for odour management purposes during all maintenance and construction works within Proposed Lot 64. • The specific monitoring methodology / regime should be developed by the Suitably Qualified Environmental Specialist and based on the specific tasks / construction methodology. • The Suitably Qualified Environmental Specialist shall determine whether action levels (odour, dust) are to be developed to incorporate thresholds where intrusive works are to cease and control measures are to be re-assessed / implemented. These action levels are to be based on relevant regulatory guidance at the time of works and are to be incorporated into Health and Safety Planning documentation when undertaking works. It is a requirements of this LTEMP that Groundwater Monitoring requirements, as per the GWMP (Appendix E), Ground Gas Monitoring as per Ground Gas Monitoring Program (Appendix F), and capping inspections (as per Table 6-2) are undertaken.
Task Specific Works Plan	**Excavation works are not to be undertaken within the footprint of the capped area, as shown in *Figure 1-3, Appendix A*.** Where excavation works are required to be undertaken outside of the capped area of Proposed Lot 64, the contractor is to ensure that a Task Specific Works Plan is prepared by a suitably qualified environmental professional to ensure all environmental risks are appropriately managed prior to commencement. • The Works Plan should be prepared for the specific works to be undertaken. • The Works Plan should be prepared in accordance with good industry practice standards at the time of works and must comply with all relevant NSW EPA regulatory guideline criteria relating to contaminated sites. The plans should include (but not be limited to) the following details: • Risks to human health and the environment – potential risks associated with the work should be highlighted.

Item	Requirements

	• General site management – Details of required inductions of employees or contractors.
	• Procedures and methodologies to be used for undertaking the works.
	• Specific details of ways to limit disturbance of impacted soils / groundwater / redundant site drainage infrastructure etc. (e.g. soil boring as opposed to open trenching).
	• Mitigation measures.
	• Air / dust monitoring action levels, around areas of residual hydrocarbon impacts;
	• Personal protective equipment.
	• Other protection measures (cabin ventilation, etc.).
	• Roles and responsibilities for implementing the mitigation measures.
	• Soil and groundwater management controls - As a minimum the following requirements should be detailed:
	    ◦ Any groundwater extracted during intrusive works is to be disposed in accordance with all legal requirements.
	    ◦ Excavated soils should be placed within a bunded area to minimise potential run off.
	    ◦ Soil / concrete material should be kept moist to limit dust.
	    ◦ Excavated materials, where possible, be replaced in the same location. Where this is not practicable, material must be disposed of in accordance with all legal requirements.
	• Reinstatement of the site surface.
	• Waste management including waste disposal.
	• Record Keeping, audit and review.

Excavation works and temporary stockpiling	To reduce and / or prevent the exposure of human receptors at within Proposed Lot 64 to potential contamination within on-site soils, the following will be undertaken during any intrusive excavation works within Proposed Lot 64 (but outside of the capped area): • To reduce the area of disturbed material, the number of areas subject to excavation works at any one time can be minimised. • During excavation works, measures to reduce dust emissions such as spraying with water, addition of soil binding agents etc. should be undertaken. • During excavation and materials handling, sufficient odour control such as covers, tarps, odour control sprays etc., are to be implemented during works to minimise any disturbance to neighbouring premises. • Where material requires off-site disposal, excavated material should be placed directly into a tipper truck and, where possible, material should not be placed into temporary stockpiles awaiting off-site disposal. • Where material requires stockpiling prior to off-site disposal, appropriate dust and sediment controls must be in place. Smaller volumes can be contained within an enclosed or covered skip. • All materials movement within the Site, including Proposed Lot 64 must be recorded within an appropriate Materials Tracking Register.
Excavation of stockpiles containing asbestos	To reduce and / or prevent the exposure of human receptors at the Site to asbestos within on-site stockpiles, the following will be undertaken during any intrusive excavation works of stockpiles: • To reduce the area of disturbed material, the number of areas subject to excavation works at any one time can be minimised. • During excavation works, measures to reduce dust emissions such as spraying with water, addition of soil binding agents etc. should be undertaken. • Asbestos controls are to be applied as per an Asbestos Management Plan or similar document outlining asbestos controls to limit exposure to human receptors and cross contamination of other site materials/areas. Examples include dust suppression (as above), exclusion zone around excavation area and relocation area, with appropriate personal protective equipment implemented (i.e. P2 respirator, coveralls, boot covers and gloves). • Updated locations of stockpiles are to be incorporated within the Asbestos Register (*Appendix D*), with the soil surface of the stockpile's former footprint to be visually cleared of asbestos containing materials by a Suitably Qualified Environmental Specialist.

Item	Requirements
	• If asbestos stockpiles are relocated below ground level, they must be reinstated beneath the capping layer and marker layer. Each layer is to be validated as intact and surfaces visually cleared of asbestos containing materials by a Suitably Qualified Environmental Specialist. • Where material requires off-site disposal, excavated material should be placed directly into a tipper truck and, where possible, material should not be placed into temporary stockpiles awaiting off-site disposal.
Materials handling and disposal	• **Soil** - Excavated materials are to be either re-instated within the same location and depth (in accordance with relevant planning / DA conditions) or disposed off-site to a suitably licenced landfill / receiving facility in accordance with relevant NSW EPA waste disposal guidance at the time of works. • **Groundwater** - Any groundwater extracted from excavation works outside of the capped area is to be managed or disposed in accordance with relevant NSW EPA made or endorsed waste disposal guidance at the time of works.
Sediment and Stormwater Run-off Controls	During works, sediment and surface water run-off controls will be implemented to minimise generation and transport of potentially contaminated sediments and surface water on and off-site. Controls will be developed based on a specific management plan (which may be a safe work method statement or Construction Environmental Management Plan [CEMP] depending on the nature of the works) specific to the location / nature of works to be undertaken. Controls may include (but not be limited to): • sediment control; • clean water diversions; • stormwater drain protection; and • Environmental Management Controls as per *Managing Urban Stormwater – Soils and Construction (Landcom 2004),* or its most recent update.
Imported Fill Material	If imported fill is required at the Site, only construction materials or certified Excavated Natural Material (ENM) or 'Virgin **Excavated Natural Material'** (VENM) materials are to be imported for use. If ENM / VENM is imported to the Site accompanied by an ENM / VENM certificate, sampling will not be required. The ENM / VENM certificate should at a minimum: • state that the material has been classified as ENM / VENM (in accordance with relevant NSW EPA guidance) and is suitable for re-use within the Site; and • include a summary of the site history of the source site, the findings of any environmental site investigations undertaken at that site and the results of any soil analysis undertaken. If the ENM / VENM certificate does not meet these requirements, it must be approved in writing from the NSW EPA (e.g. via a Resource Recovery Exemption). All ENM / VENM / imported material classification reports are to be provided to the Land Custodian or their nominated representative and included within compliance reporting upon completion of works (*Section 6.3*).
Unexpected Finds Management	During excavation works there is the potential of encountering additional in-ground finds outside of the capped extent of Lot 64. Unexpected finds may include (but not be limited to): • additional asbestos containing materials; • additional LNAPL / hydrocarbon impact; • buried building rubble; • unusual soil staining and discoloration; and • odours emanating from the ground during earthworks. Unexpected finds within the capped extent of Lot 64 may include visual or olfactory indicators of contamination that are not outlined above. Where unexpected finds are uncovered: • works are to cease immediately in the vicinity of the excavation; • the Land Custodian or their nominated representative is to be informed immediately; • the area surrounding the unexpected find is to be barricaded to ensure the area is not further disturbed; and • a Suitably Qualified Environmental Specialist is to visit the Site, assess the discovery and undertake assessment / provide recommendations.

Item	Requirements
	The Suitably Qualified Environmental Specialist is to advise on the required course of action for the find. This may include: • sample collection and analysis; • a detailed assessment (if required); and • preparation of an assessment report and remediation plan (if required). All reports are to be prepared in accordance with relevant NSW EPA guidance and provided to the Land Custodian for record keeping requirements. Should finds of asbestos containing materials be reported, the asbestos register (*Appendix D*) should be updated accordingly.
Excavation Re-instatement	Upon completion of excavation works, the area must be re-instated with excavated material in the order in which it was excavated or with other approved imported fill materials.
Biodiversity Management Measures - Green and Golden Bell Frog (GGBF)	
Green and Golden Bell Frog (GGBF)	Pursuant to a Biodiversity Development Assessment Report dated 3 Dec 2018 prepared by Biosis (see appendix I of the Environmental Impact Statement [EIS] for SSD 9302) there is no residual GGBF habitat within Proposed Lot 64. In addition, the further earthworks authorised under development consent SSD 10459, when completed, will permanently remove the potential for the ponding of water that might provide habitat for the GGBF.

6.2 FINAL LANDFORM CONSTRUCTION WITHIN THE CAPPED AREA

Following installation of the liner materials to meet remediation requirements for the capped area, the subsections below outline the requirements for completion of the final landform.

6.2.1 MATERIALS AND CONSTRUCTION

Engineered fill materials must meet the requirements which are stated in *Table 6-1* of this LTEMP. Furthermore, any materials applied to the capped area must confirm with the requirements specified within *Section 5.5.3* of the *Clyde Western Area Remediation Project – Proposed Lot 64-AEC-4 Capping Construction Technical Specification,* dated 12 March 2024 (ERM, 2024).

Materials and construction methodologies for pavement and landform construction within the capped area are to confirm to Civil Design Drawing CO13919.06-CC30 and CO13919.06-CC56 provided within *Appendix G*.

6.2.2 INSPECTION AND TESTING

Inspection and Testing shall be conducted by the Geotechnical Consultant under Full Time (Level 1) Supervision to meet compaction requirements as per Pavement Design.

Engineered fill materials are also subject to the documentation, testing and inspection requirements specified within *Section 5.5.3* of the Technical Specification (ERM, 2024).

Survey of the final finished surface is to be undertaken by the contractor and subject to final inspection by the Validation Consultant to verify that a minimum slope of 1% is maintained, such that stormwater runoff will not pool on the finished capped area.

6.3 INSPECTIONS, REPORTING AND LTEMP REVIEW

The table below outlines the inspection, reporting and review requirements related to this LTEMP.

TABLE 6-2 – LTEMP REPORTING

Report	Requirement
Capping Inspections	Regular site inspections of Proposed Lot 64 are to be undertaken to assess the condition of capping, and integrity of the completed remedial works. At a minimum, inspections of the cap within Proposed Lot 64: • Inspection of the capping to assess the integrity, and whether any activities have been undertaken, or issues have arisen within the capped area which may require maintenance; • Inspect vegetation growth surrounding the capped area, and determine whether any management works such as slashing is required; and • Observe whether there is suitable control of surface water run-off with minimal sediment transport outside of the designed flow paths. Inspections of Proposed Lot 64 should take place monthly for the first six months following completion of the remedial activities. After the first six months, inspections should be reduced to quarterly for a further twelve months (i.e. every three months). Following the initial 18-month period of inspections and monitoring, if no major issues have been identified, inspections of Proposed Lot 64 should be conducted in perpetuity on an annual basis subject to the requirements of this LTEMP and observations from previous inspections, management actions and results of environmental monitoring. Should no major actions be required following the first 18 months, it is intended that inspections will be undertaken in line with the environmental monitoring works described within this LTEMP.
Post Construction Gas Monitoring Events	The Ground Gas Monitoring Program (GGMP) has been developed for Proposed Lot 64, the GGMP was developed in accordance with the *Solid Waste Landfill Guidelines* (NSW EPA, 2016) and the conditions of SSD 9302. Post-remediation gas monitoring requirements are detailed within the GGMP and form part of this LTEMP. The objective of this post-remediation ground gas monitoring plan is to utilise the collected dataset to assess the efficacy of the remediation strategy of Proposed Lot 64 by encapsulation of residual contamination. Should elevated levels of methane be detected above 1% v/v, the Site Operator must notify NSW EPA within 24 hours, and adhere to the Action Requirements, as described in Section 6 of the GGMP.
Groundwater Monitoring Reports	A GWMP has been developed for the Stage 2 Area, which includes Proposed Lot 64. The GWMP was developed in accordance with the consent conditions associated with approval SSD 9302. Post remediation groundwater monitoring requirements are detailed within the GWMP, and forms part of the requirements of this LTEMP. The specific conditions of SSD 9302 and their objectives include: • **Condition B22 (d)**: detail ongoing monitoring following demobilisation, to verify that natural attenuation of groundwater contamination is occurring over time; • **Condition B22 (e)**: include trigger levels for investigating potential adverse impacts to the Duck River, including triggers for indicating if further remediation of groundwater is required; • **Condition B22 (f)**: outline contingency actions to be implemented if monitoring indicates that natural attenuation is not occurring, or groundwater is having an adverse impact on the Duck River; • **Condition B22 (g)**: monitor the effectiveness of management measures and contingency actions for reducing impacts To demonstrate ongoing stability of groundwater conditions and that residual groundwater impacts do not present a risk to the ecological values of receptors, specifically the Duck River. The monitoring program to be implemented post-remediation is presented as Table B2 of the GWMP presented in *Appendix D*.

Report	Requirement
Material Classification Reports	• All reports relating to unexpected finds, off-site disposal of fill materials and importation of any materials used for construction / backfilling purposes are to be provided to the Land Custodian upon completion of works. • Reports are to include details of laboratory analysis and subsequent classification information and materials tracking information detailing the total volume and final placement / disposal location.
Non-Conformance Reporting	• Any non-conformances with this LTEMP will be recorded in a Non-Conformance and Corrective Action Report. Details of the non-conformance, including any immediate corrective actions undertaken, are to be recorded by the Site Operator. • It is the responsibility of the Site Operator to immediately initiate corrective actions, if required. Once completed, the Site Operator will provide details of the actions undertaken on the Non-Conformance Report and sign, date and file the report.
LTEMP Review	This LTEMP should be reviewed by the Land Custodian or their nominated representative upon completion of all intrusive excavation activities (outside of the capped area) and / or after incidents or reported findings, to ensure that: • information and environmental management strategies remain current; • any opportunities for improvement are identified; and • changes to legislation, environmental standards licence and approval conditions are identified and complied with. Information obtained during intrusive works including (but not limited to) the following sources may be utilised to review the LTEMP: • Details of the works undertaken including relevant photographs. • Details of any unexpected finds (nature, location, extent and results of testing / analysis undertaken, photographs). • Any pertinent additional safety controls that were required to be implemented during intrusive works. The assessment should take into account all changes such as (but not limited to): • changes to Site conditions, or conditions within Proposed Lot 64; • work requirements; • legislation; and • environmental condition. If during the review process described above, areas for improvement are identified, or it be determined that the LTEMP requires revision, any changes to the document will require agreement by at least the following stakeholders: • Land Custodian (or nominated representative); • Suitably Qualified Environmental Specialist; and • a NSW EPA accredited Site Auditor.
Record Keeping	All records related to implementation of the LTEMP should be maintained by the Land Custodian or their nominated representative in a consolidated and easily accessible location.

7. CONTINGENCY ACTIONS

The purpose of the contingency plan is to identify unexpected situations that could occur, and specify procedures that can be implemented to manage such situations and prevent or minimise adverse impacts to the environment and human health.

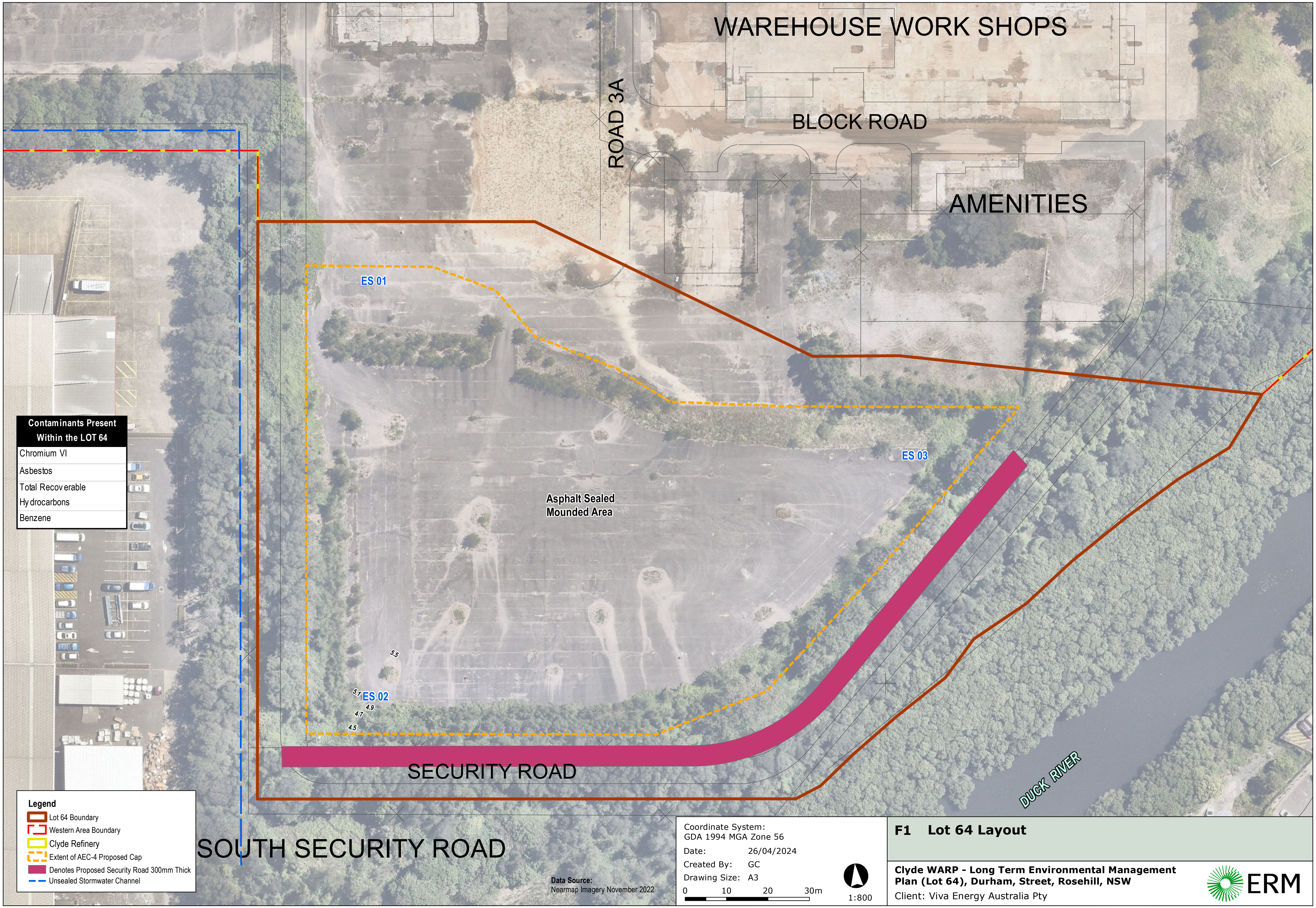
Details of the procedures are defined in the Table 7-1 below:

TABLE 7-1 – CONTINGENCY ACTIONS

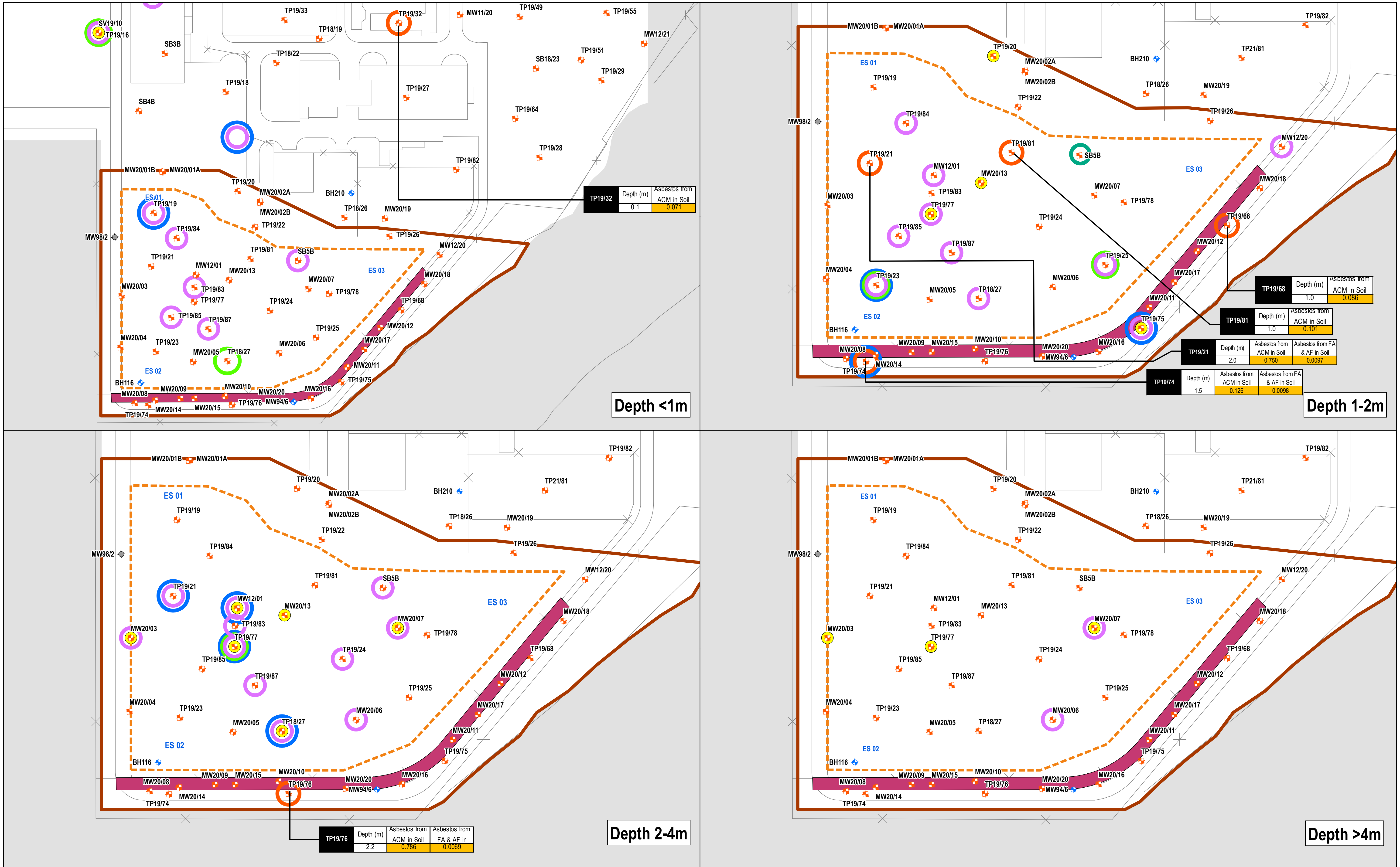
Item	Contingency Action
Asbestos in soils – outside of capping extent	• Where asbestos contaminated soil is identified outside the capped extent of Lot 64 during development works, any finds should be investigated as per the unexpected finds methodology detailed within *Section 6.1*. • Identified asbestos remaining on-site should be included on an updated version of the Asbestos Register (provided as *Appendix D*).
LNAPL / hydrocarbon contamination – outside of capping extent	• Where LNAPL / hydrocarbon impacted soil and / or groundwater is identified outside the capped extent of Lot 64 during development works, any finds should be investigated as per the unexpected finds methodology detailed within *Section 6.1*.
Penetration of LLPDE liner required for future construction	• Engagement of Suitably Qualified Environmental Specialist / NSW EPA accredited Site Auditor to assess environmental risk and required repairs/ design to reinstate integrity of capping/ liner.
Degradation / cracking of asphalt pavement surface, resulting in greater potential for ingress of runoff into buried waste materials	Inspections of Proposed Lot 64 should take place monthly for the first six months following completion of the remedial activities. After the first six months, inspections should be reduced to quarterly for a further twelve months (i.e. every three months). Following the initial 18 month period of inspections and monitoring, if no major issues have been identified, the inspections should be conducted in perpetuity subject to the requirements of this LTEMP and observations from previous inspections, management actions and results of environmental monitoring. Should no major actions be required following the first 18 months, it is intended that inspections will be undertaken in line with the environmental monitoring works described within this LTEMP.
Groundwater monitoring well network (destroyed/ unserviceable wells)	• Engagement of Suitably Qualified Environmental Specialist to assess impact of well loss on meeting the groundwater monitoring objectives. • If required, wells will be re-installed.
Post-remediation groundwater monitoring – potential off-site migration	• Contingency measures associated with groundwater monitoring works are outlined in Section 3.7 of the GWMP (Appendix E)
Hazardous ground gas concentrations identified in stormwater pits post construction of the capped area	• Enclosed space monitoring as per the GGMP. • Gas concentration levels will be compared with the 'Gas Accumulation Criterion' for enclosed structures (methane <1% v/v) as per Section 5.4 of the *Solid Waste Landfill Guidelines* (NSW EPA, 2016). Should elevated levels of methane be detected above 1% v/v, the measures outlines within these guidelines will apply.

ERM

APPENDIX A FIGURES



WAREHOUSE WORK SHOPS
ROAD 3A
BLOCK ROAD
AMENITIES
ES 01
ES 02
ES 03
Asphalt Sealed Mounded Area
SECURITY ROAD
SOUTH SECURITY ROAD
DUCK RIVER
5.5
5.1
4.9
4.7
4.5
Contaminants Present Within the LOT 64
Chromium VI
Asbestos
Total Recoverable Hydrocarbons
Benzene
Legend
Lot 64 Boundary
Western Area Boundary
Clyde Refinery
Extent of AEC-4 Proposed Cap
Denotes Proposed Security Road 300mm Thick
Unsealed Stormwater Channel
Data Source:
Nearmap Imagery November 2022
Coordinate System:
GDA 1994 MGA Zone 56
Date: 26/04/2024
Created By: GC
Drawing Size: A3
0 10 20 30m
1:800
F1 Lot 64 Layout
Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty
ERM



Legend

- Lot 64 Boundary
- Extent of AEC-4 Proposed Cap
- Denotes Proposed Security Road 300mm Thick
- LNAPL Present
- Monitoring Well
- Lost/Destroyed Monitoring Well
- Soil Sampling Location
- TRH Management Limit
- Inhalation (Asbestos)
- Vapour Intrusion
- Direct Contact (Hydrocarbons)
- Direct Contact (Chromium VI)

Coordinate System:
GDA 1994 MGA Zone 56

Date: 26/04/2024

Created By: GC

Drawing Size: A3

0 10 20 30m

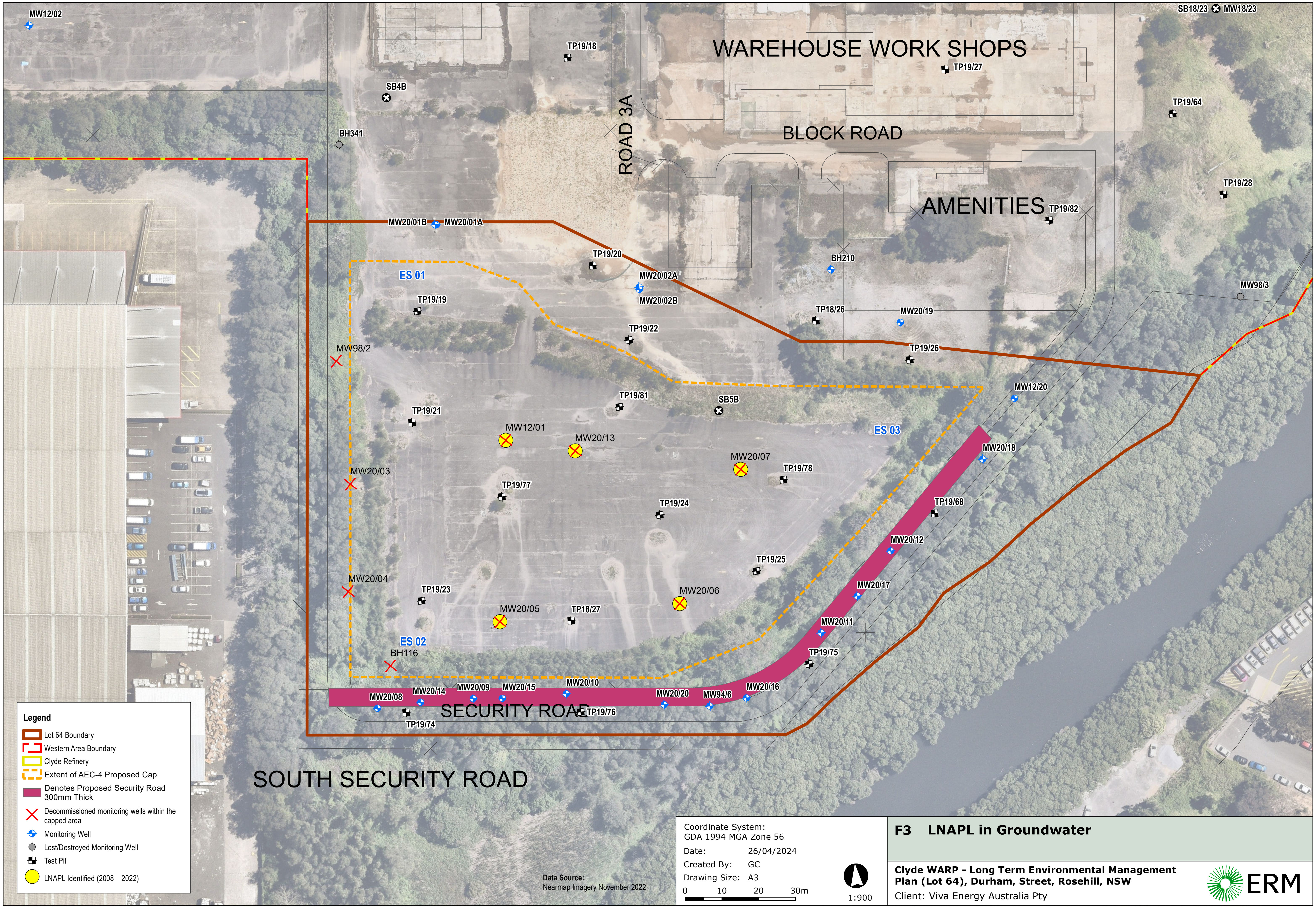
1:1,400

F2 Risks For Intrusive Workers - Soil

Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW

Client: Viva Energy Australia Pty

ERM



Coordinate System:
GDA 1994 MGA Zone 56

Date: 26/04/2024

Created By: GC

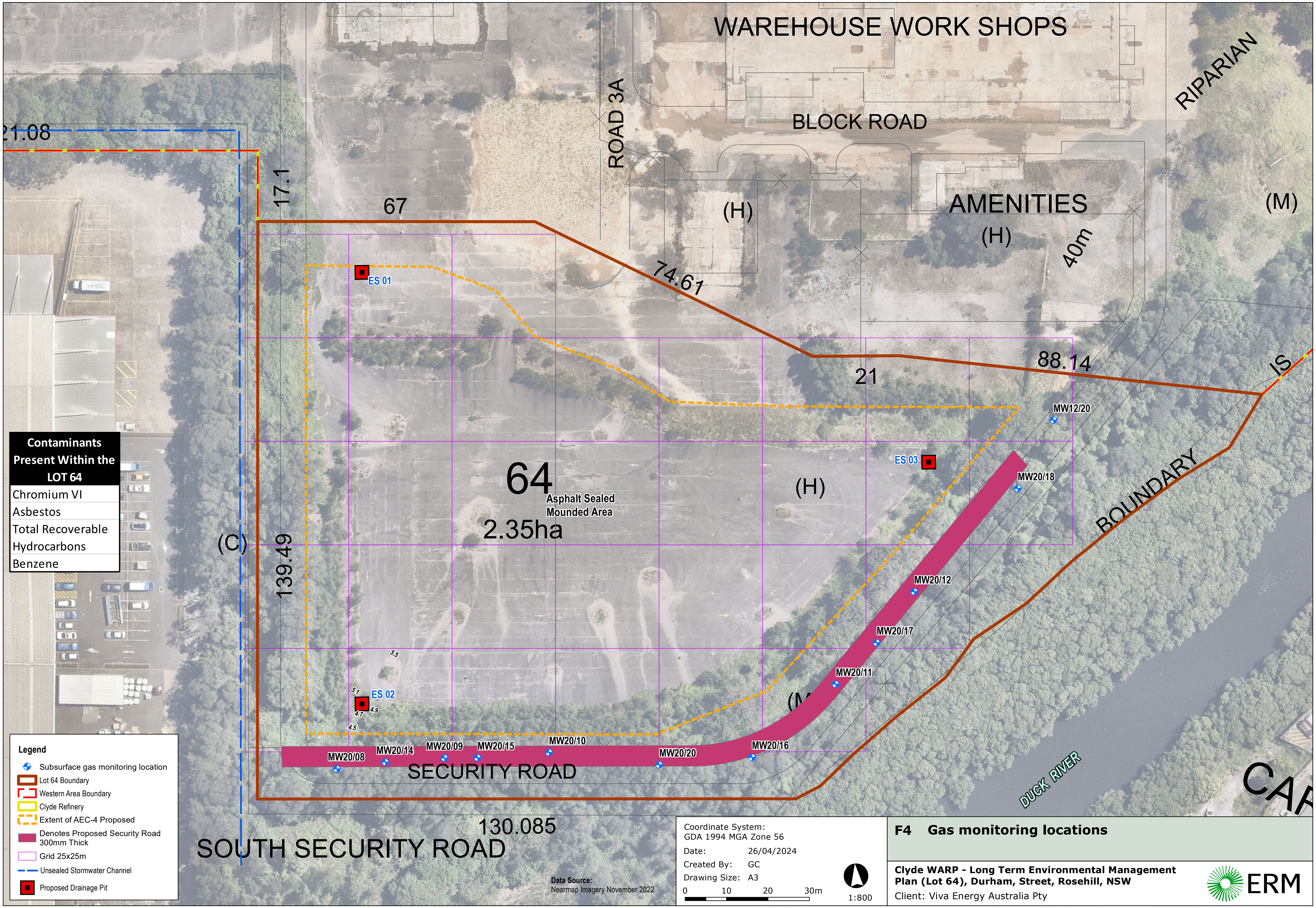
Drawing Size: A3

F3 LNAPL in Groundwater

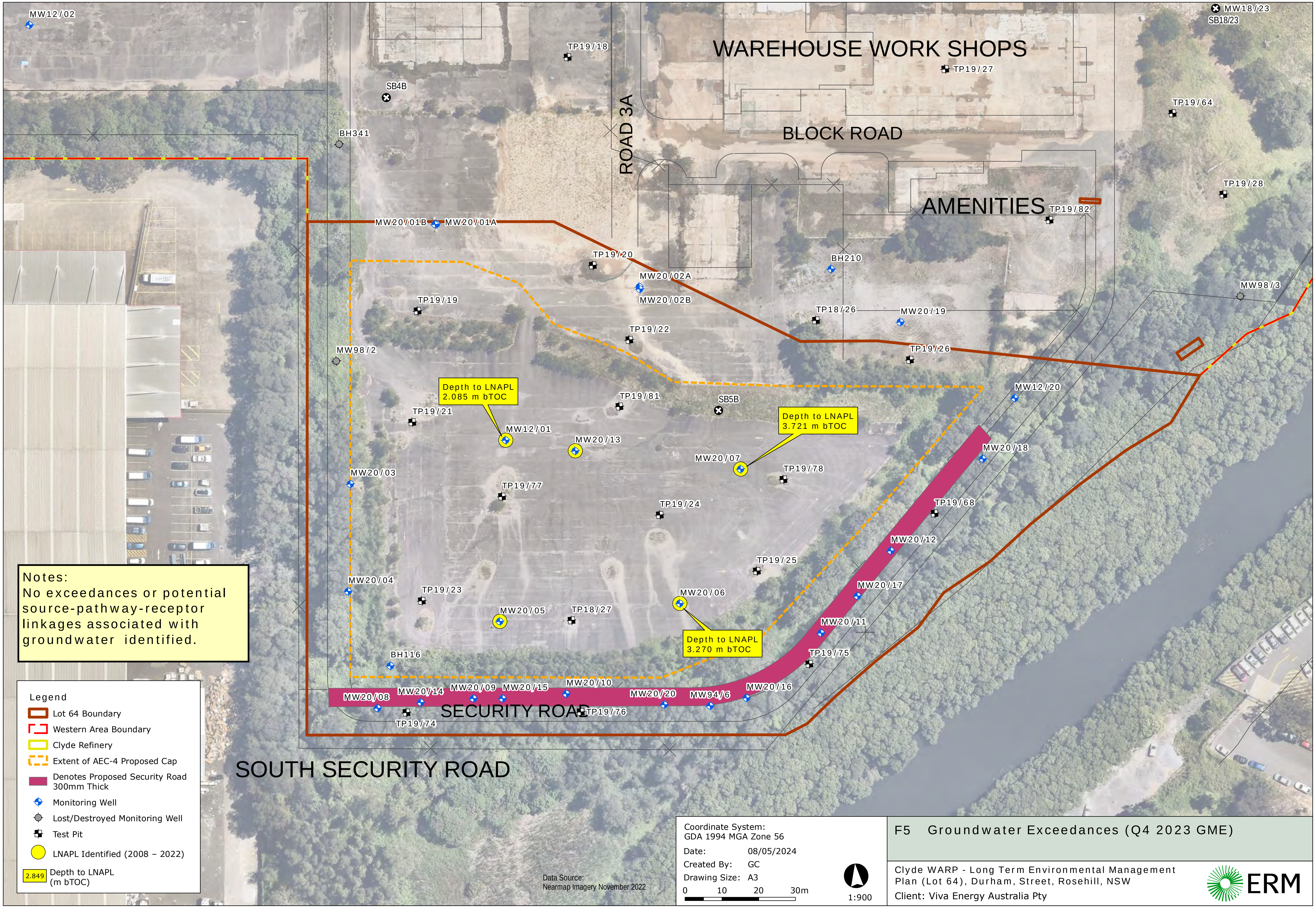
Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW

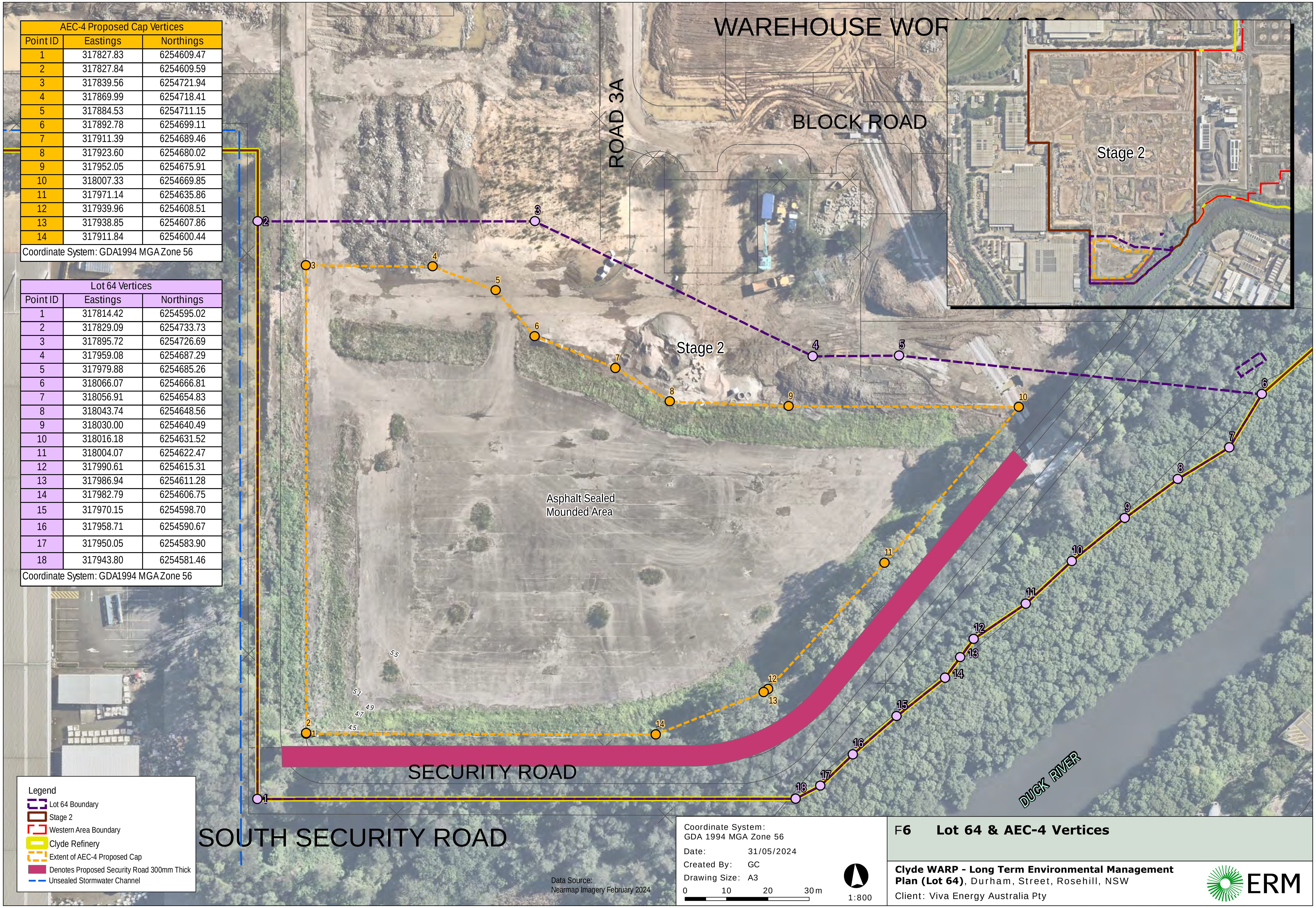
Client: Viva Energy Australia Pty

ERM



WAREHOUSE WORK SHOPS
BLOCK ROAD
ROAD 3A
RIPARIAN
AMENITIES
(H)
(H)
(H)
(M)
(C)
40m
21.08
17.1
67
74.61
21
88.14
139.49
130.085
IS
BOUNDARY
64
2.35ha
Asphalt Sealed
Mounded Area
ES 01
ES 02
ES 03
MW12/20
MW20/18
MW20/12
MW20/17
MW20/11
MW20/16
MW20/20
MW20/10
MW20/15
MW20/09
MW20/14
MW20/08
SECURITY ROAD
SOUTH SECURITY ROAD
DUCK RIVER
Contaminants Present Within the LOT 64
Chromium VI
Asbestos
Total Recoverable Hydrocarbons
Benzene
Legend
Subsurface gas monitoring location
Lot 64 Boundary
Western Area Boundary
Clyde Refinery
Extent of AEC-4 Proposed
Denotes Proposed Security Road 300mm Thick
Grid 25x25m
Unsealed Stormwater Channel
Proposed Drainage Pit
Data Source:
Nearmap Imagery November 2022
Coordinate System:
GDA 1994 MGA Zone 56
Date: 26/04/2024
Created By: GC
Drawing Size: A3
0 10 20 30m
1:800
F4 Gas monitoring locations
Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty
ERM


WAREHOUSE WORK SHOPS
BLOCK ROAD
ROAD 3A
AMENITIES
SECURITY ROAD
SOUTH SECURITY ROAD
MW12/02
MW18/23
SB18/23
TP19/18
TP19/27
SB4B
TP19/64
BH341
TP19/28
TP19/82
MW20/01B
MW20/01A
TP19/20
BH210
MW20/02A
MW20/02B
MW98/3
TP19/19
TP18/26
MW20/19
TP19/22
MW98/2
TP19/26
Depth to LNAPL
2.085 m bTOC
MW12/20
TP19/81
SB5B
TP19/21
Depth to LNAPL
3.721 m bTOC
MW12/01
MW20/13
MW20/18
MW20/07
TP19/78
MW20/03
TP19/77
TP19/24
TP19/68
MW20/12
TP19/25
MW20/04
MW20/17
TP19/23
MW20/06
MW20/05
TP18/27
MW20/11
Depth to LNAPL
3.270 m bTOC
BH116
TP19/75
MW20/14
MW20/09
MW20/15
MW20/10
MW20/16
MW20/08
MW20/20
MW94/6
TP19/76
TP19/74
Notes:
No exceedances or potential source-pathway-receptor linkages associated with groundwater identified.
Legend
Lot 64 Boundary
Western Area Boundary
Clyde Refinery
Extent of AEC-4 Proposed Cap
Denotes Proposed Security Road 300mm Thick
Monitoring Well
Lost/Destroyed Monitoring Well
Test Pit
LNAPL Identified (2008 – 2022)
2.849
Depth to LNAPL (m bTOC)
Data Source:
Nearmap Imagery November 2022
Coordinate System:
GDA 1994 MGA Zone 56
Date: 08/05/2024
Created By: GC
Drawing Size: A3
0 10 20 30m
1:900
F5 Groundwater Exceedances (Q4 2023 GME)
Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty
ERM



AEC-4 Proposed Cap Vertices		
Point ID	Eastings	Northings
1	317827.83	6254609.47
2	317827.84	6254609.59
3	317839.56	6254721.94
4	317869.99	6254718.41
5	317884.53	6254711.15
6	317892.78	6254699.11
7	317911.39	6254689.46
8	317923.60	6254680.02
9	317952.05	6254675.91
10	318007.33	6254669.85
11	317971.14	6254635.86
12	317939.96	6254608.51
13	317938.85	6254607.86
14	317911.84	6254600.44
Coordinate System: GDA1994 MGA Zone 56		

Lot 64 Vertices		
Point ID	Eastings	Northings
1	317814.42	6254595.02
2	317829.09	6254733.73
3	317895.72	6254726.69
4	317959.08	6254687.29
5	317979.88	6254685.26
6	318066.07	6254666.81
7	318056.91	6254654.83
8	318043.74	6254648.56
9	318030.00	6254640.49
10	318016.18	6254631.52
11	318004.07	6254622.47
12	317990.61	6254615.31
13	317986.94	6254611.28
14	317982.79	6254606.75
15	317970.15	6254598.70
16	317958.71	6254590.67
17	317950.05	6254583.90
18	317943.80	6254581.46
Coordinate System: GDA1994 MGA Zone 56		

Coordinate System:
GDA 1994 MGA Zone 56

Date: 31/05/2024

Created By: GC

Drawing Size: A3

F6 Lot 64 & AEC-4 Vertices

Clyde WARP - Long Term Environmental Management Plan (Lot 64), Durham, Street, Rosehill, NSW

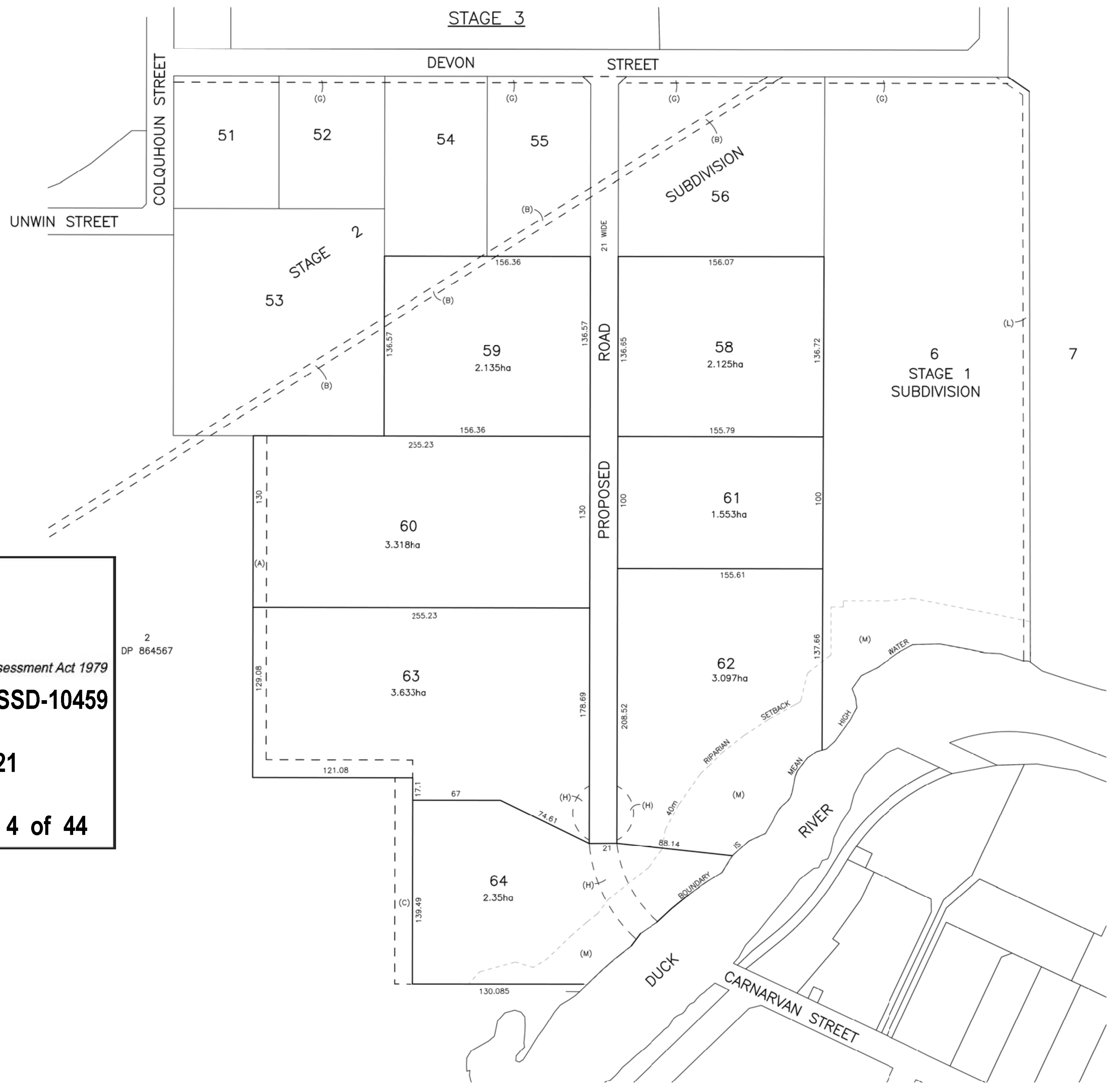
Client: Viva Energy Australia Pty

ERM

0561882_St2AEC4L64V_G002_R0.mxd

ERM

APPENDIX B SITE SURVEY



Planning, Industry & Environment

NSW GOVERNMENT

Issued under the Environmental Planning and Assessment Act 1979

Approved Application No: SSD-10459

Granted on: 31 January 2021

Signed: JF Sheet No: 4 of 44

NOTES:
1. ALL DIMENSIONS SHOWN HEREON ARE APPROXIMATE AND SUBJECT TO FINAL SURVEY
2. NO CADASTRAL SURVEY HAS BEEN UNDERTAKEN

(A) EASEMENT TO DRAIN WATER 10.2 & 13.4 WIDE (AC 424785)
(B) EASEMENT 6.095 WIDE (B309159) – SYDNEY WATER PIPELINE
(C) EASEMENT TO DRAIN WATER 13.4 WIDE (AC424784)
(G) PROPOSED EASEMENT FOR SERVICES 5 WIDE
(H) RIGHT OF ACCESS 21 WIDE AND VARIABLE WIDTH
(L) EASEMENT FOR OVERLAND FLOW 5 WIDE
(M) EASEMENT FOR PEDESTRIAN ACCESS 40 WIDE & VARIABLE WIDTH

20 0 40 100 140m

SCALE 1:1500

CLIENT

VE PROPERTY PTY LTD

PROJECT

PLAN OF PROPOSED SUBDIVISION OF LOT 57 OF STAGE 2 OF SUBDIVISON OF LOT 100 IN DP1168951 STAGE 3

NOTES

The title boundaries shown hereon were not marked at the time of survey and have been determined by plan dimensions only and not by field survey.

Services shown hereon have been located where possible by field survey. If not able to be so located, services have been plotted from the records of relevant authorities where available and have been noted accordingly on the plan. Where such records do not exist or are inadequate a notation has been made hereon.

Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

8	GKO	23/11/2020	LOT 61 & 62 AMENDED
7	GKO	11/11/2020	AMEND RIPARIAN SETBACK & (H)
6	GKO	02/11/2020	LANDSCAPE SETBACK REMOVED
5	GKO	29/10/2020	PLAN AMENDED
4	GKO	20/10/2020	LOT BOUNDARIES AMENDED
3	GKO	24/07/2020	EASEMENTS DETAIL ADDED
2	GKO	17/07/2020	EASEMENT AMENDED
1	GKO	22/06/2020	INITIAL ISSUE

SYM	CODE	DESCRIPTION
	BIN	BIN
	BM	BENCH MARK
	BO	BOLLARD
	DJM	DRAINAGE MANHOLE
	EFP	ELEC FUSE BOX
	ELP	ELEC GARDEN LIGHT
	EL	ELEC GREEN PILLAR
	LP	ELEC LIGHT POLE
	EP	ELECT SINGLE PIT
	SPL	ELEC STAY POLE
	PP	ELEC POWER POLE
	ELP	ELEC POLE/LIGHT
	TRANS	ELE POLE/TRANSFORM
	FD	FUEL DIP
	GM	GAS MAIN
	GMR	GAS METER
	GAS	GAS VALVE
	AG	GATE
	GUL	GULLY PIT
	HYD	HYDRANT
	BOR	BOREHOLE

SYM	CODE	DESCRIPTION
	OFM	OPTICAL FIBRE MARKER
	OFP	OPTICAL FIBRE PIT
	TM	PALM TREE
	SE	SEAT
	TS	SHRUB
	TCA	TELSTRA PIT
	SLH	SEWER LAMP HOLE
	SMH	SEWER MANHOLE
	SVP	SEWER VENT PIPE
	SI	SIGN
	BUS	BUS STOP SIGN
	T	TREE
	SGL	TRAFFIC LIGHT
	SCL	TRAFFIC CONTROLLER
	SJX	TRAFFIC JUNCTION BOX
	US	UNKNOWN SERVICE
	WAV	WATER AIR VALVE
	WMR	WATER METER
	WEP	WATER PUMP
	WSV	WATER STOP VALVE
	WTP	WATER TAP

Symbols shown are indicative only. The symbol size and orientation does not necessarily represent the real size or orientation of the feature.

DRAINAGE PIPE U/G
DRAIN
ELECT. CABLE A/G
ELEC. CABLE U/G
GAS PIPE
FENCE LINE
SEWERAGE PIPE
TELSTRA CABLE
WATER PIPE

LANDPARTNERS
built environment consultants

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Rydalmere NSW 2116
PO Box 1144
Dundas NSW 2117

t (02) 9685 2000
e info@landpartners.com.au
w www.landpartners.com.au

HEIGHT DATUM AHD	LOCAL AUTHORITY CITY OF PARRAMATTA
HEIGHT ORIGIN N/A	SCALE 1:1500 (A1)
MERIDIAN 56	CONTOUR INTERVAL N/A
CO-ORD SYSTEM MGA	SURVEYOR N/A — DATE OF SURVEY -
CCAD FILE 74707 ver 9 final subdivision	DRAWN SF/CLP — DATE 23/11/2020
AUTOCAD FILE SY074707.000.13.8	CHECKED GKO — DATE 23/11/2020
ARCHIVE FILE SY074707.000.13.6	APPROVED GKO — DATE 23/11/2020

PLAN NUMBER SHEET 1 OF 1

SY074707.000.13.8

ERM

APPENDIX C RESIDUAL CONTAMINATION SUMMARY

						TRH Aliphatic/Aromatic Split													TRH Silica Gel Cleanup								
						TRH >C5-C7 (Benzene) Aromatic	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C10-C12 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C16-C21 Aliphatic	TRH >C21-C35 Aliphatic	TRH >C7-C8 Aromatic	TRH >C8-C10 Aromatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	TRH >C10-C16 Fraction SG less Naphthalene	TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C10-C40 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36	TRH >C34-C40 Silica Gel Cleanup
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.1	10	10	10	10	10	10	0.1	1	10	10	10	10	50	20	50	50	50	50	100	50	100
Clyde WARP SSTL (Direct Contact - Commercial)							**1200000**	**24000**	**24000**	**24000**	**470000**	**470000**		**9500**	**9500**	**9500**	**7100**	**7100**									
Clyde WARP SSTL (Direct Contact - Construction Worker)							**310000**	**62000**	**62000**	**62000**	**370000**	**370000**		**25000**	**25000**	**25000**	**18000**	**18000**									
Clyde WARP SSTL (Direct Contact - IMW)							**3700000**	**740000**	**740000**	**740000**	**4400000**	**4400000**		**300000**	**300000**	**300000**	**220000**	**220000**									
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m							**480**	**760**	**430**	**4300**				**110**	**280**	**430**											
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m							**610**	**980**	**600**	**8300**				**150**	**430**	**2800**											
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m							**880**	**1400**	**980**	**17000**				**230**	**750**	**5100**											
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m							**1400**	**2200**	**1800**	**33000**				**420**	**1400**	**9800**											
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)							**NL**	**NL**	**NL**	**NL**				**NL**	**NL**	**NL**											
Clyde WARP SSTL (Vapour Intrusion - IMW)							**NL**	**NL**	**NL**	**NL**				**NL**	**NL**	**NL**	**NL**	**NL**									
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																					**1000**				**3500**		**10000**
Field_ID	**Sampled_Date_Time**	**Lab_Report_Number**	**Location_Code**	**Sample_Type**	**Location_Type**																						
D01_150719	15/07/2019	665944	TP19/23	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_150719	15/07/2019	669352	TP19/23	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500	**2500**	27,500	-	16,000	**21,000**	10,000	1700
D01_150719	16/07/2019	666164	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_160719	16/07/2019	669352	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	570	-	120	390	450	390
D01_20200714	14/07/2020	732060	MW20/13	Field_D	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	240	220	820	-	400	120	180	<100
D02_150719	15/07/2019	665944	TP19/77	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D02_150719	15/07/2019	669352	TP19/77	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1100	**2200**	17,700	-	12,000	**14,000**	4600	1700
D02_160719	16/07/2019	666164	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D02_160719	16/07/2019	669352	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	518	-	78	320	440	400
D03_20191120	20/11/2019	689333	TP19/87	Field_D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/01_0.15	27/02/2012	328708	MW12/01	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/01_2.0	27/02/2012	328708	MW12/01	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/01_2.5	27/02/2012	328708	MW12/01	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/20_0.4	6/03/2012	329576	MW12/20	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/20_2.0	6/03/2012	329576	MW12/20	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/20_2.4	6/03/2012	329576	MW12/20	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW20/03_0.8	13/07/2020	732060	MW20/03	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<100	-	<100	<100	<100	<100
MW20/03_3.0	13/07/2020	732060	MW20/03	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2100	**2400**	6800	-	3700	1500	1000	220
MW20/03_6.0	13/07/2020	732060	MW20/03	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<100	-	<100	<100	<100	<100
MW20/04_1.0	13/07/2020	732060	MW20/04	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<100	-	<100	100	<100	<100
MW20/04_3.5	13/07/2020	732060	MW20/04	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	390	590	3040	-	1700	560	950	270
MW20/04_4.5	13/07/2020	732060	MW20/04	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<100	-	<100	<100	<100	<100
MW20/05_3.5	13/07/2020	732060	MW20/05	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<100	-	<100	120	<100	<100
MW20/06_6.0	14/07/2020	732060	MW20/06	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500	**2400**	9900	-	6600	**3700**	1800	330
MW20/07_6.0	14/07/2020	732060	MW20/07	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	550	590	2090	-	1100	340	440	<100
MW20/13_6.0	14/07/2020	732060	MW20/13	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	110	234	-	170	<100	<100	<100
MW20/17_3.0	9/07/2020	732060	MW20/17	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	480	2780	-	2400	1200	230	240
QC18_102	7/02/2018	ES1804294	TP18/27	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	2320	1390	**2320**	15,300	16,200	10,000	**12,000**	3950	1830
QC18_103	7/02/2018	ES1804294	TP18/27	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	11,500	8820	**11,500**	16,900	16,400	8080	**4880**	<100	<100
SB5B_1.0	5/02/2018	ES1804047	SB5B	Normal	Soil Bore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SB5B_4.0	5/02/2018	ES1804047	SB5B	Normal	Soil Bore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T01_150719	15/07/2019	ES1922291	TP19/23	Interlab_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T01_160719	16/07/2019	ES1922517	TP19/20	Interlab_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T01_20200714	14/07/2020	ES2024476	MW20/13	Interlab_D	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	490	250	490	1670	1830	1010	1100	410	240
T02_150719	15/07/2019	ES1922291	TP19/77	Interlab_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T02_160719	16/07/2019	ES1922517	TP19/20	Interlab_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T03_050218	5/02/2018	184769	SB5B	Interlab_D	Soil Bore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6200	-	8500	-
TP18/27_0.3	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<50	<100	<100	<100	<100
TP18/27_1.2	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	2780	1280	**2790**	19,200	20,200	13,500	**15,500**	4430	1920
TP18/27_1.8	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	2140	1240	**2140**	18,700	19,800	12,500	**15,300**	4990	2330
TP18/27_1.8	7/02/2018	ES1805843	TP18/27	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/27_3.0	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	14,900	11,200	**14,900**	22,500	21,900	11,300	**7030**	<100	<100
TP19/19_0.6	16/07/2019	666164	TP19/19	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/19_0.6	16/07/2019	669352	TP19/19	Normal	Test Pit	8.6	<50	**1100**	**9200**	**19,000**	14,000	19,000	27	**140**	**1200**	**7900**	**9800**	**15,000**	-	21,000	**29,000**	72,000	-	38,000	**35,000**	13,000	6600
TP19/19_2.0	16/07/2019	666164	TP19/19	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/19_2.0	16/07/2019	669352	TP19/19	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	550	900	3050	-	1800	1800	700	350
TP19/20_0.1	16/07/2019	666164	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/20_0.1	16/07/2019	669352	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	770	-	200	560	570	620
TP19/20_0.4	16/07/2019	666164	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/20_0.4	16/07/2019	669352	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	160	960	-	450	670	510	340
TP19/21_2.8	16/07/2019	666164	TP19/21	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/21_2.8	16/07/2019	669352	TP19/21	Normal	Test Pit	<0.4	<40	490	180	330	290	330	0.8	40	27	240	220	230	-	310	460	1340	-	790	730	240	130
TP19/21_4.0	16/07/2019	666164	TP19/21	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/21_4.0	16/07/2019	669352	TP19/21	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	340	2600	-	1800	2000	620	200
TP19/22_0.5	16/07/2019	666164	TP19/22	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/22_1.2	16/07/2019	666164	TP19/22	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-1: Residual Chemical Contamination in Soil Data
Clyde WARP - Lot 64

						TRH Aliphatic/Aromatic Split													TRH Silica Gel Cleanup								
						TRH >C5-C7 (Benzene) Aromatic	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C10-C12 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C16-C21 Aliphatic	TRH >C21-C35 Aliphatic	TRH >C7-C8 Aromatic	TRH >C8-C10 Aromatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	TRH >C10-C16 Fraction SG less Naphthalene	TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C10-C40 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36	TRH >C34-C40 Silica Gel Cleanup
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.1	10	10	10	10	10	10	0.1	1	10	10	10	10	50	20	50	50	50	50	100	50	100
Clyde WARP SSTL (Direct Contact - Commercial)							1200000	24000	24000	24000	470000	470000		9500	9500	9500	7100	7100									
Clyde WARP SSTL (Direct Contact - Construction Worker)							310000	62000	62000	62000	370000	370000		25000	25000	25000	18000	18000									
Clyde WARP SSTL (Direct Contact - IMW)							3700000	740000	740000	740000	4400000	4400000		300000	300000	300000	220000	220000									
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m							480	760	430	4300				110	280	430											
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m							610	980	600	8300				150	430	2800											
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m							880	1400	980	17000				230	750	5100											
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m							1400	2200	1800	33000				420	1400	9800											
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)							NL	NL	NL	NL				NL	NL	NL											
Clyde WARP SSTL (Vapour Intrusion - IMW)							NL	NL	NL	NL				NL	NL	NL	NL	NL									
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																					1000				3500		10000
Field_ID	**Sampled_Date_Time**	**Lab_Report_Number**	**Location_Code**	**Sample_Type**	**Location_Type**																						
TP19/23_1.5	15/07/2019	665944	TP19/23	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/23_1.5	15/07/2019	669352	TP19/23	Normal	Test Pit	3.6	<100	330	1300	2700	3800	12,000	66	140	530	3200	10,000	32,000	-	1900	2800	21,900	-	14,000	17,000	6000	1100
TP19/23_3.5	15/07/2019	665944	TP19/23	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/23_3.5	15/07/2019	669352	TP19/23	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	<50	-	<50	<100	<50	<100
TP19/24_1.5	15/07/2019	665944	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_1.5	15/07/2019	669352	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	120	1981	-	1200	1500	730	240
TP19/24_3.0	15/07/2019	665944	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_3.0	15/07/2019	669352	TP19/24	Normal	Test Pit	<0.5	<50	200	2400	3500	2000	910	0.8	14	240	1800	1200	460	-	5000	6000	11,720	-	5800	4200	920	150
TP19/24_4.2	15/07/2019	665944	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_4.2	15/07/2019	669352	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	<50	-	<50	<100	<50	<100
TP19/25_0.5	15/07/2019	665944	TP19/25	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/25_0.5	15/07/2019	669352	TP19/25	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	51	-	51	<100	<50	<100
TP19/25_1.3	15/07/2019	665944	TP19/25	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/25_1.3	15/07/2019	669352	TP19/25	Normal	Test Pit	<1	<100	360	1200	2400	2500	6600	100	95	130	1700	4500	13,000	-	2100	3100	17,800	-	10,000	13,000	5700	1100
TP19/74_1.5	19/07/2019	666846	TP19/74	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/74_2.5	19/07/2019	666846	TP19/74	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/75_0.5	19/07/2019	666846	TP19/75	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/75_1.5	19/07/2019	666846	TP19/75	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/75_1.5	19/07/2019	669352	TP19/75	Normal	Test Pit	<0.2	<20	310	820	1700	1500	2100	1.1	6.3	83	510	740	1500	-	3300	4800	17,100	-	8100	9500	5700	1400
TP19/75_3.0	19/07/2019	666846	TP19/75	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/76_1.5	19/07/2019	666846	TP19/76	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/76_2.2	19/07/2019	666846	TP19/76	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/76_2.2	19/07/2019	669352	TP19/76	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	<50	-	<50	<100	<50	<100
TP19/77_1.5	15/07/2019	665944	TP19/77	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/77_1.5	15/07/2019	669352	TP19/77	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500	2900	21,800	-	15,000	17,000	5300	1400
TP19/77_4.0	15/07/2019	665944	TP19/77	Normal	Test Pit	24	1000	2300	16,000	27,000	19,000	22,000	75	550	2200	11,000	12,000	23,000	-	-	-	-	-	-	-	-	-
TP19/77_4.0	15/07/2019	669352	TP19/77	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30,000	38,000	76,600	-	37,000	30,000	9600	4800
TP19/83_1.0	20/11/2019	689333	TP19/83	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/83_3.0	20/11/2019	689333	TP19/83	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/84_1.0	20/11/2019	689333	TP19/84	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/84_2.0	20/11/2019	689333	TP19/84	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/85_1.0	20/11/2019	689333	TP19/85	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/85_2.0	20/11/2019	689333	TP19/85	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/85_3.0	20/11/2019	689333	TP19/85	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/87_1.0	20/11/2019	689333	TP19/87	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/87_2.0	20/11/2019	689333	TP19/87	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/87_3.0	20/11/2019	689333	TP19/87	Normal		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Statistical Summary

Number of Results	7	7	7	7	7	7	7	7	7	7	7	7	7	7	40	40	40	7	41	40	41	40
Number of Detects	3	1	7	7	7	7	7	7	7	7	7	7	7	6	26	27	31	6	32	31	28	25
Minimum Concentration	<0.2	<20	200	180	330	290	330	0.8	6.3	27	240	220	230	<50	<20	<50	<50	<50	<50	<100	<50	<100
Minimum Detect	3.6	1000	200	180	330	290	330	0.8	6.3	27	240	220	230	490	51	110	51	1830	51	100	180	130
Maximum Concentration	24	1000	2300	16000	27000	19000	22000	100	550	2200	11000	12000	32000	14900	30000	38000	76600	21900	38000	35000	13000	6600
Maximum Detect	24	1000	2300	16000	27000	19000	22000	100	550	2200	11000	12000	32000	14900	30000	38000	76600	21900	38000	35000	13000	6600
Average Concentration	5.3	169	727	4443	8090	6156	8991	39	141	630	3764	5494	12170	4879	2447	3363	10406	13765	5888	5814	2256	769
Median Concentration	0.5	25	360	1300	2700	2500	6600	27	95	240	1800	4500	13000	2320	280	485	2345	16400	1700	1150	510	240
Standard Deviation	8.8	367	754	5945	10489	7289	8869	41	189	803	4101	5017	12334	5853	5921	7704	17118	9020	8886	8751	3331	1330
Number of Guideline Exceedances	0	1	2	5	2	0	0	0	3	3	4	3	4	0	0	16	0	0	0	15	0	0
Number of Guideline Exceedances(Detects Only)	0	1	2	5	2	0	0	0	3	3	4	3	4	0	0	16	0	0	0	15	0	0

						BTEX							Naphthalene	TRH NEPM (1999)						TRH NEPM (2013)							Metals			PAH						
						Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C15-C36 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C10-C40 Fraction	TRH >C34-C40 Fraction	Chromium	Chromium (hexavalent)	Chromium (Trivalent)	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(a)pyrene TEQ (lower bound)*	Benzo(a)pyrene TEQ (upper bound)*	Benzo(a)pyrene TEQ (medium bound)*
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.5	10	20	50		50	50	10	10	50	50	100	50	100	2	0.5	2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Clyde WARP SSTL (Direct Contact - Commercial)						**400**							**9800**								**28000**		**17000**	**27000**		**27000**	**21000**	**3600**								**40**
Clyde WARP SSTL (Direct Contact - Construction Worker)						**1200**							**67000**								**69000**		**45000**	**64000**		**64000**	**8200**	**1400**								**200**
Clyde WARP SSTL (Direct Contact - IMW)						**15000**							**810000**								**830000**		**540000**	**770000**		**770000**	**100000**	**17000**								**3000**
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m						**3.2**							**NL**								**600**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m						**3.2**							**NL**								**770**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m						**3.2**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m						**3.2**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)						**NL**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - IMW)						**NL**							**NL**								**NL**		**NL**													
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																				**700**		**1000**		**3500**		**10000**										
Field_ID	**Sampled_Date_Time**	**Lab_Report_Number**	**Location_Code**	**Sample_Type**	**Location_Type**																															
D01_150719	15/07/2019	665944	TP19/23	Field_D	Test Pit	2.7	28	7.9	12	30	42	-	22	190	4300	31,000	-	12,000	47,300	250	170	**6700**	6678	**34,000**	45,200	4500	580	-	-	16	-	-	-	27	27	27
D01_150719	15/07/2019	669352	TP19/23	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_150719	16/07/2019	666164	TP19/20	Field_D	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	520	-	210	730	<20	<20	<50	<50	1100	1410	310	36	-	-	-	-	-	-	-	-	-
D01_160719	16/07/2019	669352	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_20200714	14/07/2020	732060	MW20/13	Field_D	Monitoring Well	<0.1	0.8	1.1	1.1	2	3.1	-	1 - 6.1	120	310	620	-	220	1150	230	230	360	353.9	100	460	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
D02_150719	15/07/2019	665944	TP19/77	Field_D	Test Pit	<0.5	3.2	2	1	2.4	3.4	-	29	<100	1700	25,000	-	9500	36,200	<100	<100	**3200**	3171	**28,000**	33,900	2700	380	-	-	-	-	-	-	-	-	-
D02_150719	15/07/2019	669352	TP19/77	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D02_160719	16/07/2019	666164	TP19/20	Field_D	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5 - 0.7	27	170	750	-	71	991	64	64	290	289.3	1100	1620	230	59	-	-	<0.5	-	-	-	<0.5	1.2	0.6
D02_160719	16/07/2019	669352	TP19/20	Field_D	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D03_20191120	20/11/2019	689333	TP19/87	Field_D		0.2	6.1	2.5	3.5	5.8	9.4	-	11	540	2800	16,000	-	4400	23,200	460	440	**4300**	4289	**17,000**	22,500	1200	-	-	-	-	-	-	-	-	-	-
MW12/01_0.15	27/02/2012	328708	MW12/01	Normal	Monitoring Well	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	<50	<100	180	130	130 - 205	<20	<20	<50	<50	180	-	<100	-	-	-	-	-	-	-	-	-	-
MW12/01_2.0	27/02/2012	328708	MW12/01	Normal	Monitoring Well	1.2	780	3.4	6	14	20	800 - 804.6	16 - 33	1200	7400	57,000	74,000	17,000	81,000 - 81,400	**1300**	510	**15,000**	15,000	**61,000**	-	7900	3000	<1	3000	18	-	-	-	-	-	-
MW12/01_2.5	27/02/2012	328708	MW12/01	Normal	Monitoring Well	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	480	3700	4800	1100	5280 - 5300	<20	<20	930	930	**4100**	-	490	170	-	-	0.9	-	-	-	-	-	-
MW12/20_0.4	6/03/2012	329576	MW12/20	Normal	Monitoring Well	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	<50	150	350	200	350 - 375	<20	<20	<50	<50	330	-	<100	17	-	-	7.9	-	-	-	-	-	-
MW12/20_2.0	6/03/2012	329576	MW12/20	Normal	Monitoring Well	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	76	2100	4700	2600	4776 - 4800	<20	<20	180	180	**4200**	-	1100	18	-	-	-	-	-	-	-	-	-
MW12/20_2.4	6/03/2012	329576	MW12/20	Normal	Monitoring Well	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.7	-	-	-	-	-	-	-	-	-
MW20/03_0.8	13/07/2020	732060	MW20/03	Normal	Monitoring Well	<0.1	<0.1	<0.1	0.3	2.2	2.5	-	<0.5	<20	59	100	-	56	215	<20	<20	<50	<50	<100	<100	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/03_3.0	13/07/2020	732060	MW20/03	Normal	Monitoring Well	0.3	0.2	3.9	1	2.5	3.5	-	5 - 9.1	350	2600	5200	-	1600	9400	620	610	**2800**	2790.9	2200	5340	340	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/03_6.0	13/07/2020	732060	MW20/03	Normal	Monitoring Well	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	330	970	-	<50	1300	35	35	520	520	240	760	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/04_1.0	13/07/2020	732060	MW20/04	Normal	Monitoring Well	<0.1	<0.1	<0.1	0.2	2.2	2.4	-	<0.5	<20	<20	150	-	<50	150	<20	<20	<50	<50	190	190	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/04_3.5	13/07/2020	732060	MW20/04	Normal	Monitoring Well	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	52	-	<50	52	24	24	<50	<50	<100	<100	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/04_4.5	13/07/2020	732060	MW20/04	Normal	Monitoring Well	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/05_3.5	13/07/2020	732060	MW20/05	Normal	Monitoring Well	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	20	160	-	110	290	<20	<20	<50	<50	160	160	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/06_6.0	14/07/2020	732060	MW20/06	Normal	Monitoring Well	<1	5.2	1.3	2	4	6	-	3.2 - 8.9	<200	2200	14,000	-	1600	17,800	<200	<200	**4400**	4391.1	**9800**	14,990	790	-	<1	-	2.8	-	-	-	4.5	4.5	4.5
MW20/07_6.0	14/07/2020	732060	MW20/07	Normal	Monitoring Well	<0.1	0.6	0.9	1.4	5.7	7.1	-	1.5 - 7.6	470	820	2200	-	710	3730	**970**	960	940	932.4	890	1990	160	-	<1	-	0.5	-	-	-	0.7	1.4	1
MW20/13_6.0	14/07/2020	732060	MW20/13	Normal	Monitoring Well	<0.1	<0.1	0.2	0.2	0.3	0.4	-	<0.5 - 2	<20	94	350	-	<50	444	49	48	170	168	190	360	<100	-	<1	-	<0.5	-	-	-	<0.5	1.2	0.6
MW20/17_3.0	9/07/2020	732060	MW20/17	Normal	Monitoring Well	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	190	4000	-	340	4530	<20	<20	580	580	2900	3920	440	-	<1	-	1.9	-	-	-	3	3	3
QC18_102	7/02/2018	ES1804294	TP18/27	Field_D	Test Pit	0.3	12.5	4.5	7.1	13.9	21	38.3	4	104	2040	20,800	-	9380	32,200	168	130	**3750**	3750	**28,100**	36,300	4460	-	-	-	-	-	-	-	-	-	-
QC18_103	7/02/2018	ES1804294	TP18/27	Field_D	Test Pit	0.7	1.1	5.4	4	6	10	17.2	22	234	34,000	11,100	-	480	45,600	521	504	**34,400**	**34,400**	**6810**	41,200	<100	-	-	-	-	-	-	-	-	-	-
SB5B_1.0	5/02/2018	ES1804047	SB5B	Normal	Soil Bore	<0.2	<0.5	0.6	1.6	2.2	3.8	4.4	1 - 3	11	240	11,000	-	10,100	21,300	22	18	340	340	**19,200**	24,000	4440	**37,800**	-	-	<0.5	0.6	1.2	<0.5	-	-	-
SB5B_4.0	5/02/2018	ES1804047	SB5B	Normal	Soil Bore	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1 - 0.6	12	340	5580	-	2640	8560	24	24	720	720	**7090**	9350	1540	160	-	-	2.8	5.6	5.6	5.6	-	-	-
T01_150719	15/07/2019	ES1922291	TP19/23	Interlab_D	Test Pit	**12.3**	67.8	16.6	19.7	65.6	85.3	182	31.4 - 34	571	3050	55,800	-	27,300	86,200	661	479	**5680**	5650	**73,400**	92,900	**13,800**	560	-	-	14.4	-	-	-	21.2	21.8	21.5
T01_160719	16/07/2019	ES1922517	TP19/20	Interlab_D	Test Pit	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	<50	230	-	590	820	<10	<10	<50	<50	660	1360	700	51	-	-	-	-	-	-	-	-	-
T01_20200714	14/07/2020	ES2024476	MW20/13	Interlab_D	Monitoring Well	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	1 - 3.3	55	520	1480	-	540	2540	79	79	820	820	1570	2690	300	-	<0.5	-	<0.5	0.6	1.2	<0.5	-	-	-
T02_150719	15/07/2019	ES1922291	TP19/77	Interlab_D	Test Pit	<0.5	5	3.4	1.5	2	3.5	11.9	39	54	2200	38,500	-	17,300	58,000	92	80	**5200**	5160	**49,300**	61,800	7270	69	-	-	-	-	-	-	-	-	-
T02_160719	16/07/2019	ES1922517	TP19/20	Interlab_D	Test Pit	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1 - 0.6	46	260	1910	-	1620	3790	68	68	490	490	2820	4580	1270	36	-	-	<0.5	-	-	-	<0.5	1.2	0.6
T03_050218	5/02/2018	184769	SB5B	Interlab_D	Soil Bore	<0.2	<0.5	<1	1	<2	1	-	1 - 1.8	<25	220	-	-	-	-	<25	<25	300	300	**13,000**	17,000	4500	**26,000**	-	-	0.2	<0.5	<0.5	<0.5	-	-	-
TP18/27_0.3	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	<50	160	-	180	340	<10	<10	<50	<50	270	440	170	-	-	-	-	-	-	-	-	-	-
TP18/27_1.2	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	0.3	12.6	4.5	6.8	13.5	20.3	37.7	5	106	8400	43,500	-	8420	60,300	169	131	**9900**	9900	**48,200**	61,200	3130	-	-	-	-	-	-	-	-	-	-
TP18/27_1.8	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	0.8	<0.5	3.1	0.6	5.1	5.7	9.6	1	61	1660	25,300	-	11,300	38,300	90	81	**3240**	3240	**34,800**	43,200	5150	-	-	-	-	-	-	-	-	-	-
TP18/27_1.8	7/02/2018	ES1805843	TP18/27	Normal	Test Pit	0.3	<0.5	2.9	1.2	5.9	-	-	2 - 4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	805	3.2	802	<0.5	4.6	5.1	4.1	-	-	-
TP18/27_3.0	7/02/2018	ES1804294	TP18/27	Normal	Test Pit	0.6	0.7	5	3.1	5.3	8.4	14.7	20	246	37,000	12,800	-	580	50,400	579	564	**37,500**	**37,500**	**8170**	45,700	<100	-	-	-	-	-	-	-	-	-	-
TP19/19_0.6	16/07/2019	666164	TP19/19	Normal	Test Pit	**14**	37	12	22	53	76	-	47	1100	41,000	110,000	-	9000	160,000	**2100**	**2000**	**67,000**	**66,953**	**110,000**	186,000	9000	350	-	-	-	-	-	-	-	-	-
TP19/19_0.6	16/07/2019	669352	TP19/19	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/19_2.0	16/07/2019	666164	TP19/19	Normal	Test Pit	<0.1	0.3	0.2	0.3	0.6	0.9	-	0.7 - 1.2	22	520	2700	-	250	3470	53	52	950	948.8	3300	4720	470	400	-	-	<0.5	-	-	-	<0.5	1.2	0.6
TP19/19_2.0	16/07/2019	669352	TP19/19	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/20_0.1	16/07/2019	666164	TP19/20	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	380	-	200	580	<20	<20	<50	<50	880	1130	250	17	-	-	-	-	-	-	-	-	-
TP19/20_0.1	16/07/2019	669352	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/20_0.4	16/07/2019	666164	TP19/20	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	78	400	2800	-	480	3680	140	140	860	860	3400	4620	360	32	-	-	<0.5	-	-	-	<0.5	1.2	0.6
TP19/20_0.4	16/07/2019	669352	TP19/20	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/21_2.8	16/07/2019	666164	TP19/21	Normal	Test Pit	<1	<1	62	<1	4.1	<3	-	24 - 39	520	5400	19,000	-	6100	30,500	**930**	860	**8100**	8061	**17,000**	27,600	2500	170	-	-	2.2	-	-	-	3.4	3.4	3.4
TP19/21_2.8	16/07/2019	669352	TP19/21	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/21_4.0	16/07/2019	666164	TP19/21	Normal	Test Pit	<0.2	<0.2	0.7	0.3	<0.4	<0.3	-	7.3	<40	630	6400	-	1000	8030	<40	<40	**1200**	1192.7	**7200**	8790	390	850	-	-	-	-	-	-	-	-	-
TP19/21_4.0	16/07/2019	669352	TP19/21	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/22_0.5	16/07/2019	666164	TP19/22	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	18	-	-	<0.5	-	-	-	<0.5	1.2	0.6
TP19/22_1.2	16/07/2019	666164	TP19/22	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	20	-	-	-	-	-	-	-	-	-

						BTEX							Naphthalene	TRH NEPM (1999)						TRH NEPM (2013)							Metals			PAH						
						Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C15-C36 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C10-C40 Fraction	TRH >C34-C40 Fraction	Chromium	Chromium (hexavalent)	Chromium (Trivalent)	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(a)pyrene TEQ (lower bound)*	Benzo(a)pyrene TEQ (upper bound)*	Benzo(a)pyrene TEQ (medium bound)*
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.5	10	20	50		50	50	10	10	50	50	100	50	100	2	0.5	2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Clyde WARP SSTL (Direct Contact - Commercial)						**400**							**9800**								**28000**		**17000**	**27000**		**27000**	**21000**	**3600**								**40**
Clyde WARP SSTL (Direct Contact - Construction Worker)						**1200**							**67000**								**69000**		**45000**	**64000**		**64000**	**8200**	**1400**								**200**
Clyde WARP SSTL (Direct Contact - IMW)						**15000**							**810000**								**830000**		**540000**	**770000**		**770000**	**100000**	**17000**								**3000**
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m						**3.2**							**NL**								**600**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m						**3.2**							**NL**								**770**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m						**3.2**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m						**3.2**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)						**NL**							**NL**								**NL**		**NL**													
Clyde WARP SSTL (Vapour Intrusion - IMW)						**NL**							**NL**								**NL**		**NL**													
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																				**700**		**1000**		**3500**		**10000**										
Field_ID	**Sampled_Date_Time**	**Lab_Report_Number**	**Location_Code**	**Sample_Type**	**Location_Type**																															
TP19/23_1.5	15/07/2019	665944	TP19/23	Normal	Test Pit	**3.8**	48	13	23	51	74	-	27 - 30	360	5000	36,000	-	15,000	56,000	470	330	**7700**	7670	**41,000**	53,500	4800	1000	-	-	19	-	-	-	36	36	36
TP19/23_1.5	15/07/2019	669352	TP19/23	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/23_3.5	15/07/2019	665944	TP19/23	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	230	-	140	370	<20	<20	<50	<50	290	290	<100	29	-	-	-	-	-	-	-	-	-
TP19/23_3.5	15/07/2019	669352	TP19/23	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_1.5	15/07/2019	665944	TP19/24	Normal	Test Pit	<0.1	0.7	0.4	0.5	0.9	1.4	-	<0.5	<20	140	4100	-	2600	6840	<20	<20	280	280	**5600**	7180	1300	960	-	-	-	-	-	-	-	-	-
TP19/24_1.5	15/07/2019	669352	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_3.0	15/07/2019	665944	TP19/24	Normal	Test Pit	<0.1	<0.1	2.8	0.7	0.4	1.1	-	11 - 18	92	3500	4900	-	710	9110	270	270	**4800**	4782	**3700**	8890	390	40	-	-	0.6	-	-	-	0.8	1.4	1.1
TP19/24_3.0	15/07/2019	669352	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/24_4.2	15/07/2019	665944	TP19/24	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	200	-	150	350	<20	<20	<50	<50	280	280	<100	26	-	-	-	-	-	-	-	-	-
TP19/24_4.2	15/07/2019	669352	TP19/24	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/25_0.5	15/07/2019	665944	TP19/25	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	400	-	380	780	<20	<20	<50	<50	660	850	190	190	-	-	-	-	-	-	-	-	-
TP19/25_0.5	15/07/2019	669352	TP19/25	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/25_1.3	15/07/2019	665944	TP19/25	Normal	Test Pit	1.4	28	13	25	45	70	-	20 - 21	<400	6900	54,000	-	20,000	80,900	<400	<400	**11,000**	10,979	**58,000**	76,500	7500	1200	-	-	37	-	-	-	59	59	**59**
TP19/25_1.3	15/07/2019	669352	TP19/25	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/74_1.5	19/07/2019	666846	TP19/74	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	79	-	-	-	-	-	-	-	-	-
TP19/74_2.5	19/07/2019	666846	TP19/74	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	9.8	-	-	<0.5	-	-	-	<0.5	1.2	0.6
TP19/75_0.5	19/07/2019	666846	TP19/75	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/75_1.5	19/07/2019	666846	TP19/75	Normal	Test Pit	<0.2	1	1.2	1.1	2.1	3.2	-	16 - 17	290	5700	14,000	-	4600	24,300	590	580	**8400**	8384	**13,000**	23,800	2400	110	-	-	2.2	-	-	-	5.1	5.1	5.1
TP19/75_1.5	19/07/2019	669352	TP19/75	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/75_3.0	19/07/2019	666846	TP19/75	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	12	-	-	-	-	-	-	-	-	-
TP19/76_1.5	19/07/2019	666846	TP19/76	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	-	<50	<50	<20	<20	<50	<50	<100	<100	<100	57	-	-	-	-	-	-	-	-	-
TP19/76_2.2	19/07/2019	666846	TP19/76	Normal	Test Pit	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	98	-	77	175	<20	<20	<50	<50	140	140	<100	48	-	-	<0.5	-	-	-	<0.5	1.2	0.6
TP19/76_2.2	19/07/2019	669352	TP19/76	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/77_1.5	15/07/2019	665944	TP19/77	Normal	Test Pit	<1	3.2	2	<1	<2	<3	-	41	<200	2400	33,000	-	13,000	48,400	<200	<200	**4500**	4459	**38,000**	46,700	4200	39	-	-	-	-	-	-	-	-	-
TP19/77_1.5	15/07/2019	669352	TP19/77	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/77_4.0	15/07/2019	665944	TP19/77	Normal	Test Pit	**24**	75	99	77	200	280	-	150 - 220	3000	45,000	74,000	-	22,000	141,000	**5000**	4500	**58,000**	**57,850**	**70,000**	136,200	8200	540	-	-	6.5	-	-	-	7.7	8.2	8
TP19/77_4.0	15/07/2019	669352	TP19/77	Normal	Test Pit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/83_1.0	20/11/2019	689333	TP19/83	Normal		<0.1	0.4	0.2	1.4	1.1	2.5	-	4.1	25	2000	27,000	-	7200	36,200	52	49	**3700**	3695.9	**28,000**	33,400	1700	-	-	-	-	-	-	-	-	-	-
TP19/83_3.0	20/11/2019	689333	TP19/83	Normal		<0.1	2.8	0.3	0.8	1.3	2	-	2.2	40	710	9400	-	3600	13,710	70	65	**1500**	1497.8	**11,000**	13,800	1300	-	-	-	-	-	-	-	-	-	-
TP19/84_1.0	20/11/2019	689333	TP19/84	Normal		<1	2	1.6	4	<2	4	-	64	<200	2600	32,000	-	9200	43,800	<200	<200	**4600**	4536	**35,000**	41,500	1900	-	-	-	-	-	-	-	-	-	-
TP19/84_2.0	20/11/2019	689333	TP19/84	Normal		**3.6**	16	32	39	84	120	-	140	1800	51,000	92,000	-	14,000	157,000	**3600**	3400	**72,000**	**71,860**	**66,000**	143,900	5900	-	-	-	-	-	-	-	-	-	-
TP19/85_1.0	20/11/2019	689333	TP19/85	Normal		0.4	12	5.3	6.3	13	20	-	22	74	720	12,000	-	4600	17,320	130	93	**1400**	1378	**14,000**	17,100	1700	-	-	-	-	-	-	-	-	-	-
TP19/85_2.0	20/11/2019	689333	TP19/85	Normal		<0.1	0.5	0.4	1.1	1.5	2.6	-	2.8	37	4700	6200	-	1700	12,600	90	87	**5900**	5897.2	**5500**	12,400	1000	-	-	-	-	-	-	-	-	-	-
TP19/85_3.0	20/11/2019	689333	TP19/85	Normal		<0.1	0.2	0.6	<0.1	<0.2	<0.3	-	1.7	<20	370	1500	-	670	2540	45	44	580	578.3	1700	2650	370	-	-	-	-	-	-	-	-	-	-
TP19/87_1.0	20/11/2019	689333	TP19/87	Normal		<0.1	0.4	1.6	1.6	2.9	4.4	-	<1	440	2300	5000	-	1700	9000	**750**	740	**3200**	3200	**4900**	9030	930	-	-	-	-	-	-	-	-	-	-
TP19/87_2.0	20/11/2019	689333	TP19/87	Normal		<0.2	0.9	3.1	2.2	4	6.2	-	13	120	2800	3700	-	600	7100	330	320	**3800**	3787	2900	7090	390	-	-	-	-	-	-	-	-	-	-
TP19/87_3.0	20/11/2019	689333	TP19/87	Normal		<0.5	15	6.6	9.5	15	25	-	33	720	6600	23,000	-	5400	35,000	**970**	920	**9200**	9167	**23,000**	33,600	1400	-	-	-	-	-	-	-	-	-	-
Statistical Summary																																				
Number of Results						70	70	70	70	70	69	18	70	69	69	68	5	68	68	69	69	69	69	69	64	69	40	15	2	35	5	5	5	27	27	27
Number of Detects						17	32	39	39	37	37	9	42	34	50	60	5	57	61	38	38	48	48	60	55	48	40	1	2	16	4	4	2	11	27	27
Minimum Concentration						<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.2	<0.5	<10	<20	<50	180	<50	<50	<10	<10	<50	<50	<100	<100	<100	6.7	<0.5	802	0.2	<0.5	<0.5	<0.5	<0.5	1.2	0.6
Minimum Detect						0.2	0.2	0.2	0.2	0.3	0.4	4.4	0.7	11	20	52	180	56	52	22	18	170	168	100	140	160	6.7	3.2	802	0.2	0.6	1.2	4.1	0.7	1.2	0.6
Maximum Concentration						24	780	99	77	200	280	804.6	220	3000	51000	110000	74000	27300	160000	5000	4500	72000	71860	110000	186000	13800	37800	3.2	3000	37	5.6	5.6	5.6	59	59	59
Maximum Detect						24	780	99	77	200	280	804.6	220	3000	51000	110000	74000	27300	160000	5000	4500	72000	71860	110000	186000	13800	37800	3.2	3000	37	5.6	5.6	5.6	59	59	59
Average Concentration						1	17	4.7	4.2	9.7	14	62	13	202	4408	14212	16806	4219	22891	332	297	6115	6103	14869	23072	1833	1899	0.66		3.9	2.3	2.7	2.1	6.4	7	6.6
Median Concentration						0.1	0.25	0.4	0.5	1	1.4	2.575	1.55	27	480	3850	4700	710	6065	53	52	860	860	3700	7135	440	74	0.5	1901	0.25	0.6	1.2	0.25	0.25	1.2	0.6
Standard Deviation						3.6	94	14	11	28	40	190	29	462	10795	22598	32051	6252	35989	791	720	14402	14382	22700	36759	2754	7118	0.7		7.9	2.6	2.5	2.6	14	14	14
Number of Guideline Exceedances						5	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	31	5	35	0	1	2	0	0	0	0	0	0	0	0	1
Number of Guideline Exceedances(Detects Only)						5	0	0	0	0	0	0	0	0	0	0	0	0	0	8	4	31	5	35	0	1	2	0	0	0	0	0	0	0	0	1

Field_ID	Location_Code	Well	Sampled_Date_Time	MNA					PFAS - Fluorotelomer Sulfonates			
				Ferrous Iron - Fe2+	Methane	Nitrate (as N)	Sulphate	Sulphate (Filtered)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FtS)	8:2 Fluorotelomer sulfonate	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
				mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.05	0.01	0.01	2	1	0.05	0.05	0.05	0.05
Clyde WARP SSTL - GW VI - Commercial												
Clyde WARP SSTL - GW VI - Construction												
Clyde WARP SSTL - GW VI - IMW												
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95%)												
NEMP (2020) Interim Marine - High conservation value systems (99%)												
NEPM (2013) - Marine Water												
NEPM (2013) - Recreational							5000	5000				
NHMRC (2019) HBGV - Recreational Water												
BH210	BH210	BH210	23/11/2023	3.31	<0.01	<0.01	-	706	<0.05	<0.05	<0.05	<0.05
D01_231123	MW20/02A	MW20/02A	23/11/2023	74.8	0.012	<0.01	-	464	<0.05	<0.05	<0.05	<0.05
MW20/01A	MW20/01A	MW20/01A	23/11/2023	6.79	3.36	0.02	-	50	<0.05	<0.05	<0.05	<0.05
MW20/02A	MW20/02A	MW20/02A	23/11/2023	68.4	<0.01	<0.01	-	495	<0.05	<0.05	<0.05	<0.05
MW20/03	MW20/03	MW20/03	24/11/2023	3.31	12.1	<0.01	-	9	<0.05	<0.05	<0.05	<0.05
MW20/04	MW20/04	MW20/04	23/11/2023	119	0.272	0.03	-	744	<0.05	<0.05	<0.05	<0.05
MW20/08	MW20/08	MW20/08	23/11/2023	62.1	0.072	0.04	-	1940	<0.05	<0.05	<0.05	<0.05
MW20/09	MW20/09	MW20/09	23/11/2023	359	0.014	<0.01	-	2450	<0.05	<0.05	<0.05	<0.05
MW20/10	MW20/10	MW20/10	24/11/2023	196	0.318	<0.01	-	603	<0.05	<0.05	<0.05	<0.05
MW20/11	MW20/11	MW20/11	24/11/2023	40.6	0.034	<0.01	-	4460	<0.05	<0.05	<0.05	<0.05
MW20/12	MW20/12	MW20/12	24/11/2023	22.8	<0.01	<0.01	-	1420	<0.05	<0.05	<0.05	<0.05
MW20/14	MW20/14	MW20/14	23/11/2023	22.7	0.014	<0.01	-	1620	<0.05	<0.05	<0.05	<0.05
MW20/15	MW20/15	MW20/15	24/11/2023	136	0.032	<0.01	-	2880	<0.05	<0.05	<0.05	<0.05
MW20/16	MW20/16	MW20/16	24/11/2023	54.6	0.192	<0.01	-	2270	<0.05	<0.05	<0.05	<0.05
MW20/17	MW20/17	MW20/17	24/11/2023	11.9	0.101	<0.01	-	742	<0.05	<0.05	<0.05	<0.05
MW20/18	MW20/18	MW20/18	24/11/2023	11.3	<0.01	0.11	-	1420	<0.05	<0.05	<0.05	<0.05
MW94/6	MW94/6	MW94/6	24/11/2023	39.9	0.19	0.27	-	1700	<0.05	<0.05	<0.05	<0.05
T01-231123	BH210	BH210	23/11/2023	3.5	<0.05	<0.01	1300	-	<0.01	<0.05	<0.01	<0.01
Statistical Summary												
Number of Results				18	18	18	1	17	18	18	18	18
Number of Detects				18	13	5	1	17	0	0	0	0
Minimum Concentration				3.31	<0.01	<0.01	1300	9	<0.01	<0.05	<0.01	<0.01
Minimum Detect				3.31	0.012	0.02	1300	9	ND	ND	ND	ND
Maximum Concentration				359	12.1	0.27	1300	4460	<0.05	<0.05	<0.05	<0.05
Maximum Detect				359	12.1	0.27	1300	4460	ND	ND	ND	ND
Average Concentration				69	0.93	0.03		1410	0.024	0.025	0.024	0.024
Median Concentration				40.25	0.033	0.005	1300	1420	0.025	0.025	0.025	0.025
Standard Deviation				90	2.9	0.065		1153	0.0047	0	0.0047	0.0047
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0

Field_ID	PFAS - Long Chain PFCA							PFAS - Long Chain PFSA						
	Perfluorooctanoate (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorononanesulfonic acid (PFNS)	Perfluorodecanesulfonic acid (PFDS)	Perfluoropropanesulfonic acid (PFPrS)	Sum of PFHxS and PFOS
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.01	0.02	0.02	0.02	0.02	0.05	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.01
Clyde WARP SSTL - GW VI - Commercial														
Clyde WARP SSTL - GW VI - Construction														
Clyde WARP SSTL - GW VI - IMW														
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95%)	220									0.13				
NEMP (2020) Interim Marine - High conservation value systems (99%)	19									0.00023				
NEPM (2013) - Marine Water														
NEPM (2013) - Recreational														
NHMRC (2019) HBGV - Recreational Water	10							2		2				2
BH210	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.01	<0.02	<0.01	-	<0.02	-	<0.01
D01_231123	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.01	<0.02	<0.01	-	<0.02	-	<0.01
MW20/01A	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.03	<0.02	0.03	-	<0.02	-	0.06
MW20/02A	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.01	<0.02	<0.01	-	<0.02	-	<0.01
MW20/03	0.03	0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.06	<0.02	0.1	-	<0.02	-	0.16
MW20/04	0.04	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.81	<0.02	0.09	-	<0.02	-	0.9
MW20/08	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.1	<0.02	0.02	-	<0.02	-	0.12
MW20/09	0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.06	<0.02	<0.01	-	<0.02	-	0.06
MW20/10	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.01	<0.02	<0.01	-	<0.02	-	<0.01
MW20/11	0.09	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.9	<0.02	<0.01	-	<0.02	-	0.9
MW20/12	<0.01	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.08	<0.02	0.04	-	<0.02	-	0.12
MW20/14	0.01	0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.06	<0.02	0.11	-	<0.02	-	0.17
MW20/15	0.06	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.3	<0.02	<0.01	-	<0.02	-	0.3
MW20/16	0.08	0.03	<0.02	<0.02	<0.02	<0.05	<0.02	0.69	<0.02	0.08	-	<0.02	-	0.77
MW20/17	0.13	0.06	<0.02	<0.02	<0.02	<0.05	<0.02	0.8	<0.02	0.41	-	<0.02	-	1.21
MW20/18	0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.08	<0.02	0.1	-	<0.02	-	0.18
MW94/6	0.04	0.02	<0.02	<0.02	<0.02	<0.05	<0.02	0.3	<0.02	0.08	-	<0.02	-	0.38
T01-231123	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Statistical Summary														
Number of Results	18	18	18	18	18	18	18	18	18	18	1	18	1	18
Number of Detects	12	5	0	0	0	0	0	13	0	10	0	0	0	13
Minimum Concentration	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Minimum Detect	0.01	0.02	ND	ND	ND	ND	ND	0.03	ND	0.02	ND	ND	ND	0.06
Maximum Concentration	0.13	0.06	<0.02	<0.02	<0.02	<0.05	<0.02	0.9	<0.02	0.41	<0.01	<0.02	<0.01	1.21
Maximum Detect	0.13	0.06	ND	ND	ND	ND	ND	0.9	ND	0.41	ND	ND	ND	1.21
Average Concentration	0.031	0.015	0.0097	0.0097	0.0097	0.024	0.0097	0.24	0.0097	0.061		0.0097		0.3
Median Concentration	0.01	0.01	0.01	0.01	0.01	0.025	0.01	0.07	0.01	0.025	0.005	0.01	0.005	0.14
Standard Deviation	0.036	0.013	0.0012	0.0012	0.0012	0.0047	0.0012	0.32	0.0012	0.096		0.0012		0.38
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	18	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	10	0	0	0	0

Field_ID	PFAS - Short Chain PFCA				S - Short Chain P		
	Perfluorobutanoic acid	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.1	0.02	0.02	0.02	0.02	0.02	0.05
Clyde WARP SSTL - GW VI - Commercial							
Clyde WARP SSTL - GW VI - Construction							
Clyde WARP SSTL - GW VI - IMW							
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95%)							
NEMP (2020) Interim Marine - High conservation value systems (99%)							
NEPM (2013) - Marine Water							
NEPM (2013) - Recreational							
NHMRC (2019) HBGV - Recreational Water							
BH210	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
D01_231123	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/01A	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/02A	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/03	<0.1	<0.02	0.03	<0.02	<0.02	<0.02	<0.05
MW20/04	<0.1	<0.02	0.22	0.06	0.12	0.11	<0.05
MW20/08	<0.1	<0.02	0.04	0.02	<0.02	<0.02	<0.05
MW20/09	<0.1	<0.02	0.02	<0.02	0.02	<0.02	<0.05
MW20/10	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/11	<0.1	0.1	0.19	0.11	0.2	0.12	<0.05
MW20/12	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/14	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05
MW20/15	<0.1	0.08	0.1	0.07	0.06	0.03	<0.05
MW20/16	<0.1	<0.02	0.24	0.08	0.08	0.07	<0.05
MW20/17	<0.1	<0.02	0.18	0.13	<0.02	<0.02	<0.05
MW20/18	<0.1	<0.02	0.02	<0.02	<0.02	<0.02	<0.05
MW94/6	<0.1	<0.02	0.04	0.02	0.04	<0.02	<0.05
T01-231123	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
Statistical Summary							
Number of Results	18	18	18	18	18	18	18
Number of Detects	0	2	10	7	6	4	0
Minimum Concentration	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05
Minimum Detect	ND	0.08	0.02	0.02	0.02	0.03	ND
Maximum Concentration	<0.1	0.1	0.24	0.13	0.2	0.12	<0.05
Maximum Detect	ND	0.1	0.24	0.13	0.2	0.12	ND
Average Concentration	0.049	0.019	0.064	0.033	0.035	0.026	0.025
Median Concentration	0.05	0.01	0.02	0.01	0.01	0.01	0.025
Standard Deviation	0.0059	0.026	0.083	0.039	0.052	0.036	0
Number of Guideline Exceedances	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0

Field_ID	Location_Code	Well	Sampled_Date_Time	PFAS - Sulfonamides						PFAS Sums				TRH Silica Gel Cleanup								
				N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (N-Me-FOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorooctanesulfonamide (PFOSA)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of US EPA PFAS (PFOS + PFOA)	TRH >C10-C16 Fraction SG less Naphthalene	TRH >C10-C14 Silica Gel Cleanup	TRH >C10-C16 Silica Gel Cleanup	TRH >C10-C36 Silica Gel Cleanup	TRH >C10-C40 Silica Gel Cleanup	TRH >C15-C28 Silica Gel Cleanup	TRH >C16-C34 Silica Gel Cleanup	TRH >C29-C36	TRH >C34-C40 Silica Gel Cleanup
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.05	0.05	0.05	0.02	0.02	0.02	0.01	0.01	0.01	0.01	100	50	100	50	100	100	100	50	100
Clyde WARP SSTL - GW VI - Commercial																						
Clyde WARP SSTL - GW VI - Construction																						
Clyde WARP SSTL - GW VI - IMW																						
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95																						
NEMP (2020) Interim Marine - High conservation value systems (99%)																						
NEPM (2013) - Marine Water																						
NEPM (2013) - Recreational																						
NHMRC (2019) HBGV - Recreational Water																						
BH210	BH210	BH210	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
D01_231123	MW20/02A	MW20/02A	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/01A	MW20/01A	MW20/01A	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.07	0.07	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/02A	MW20/02A	MW20/02A	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/03	MW20/03	MW20/03	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.24	0.22	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/04	MW20/04	MW20/04	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.45	1.34	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/08	MW20/08	MW20/08	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.19	0.19	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/09	MW20/09	MW20/09	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.11	0.11	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/10	MW20/10	MW20/10	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	<0.01	<0.01	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/11	MW20/11	MW20/11	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.71	1.59	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/12	MW20/12	MW20/12	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.12	0.12	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/14	MW20/14	MW20/14	23/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.2	0.18	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/15	MW20/15	MW20/15	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.7	0.67	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/16	MW20/16	MW20/16	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.35	1.25	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/17	MW20/17	MW20/17	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	1.71	1.65	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW20/18	MW20/18	MW20/18	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.22	0.22	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
MW94/6	MW94/6	MW94/6	24/11/2023	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	-	0.54	0.52	-	<100	<50	<100	<50	<100	<100	<100	<50	<100
T01-231123	BH210	BH210	23/11/2023	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.1	<0.05	<0.01	-	-	-	-	-	-	-	-	-
Statistical Summary																						
Number of Results				18	18	18	18	18	18	1	18	18	1	17	17	17	17	17	17	17	17	17
Number of Detects				0	0	0	0	0	0	0	13	13	0	0	0	0	0	0	0	0	0	0
Minimum Concentration				<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<100	<50	<100	<50	<100	<100	<100	<50	<100
Minimum Detect				ND	ND	ND	ND	ND	ND	ND	0.07	0.07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	1.71	1.65	<0.01	<100	<50	<100	<50	<100	<100	<100	<50	<100
Maximum Detect				ND	ND	ND	ND	ND	ND	ND	1.71	1.65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration				0.025	0.025	0.025	0.011	0.011	0.011		0.48	0.45		50	25	50	25	50	50	50	25	50
Median Concentration				0.025	0.025	0.025	0.01	0.01	0.01	0.005	0.195	0.185	0.005	50	25	50	25	50	50	50	25	50
Standard Deviation				0	0	0	0.0035	0.0035	0.0035		0.62	0.58		0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Field_ID	BTEX							Naphthalene	TRH NEPM (1999)					TRH N		
	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH C6-C9 Fraction	TRH >C10-C14 Fraction	TRH >C15-C28 Fraction	TRH >C29-C36 Fraction	TRH >C10-C36 Fraction	TRH (NEPM) C>10-40 Sum	TRH C6-C10 Fraction	TRH C6-C10 less BTEX
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	MG/L	µg/L	µg/L
EQL	1	2	2	2	2	2	1	0.004	20	50	100	50	50	0.1	20	20
Clyde WARP SSTL - GW VI - Commercial	5000							13000								6200
Clyde WARP SSTL - GW VI - Construction	NL							NL							-	NL
Clyde WARP SSTL - GW VI - IMW	NL							NL							-	NL
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95																
NEMP (2020) Interim Marine - High conservation value systems (99%)																
NEPM (2013) - Marine Water	500							50								
NEPM (2013) - Recreational	10	8000	3000			6000										
NHMRC (2019) HBGV - Recreational Water																
BH210	<1	<2	<2	<2	<2	<2	<1	<5 - 0.009	<20	<50	<100	<50	<50	<0.1	<20	<20
D01_231123	<1	<2	<2	<2	<2	<2	<1	<5 - 0.006	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/01A	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	320	<50	320	0.26	<20	<20
MW20/02A	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/03	3	<2	4	2	6	8	15	4.73 - 19	120	240	2070	<50	2310	2.39	150	140
MW20/04	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	110	560	<50	670	0.71	<20	<20
MW20/08	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/09	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	260	<50	260	0.27	<20	<20
MW20/10	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/11	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	80	250	<50	330	0.3	<20	<20
MW20/12	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	220	<50	220	0.2	<20	<20
MW20/14	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	520	<50	520	0.52	<20	<20
MW20/15	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/16	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<60	<100	<60	<60	<0.1	<20	<20
MW20/17	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW20/18	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
MW94/6	<1	<2	<2	<2	<2	<2	<1	<0.004	<20	<50	120	<50	120	0.12	<20	<20
T01-231123	<1	<1	<1	<1	<2	<3	-	<0.02	<20	220	400	200	820	0.82	<20	<20
Statistical Summary																
Number of Results	18	18	18	18	18	18	17	18	18	18	18	18	18	18	18	18
Number of Detects	1	0	1	1	1	1	1	3	1	4	9	1	9	9	1	1
Minimum Concentration	<1	<1	<1	<1	<2	<2	<1	<0.004	<20	<50	<100	<50	<50	<0.1	<20	<20
Minimum Detect	3	ND	4	2	6	8	15	4.73	120	80	120	200	120	0.12	150	140
Maximum Concentration	3	<2	4	2	6	8	15	19	120	240	2070	200	2310	2.39	150	140
Maximum Detect	3	ND	4	2	6	8	15	19	120	240	2070	200	2310	2.39	150	140
Average Concentration	0.64	0.97	1.1	1	1.3	1.4	1.4	0.8	16	56	287	35	322	0.34	18	17
Median Concentration	0.5	1	1	1	1	1	0.5	0.002	10	25	85	25	75	0.085	10	10
Standard Deviation	0.59	0.12	0.72	0.27	1.2	1.6	3.5	2.8	26	67	477	41	553	0.57	33	31
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0

				IEPM (2013)				Metals						PAH/Phenols																		
				TRH >C10-C16 Fraction	TRH >C10-C16 Fraction less N	TRH >C16-C34 Fraction	TRH >C34-C40 Fraction	Chromium	Chromium (Filtered)	Chromium (hexavalent)	Chromium (hexavalent) (Filtered)	Chromium (Trivalent)	Chromium (Trivalent) (Filtered)	Benzo(b+j) & Benzo(k)fluoranthene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ (zero)	Benzo(b&j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				100	100	100	100	1	1	5	1	5	1	0.004	0.002	0.004	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.004	0.002	0.004	0.001	0.001	0.001	0.002	0.002
Clyde WARP SSTL - GW VI - Commercial					NL																											
Clyde WARP SSTL - GW VI - Construction				-	NL	-	-			-	-																					
Clyde WARP SSTL - GW VI - IMW				-	NL	-	-			-	-																					
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95																																
NEMP (2020) Interim Marine - High conservation value systems (99%)																																
NEPM (2013) - Marine Water										4.4	4.4	27	27																			
NEPM (2013) - Recreational										500	500																					
NHMRC (2019) HBGV - Recreational Water																																
Field_ID	**Location_Code**	**Well**	**Sampled_Date_Time**																													
BH210	BH210	BH210	23/11/2023	<100	<100	<100	<100	-	<1	-	<1	-	<1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
D01_231123	MW20/02A	MW20/02A	23/11/2023	<100	<100	<100	<100	-	<1	-	<1	-	<1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/01A	MW20/01A	MW20/01A	23/11/2023	<100	<100	260	<100	-	6	-	<1	-	6	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/02A	MW20/02A	MW20/02A	23/11/2023	<100	<100	<100	<100	-	<1	-	<1	-	<1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/03	MW20/03	MW20/03	24/11/2023	640	620	1750	<100	-	4	-	<1	-	4	<0.004	1.22	<0.004	0.284	0.411	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	0.017	<0.002
MW20/04	MW20/04	MW20/04	23/11/2023	200	200	510	<100	-	1	-	<1	-	1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/08	MW20/08	MW20/08	23/11/2023	<100	<100	<100	<100	-	<1	-	<1	-	<1	<0.004	0.006	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/09	MW20/09	MW20/09	23/11/2023	<100	<100	270	<100	-	3	-	<10	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/10	MW20/10	MW20/10	24/11/2023	<100	<100	<100	<100	-	<1	-	<10	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/11	MW20/11	MW20/11	24/11/2023	110	110	190	<100	-	<10	-	<1	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/12	MW20/12	MW20/12	24/11/2023	<100	<100	200	<100	-	<10	-	<1	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/14	MW20/14	MW20/14	23/11/2023	<100	<100	520	<100	-	1	-	2	-	<1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/15	MW20/15	MW20/15	24/11/2023	<100	<100	<100	<100	-	<10	-	<10	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/16	MW20/16	MW20/16	24/11/2023	<100	<100	<100	<100	-	<10	-	<1	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/17	MW20/17	MW20/17	24/11/2023	<100	<100	<100	<100	-	1	-	<1	-	1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/18	MW20/18	MW20/18	24/11/2023	<100	<100	<100	<100	-	7	-	<1	-	7	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
MW94/6	MW94/6	MW94/6	24/11/2023	<100	<100	120	<100	-	<10	-	<1	-	<10	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
T01-231123	BH210	BH210	23/11/2023	220	220	600	<100	<1	-	<5	-	<5	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Statistical Summary																																
Number of Results				18	18	18	18	1	17	1	17	1	17	17	17	17	18	18	18	18	18	17	17	17	18	18	18	18	18	18	18	18
Number of Detects				4	4	9	0	0	7	0	1	0	5	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Minimum Concentration				<100	<100	<100	<100	<1	<1	<5	<1	<5	<1	<0.004	<0.002	<0.004	<0.002	<0.002	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.004	<0.002	<0.004	<0.001	<0.001	<0.001	<0.002	<0.002
Minimum Detect				110	110	120	ND	ND	1	ND	2	ND	1	ND	0.006	ND	0.284	0.411	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND
Maximum Concentration				640	620	1750	<100	<1	<10	<5	<10	<5	<10	<0.004	1.22	<0.004	0.284	0.411	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.017	<0.01
Maximum Detect				640	620	1750	ND	ND	7	ND	2	ND	7	ND	1.22	ND	0.284	0.411	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND
Average Concentration				104	103	271	50		3		1.4		3.3	0.002	0.073	0.002	0.017	0.024	0.00075	0.0012	0.00075	0.0005	0.0005	0.0005	0.0022	0.0012	0.0022	0.00075	0.00075	0.00075	0.0021	0.0012
Median Concentration				50	50	85	50	0.5	3	2.5	0.5	2.5	5	0.002	0.001	0.002	0.001	0.001	0.0005	0.001	0.0005	0.0005	0.0005	0.0005	0.002	0.001	0.002	0.0005	0.0005	0.0005	0.001	0.001
Standard Deviation				144	139	412	0		2.4		1.8		2.4	0	0.3	0	0.067	0.097	0.0011	0.00094	0.0011	0	0	0	0.00071	0.00094	0.00071	0.0011	0.0011	0.0011	0.0038	0.00094
Number of Guideline Exceedances				18	18	18	18	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				18	18	18	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

					SVOC			
	Phenanthrene	Pyrene	PAHs (Sum of total)	7,12-dimethylbenz(a)anthracene	Benzo(e)pyrene	Coronene	Perylene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.002	0.001	0.001	0.001	0.001	0.002	0.002
Clyde WARP SSTL - GW VI - Commercial							
Clyde WARP SSTL - GW VI - Construction							
Clyde WARP SSTL - GW VI - IMW							
NEMP (2020) Freshwater - Slightly to moderately disturbed systems (95							
NEMP (2020) Interim Marine - High conservation value systems (99%)							
NEPM (2013) - Marine Water							
NEPM (2013) - Recreational							
NHMRC (2019) HBGV - Recreational Water							

Field_ID	Location_Code	Well	Sampled_Date_Time	Phenanthrene	Pyrene	PAHs (Sum of total)	7,12-dimethylbenz(a)anthracene	Benzo(e)pyrene	Coronene	Perylene
BH210	BH210	BH210	23/11/2023	<0.002	<0.001	0.009	<0.001	<0.001	<0.002	<0.002
D01_231123	MW20/02A	MW20/02A	23/11/2023	<0.002	<0.001	0.006	<0.001	<0.001	<0.002	<0.002
MW20/01A	MW20/01A	MW20/01A	23/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/02A	MW20/02A	MW20/02A	23/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/03	MW20/03	MW20/03	24/11/2023	<0.002	<0.001	5.44	<0.001	<0.001	<0.002	<0.002
MW20/04	MW20/04	MW20/04	23/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/08	MW20/08	MW20/08	23/11/2023	0.006	<0.001	0.006	<0.001	<0.001	<0.002	<0.002
MW20/09	MW20/09	MW20/09	23/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/10	MW20/10	MW20/10	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/11	MW20/11	MW20/11	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/12	MW20/12	MW20/12	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/14	MW20/14	MW20/14	23/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/15	MW20/15	MW20/15	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/16	MW20/16	MW20/16	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/17	MW20/17	MW20/17	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW20/18	MW20/18	MW20/18	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
MW94/6	MW94/6	MW94/6	24/11/2023	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
T01-231123	BH210	BH210	23/11/2023	<0.01	<0.01	<0.02	-	-	-	-

Statistical Summary

Statistical Summary	Phenanthrene	Pyrene	PAHs (Sum of total)	7,12-dimethylbenz(a)anthracene	Benzo(e)pyrene	Coronene	Perylene
Number of Results	18	18	18	17	17	17	17
Number of Detects	1	0	4	0	0	0	0
Minimum Concentration	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002
Minimum Detect	0.006	ND	0.006	ND	ND	ND	ND
Maximum Concentration	<0.01	<0.01	5.44	<0.001	<0.001	<0.002	<0.002
Maximum Detect	0.006	ND	5.44	ND	ND	ND	ND
Average Concentration	0.0015	0.00075	0.3	0.0005	0.0005	0.001	0.001
Median Concentration	0.001	0.0005	0.0005	0.0005	0.0005	0.001	0.001
Standard Deviation	0.0015	0.0011	1.3	0	0	0	0
Number of Guideline Exceedances	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0

ERM

APPENDIX D ASBESTOS REGISER

ASBESTOS REGISTER

As outlined within Section 4, asbestos in sub-surface soils have previously been detected. Asbestos management controls outlined within Section 6 are to be implemented during intrusive works the capped extent of Lot 64, which contains the below locations of contamination.

Date identified	ID	Approximate Eastings	Approximate Northings	Approximate Depth (m BGL)	Description	Friable or non-friable	Accessibility
16 and 19 July 2019	TP19/21	317851.7602	6254676.512	2.0	• Fibre cement fragments containing asbestos and soft fibrous plaster like material containing asbestos – in soil	Friable plaster and fibre cement, and non-friable fibre cement	Within Capped Area - Inaccessible under normal site conditions – only accessed via excavation
19 July 2019	TP19/81	317908.2702	6254674.853	1.0	• Fibre cement fragments containing asbestos – in soil	Non-friable	Within Capped Area - Inaccessible under normal site conditions – only accessed via excavation
19 July 2019	TP19/68	317990.4378	6254637.083	1.0	• Fibre cement fragments containing asbestos – in soil	Non-friable	Inaccessible under normal site conditions (outside capped area, riparian corridor) – only accessed via excavation
19 July 2019	TP19/74	317841.9105	6254598.265	1.5	• Weathered fibre cement fragments containing asbestos and loose fibre bundles of asbestos – in soil	Friable fibre cement and loose fibre bundles	Inaccessible under normal site conditions (outside capped area, riparian corridor) – only accessed via excavation
19 July 2019	TP19/76	317889.1246	6254593.531	2.2	• Fibre cement fragments containing asbestos and loose fibre bundles of asbestos – in soil	Friable fibre cement and loose fibre bundles	Inaccessible under normal site conditions (outside capped area, riparian corridor) – only accessed via excavation

APPENDIX E GROUNDWATER MONITORING PROGRAM

Clyde Western Area Remediation Project

Groundwater Monitoring Program – Stage 2

14 July 2021

Project No.: 0561882

The business of sustainability

Document details	
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Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	01	Stephen Mulligan	Peter Lavelle	Michael Gaggin	11.06.2021	Preliminary Draft Report for Viva Energy Review
Revised Draft	02	Stephen Mulligan	Peter Lavelle	Michael Gaggin	17.06.2021	Revised Draft incorporating Viva Energy Review
Final	03	Stephen Mulligan	Peter Lavelle	Michael Gaggin	14.07.21	Final Version for Consultation

Signature Page

14 July 2021

Clyde Western Area Remediation Project

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CONTENTS

List of Tables

Glossary

Glossary Term	Definition
the Site	Viva Energy owned land on the Camellia Peninsula consisting of the following Lots: Lot 398 DP41324, Lots 100 and 101 of DP 1168951, Lot 101 DP809340, Lot 2 DP 224288, and Lot 1 DP 383675. It includes the Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is currently vacant or leased to third parties
the Western Area	A largely vacant area of land, approximately 40 Ha in size, located in the south western part of the Site. The land previously contained a variety of refinery assets that have now been removed.
the Clyde Terminal	A part of the Site currently operating as an import, storage and distribution terminal for finished petroleum products including diesel, jet and gasoline fuels. The Clyde Terminal makes up the majority of the central part of Site and operates under SSD 5147 and NSW EPL 570
the Parramatta Terminal	A part of the Site Currently used for distribution activities involving bulk road transport. The Parramatta Terminal is located in the north western part of the Site and operates under EPL 660.
the Wetland	A large undeveloped wetland area in the north-eastern part of the Site close to the confluence of the Parramatta and Duck Rivers.
the Project	The proposal to remediate the contaminated soils in the Western Area to a commercial/industrial standard alongside associated infrastructure removal, waste management, soil and groundwater management, land forming and storm water management activities.
the Project Area	The Project Area is the land within the Western Area where the Project will occur. The extent of the Project Area, within the Western Area, is shown on Figure 1, Appendix A.
The Stage 2 Area	The Stage 2 Area encompasses all areas within the Western Area situated to the west of the Stage 1 Area. The Stage 2 Area extends from Devon Street in the North to the Duck River at the southern boundary of the Western Area, the extent of which is shown on Figure 1 and 2.
AEC-4	Area of Environmental Concern 4 (Southern Buried Waste Area). AEC-4 forms part of the extent of remediation and management required within the Stage 2 Area of the WARP, and is situated within the southern portion of the Stage 2 Area. AEC-4 is shown on Figure 1 and 2.

1. INTRODUCTION

Viva Energy Australia Pty Ltd. (Viva Energy) contracted Environmental Resources Management Australia Pty Ltd (ERM) to prepare a Groundwater Monitoring Program (GWMP) to supplement the Groundwater Monitoring and management Plan (GMP) which has been prepared for the Clyde Western Area Remediation Project ('the Project').

This GWMP has been specifically prepared for 'Stage 2' of the Western Area, as defined in the following sections.

1.1 Background

Viva Energy owns the land associated with the former Clyde Refinery, located at Durham Street, Rosehill on the Camellia Peninsula, NSW ('the Site'). Viva Energy currently operates the Clyde Terminal on part of the former Refinery footprint; however a large part of the former refinery land in the south-western portion (the 'Western Area') is no longer required for operational purposes. As such, Viva Energy is proposing to remediate contaminated soils (as required) within the majority of the Western Area, as shown on Figure 2.

Viva Energy intends to remediate the Western Area to a standard suitable to facilitate future commercial / industrial land use. Due to the scale of remedial works, the Project was declared State Significant Development (SSD) and as such, to assess the potential environmental impacts associated with remediation, an Environmental Impact Statement (EIS) containing a Conceptual Remedial Action Plan (RAP) was prepared (AECOM, 2019a).

Based on correspondence between various Project stakeholders, Viva Energy is proposing to stage the remediation of the Western Area as follows:

- Stage 1 – Former Process West;
- Stage 2 – Former Utilities, Movements and Southern Buried Waste Area; and
- Stage 3 – Former Process East.

This groundwater monitoring program presents the groundwater monitoring requirements to be implemented across Stage 2 of the Project.

A GWMP has previously been developed (ERM, 2021a) to be implemented across all stages of the project. However, given the GWMP is associated with a Long Term Environmental Management Plan (LTEMP) for the 'Stage 1 Area', a separate GWMP has been prepared for the Stage 2 Area such that discrete revisions may be made without impacting upon the management of unrelated portions of land.

This GWMP has been developed in accordance with the consent conditions associated with approval SSD 9302 for the Project. Post remediation groundwater monitoring requirements are detailed within this GWMP and will be appended as a requirement of the Long Term Environmental Management Plans (LTEMPs) prepared for portions of the Western Area. The GMP and GWMP will be subject to Site Auditor review and approval.

1.2 Project Objectives

Viva Energy has developed three main project objectives as follows:

- Ensure on-going operational viability of Clyde Terminal assets and associated licences to operate (including but not limited to Safework NSW Major Hazard Facility (MHF) Licence, Environment Protection Licence (EPL) 570 and the SSD 5147 consent conditions).
- Ensure any future redevelopment decisions are considerate of the operational requirements of the existing terminal.
- Meet applicable regulatory requirements.

1.3 Remediation Objectives and Strategy

The remediation objectives for the Project, as defined within the Conceptual RAP (AECOM, 2019b) are as follows:

- *"Remediate the soil and manage groundwater within the appropriate parts of the Western Area (i.e. the Project Area), to enable the land to be used for commercial / industrial purposes in the future, thereby reducing the risk of contamination from the land adversely affecting human health and the environment;*
- *Ensure any approved remediation process that is implemented adheres to all applicable regulatory requirements so as to limit or eliminate (where possible) adverse effects to human health or ecological receptors..."*

These overarching remediation objectives are applicable to all stages of the Project. Where remediation is required, the focus of the works are:

- Addressing petroleum hydrocarbon impacts on shallow soil horizons;
- Addressing soil/sludge impacts in the drainage network and surrounds;
- Removing Light Non-Aqueous Phase Liquid (LNAPL) trapped within shallow soils to the extent practicable[1]; and
- Facilitating the effective removal or mitigation of short or long-term contamination risks to the environment.

The requirement to remove LNAPL would be based on the level of potential human health risk for the proposed commercial/ industrial end use. Given the established stability of LNAPL and associated dissolved phase impacts, removal of LNAPL to reduce groundwater migration is not a key driver. As such, the below risk-based approach, forms the basis for the remediation extents and volumes provided for the Western Area:

- Hydrocarbon impacted soils and LNAPL which have been assessed as posing a risk to future commercial/industrial receptors (via vapour intrusion) are proposed to be removed via excavation of shallow soils to the extent practicable;
- LNAPL which has been assessed as not posing a risk to human health, and immobile is proposed to be managed in-situ via Long Term Environmental Management Plans;
- Previous groundwater monitoring undertaken throughout the Western Area has indicated stable to decreasing concentrations of petroleum hydrocarbons, including Total Recoverable Hydrocarbons and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) in groundwater over time. Risks to human health and ecological receptors from dissolved phase groundwater

[1] Removal of LNAPL 'to the extent practicable' is defined as whereby that residual risks are mitigated or able to be managed passively under a Long Term Environmental Management Plan (LTEMP)

concentrations have not been identified in the Western Area based on the current commercial/industrial land-use.

Given the current assessment that hydrocarbon concentrations are stable to decreasing, it is expected that the remediation works proposed will enhance the current natural attenuation processes. The ongoing groundwater management approach presented within this GWMP is therefore aimed at demonstrating the ongoing stability of groundwater conditions and that residual groundwater impacts do not present a risk to the ecological values of receptors, specifically Duck River.

1.4 Stage 2 Remediation Works Overview

The scope of remediation works based on the remediation strategy and objectives for the project is provided within the Stage 2 RAP (ERM, 2021b) and summarised below.

The proposed remediation methodologies were selected for remediation of contaminated soil and LNAPL within the Stage 2 Area:

1) Excavation and on-Site bio-piling (hydrocarbon impacted areas); and/or
2) Excavation and off-site disposal of soils (for asbestos impacted soils or as a contingency measure).
3) On-site management under a constructed engineered cap (specific approach to AEC-4)
4) On-site management with management control outlined within an Long Term Environmental Management Plan (LTEMP) (direct contact risks and residual LNAPL)

Table 1-1 Remediation Methodology Summary

Remediation Methodology	Combined Estimated In-situ Volume (m3)	Remediation Area(s) of Environmental Concern
Excavation and on-Site bio-piling (hydrocarbon impacted areas)	5690	■ AEC-3A, ■ AEC-3D, ■ AEC-3E, ■ AEC-14A, ■ AEC-14B
Excavation and off-site disposal of soils (for asbestos impacted soils or as a contingency measure)	701	■ AEC-1 ■ AEC-3B
On-site management under a constructed engineered cap (Specific to AEC-4)	6968 [1]	■ AEC-4
On-site management with management controls outlined within an LTEMP (direct contact risks and residual LNAPL)	-	■ AEC-2, ■ AEC-3C, ■ AEC-5, ■ AEC-8, ■ AEC-11, ■ AEC-14, ■ AEC-15

Notes: 1. AEC-4 excavation volume refers to anticipated volume of uncontaminated surface material required to be re-worked for capping construction

1.5 Objectives of this GWMP

The objective of the GWMP is to meet the requirements of the Development Consent for the WARP (SSD 9302), and supplement the management and mitigation measures provided in the Groundwater Monitoring and Management Plan (GMP), prepared by AECOM (AECOM, 2020).

This groundwater monitoring program (GWMP) has been developed by a suitably qualified expert to monitor changes in groundwater levels and quality during and following completion of the remediation works. The plan addresses the below specific items requested in the conditions of consent:

SSD Condition	Objective	Relevant Section of this GWMP
B22 (b)	include a program to monitor groundwater levels and quality during remediation works and following demobilisation;	Section 3
B22 (d)	detail ongoing monitoring following demobilisation, to verify that natural attenuation of groundwater contamination is occurring over time;	Section 3.5 and Table 2, Appendix B
B22 (e)	include trigger levels for investigating potential adverse impacts to the Duck River, including triggers for indicating if further remediation of groundwater is required;	Section 3.3
B22 (f)	outline contingency actions to be implemented if monitoring indicates that natural attenuation is not occurring, or groundwater is having an adverse impact on the Duck River;	Section 3.7
B22 (g)	monitor the effectiveness of management measures and contingency actions for reducing impacts	Section 3.5 and 3.7
B22 (h)	procedures for reporting changes to groundwater conditions that have the potential to create unacceptable risks to the Duck River.	Section 3.6

2. CONCEPTUAL SITE MODEL AND RISK ASSESSMENT SUMMARY

2.1 Introduction

The detailed Conceptual Site Model (CSM) in relation to soil and groundwater conditions within the Western Area is presented in the Remediation Site Investigation Report (ERM, 2020a) and Human Health and Ecological Risk Assessment (HHERA) (ERM, 2020b). The CSM has been further refined based on supplementary investigations undertaken in the Stage 2 Area as detailed within the Stage 2 Remediation Action Plan ('the Stage 2 RAP', ERM 2021b) and therefore has not been reproduced in full within this GWMP. A brief summary of the environmental setting and nature and extent of groundwater impacts has been provided below for context.

2.2 Geology

The geology of the Site, including the Western Area has been characterised into four units, based on investigations completed by ERM and interpretation of soil bore log data obtained during previous investigations. A summary of the strata identified during historical investigations is detailed below:

- **Unit 1 (Fill Material)** - This material is described as a poorly compacted mixture of silt, clay and gravel, with localised areas of slag, furnace ash and concrete. This material was used to raise the level of the surface of the low-lying tidal swamp/mangrove area along the Parramatta and Duck Rivers. The fill material pinches out to the west;
- **Unit 2 (Estuarine Sediments)** - This unit is comprised of silty clay – clayey silt with occasional sandy lenses and shell fragments to a thickness of approximately 4 m. The unit generally thickens towards the Parramatta River and represents the natural profile prior to development and filling; and
- **Units 3 and 4 (Alluvial Sediments and Residual Clay)** - Tertiary alluvial sediments (up to 20 m thick, including clay with sandy lenses) and residual Ashfield Shale were reported in previous investigations.

With the exception of AEC-4, the average thickness of fill material within the Stage 2 Area is 0.6 m and this thickens to between 1.2- 1.5 m further south in proximity to the Duck River. Fill material is underlain by high plasticity orange red and grey clay (alluvial sediments) across the majority of the Stage 2 Area. Localised areas of backfill sand have been identified surrounding subsurface features (pipework) to depths of up to of 2 m bgl.

During historical site investigations, the following ground conditions were identified specific to AEC-4:

- Heterogeneous fill materials were identified to a depth of 4.0 m bgl. ERM notes that previous test pitting was terminated within fill materials in AEC-4 and as such the potential for deeper fill was noted to exist.
- The fill material is described as poorly compacted mixture of silt, clay and gravel, with localised areas of slag, furnace ash, black sludge and concrete. The RSI specifically identified anthropogenic waste such as bricks, timber, metal pipes, tiles and glass.
- LNAPL and "sludge materials" were identified at variable depths and locations throughout the fill materials.
- Field observations (and subsequent laboratory analysis) identified ACM and fibrous asbestos at a number of locations. Based on the nature and extent of fill within AEC-4, it was considered asbestos may be widely distributed throughout the fill matrix.

The Acid Sulfate Soil (ASS) Risk Map for Parramatta/Prospect (scale 1:25,000) produced by the Department of Land and Water Conservation (1997) identified the Western Area as having a high probability of ASS in estuarine sediments adjacent to the Duck River. The Stage 2 Area is classed predominantly as Class 4. A small portion of Class 2 area is noted to be present at the south-eastern extent of the Stage 2 area.

Recent investigation within AEC-4 has indicated that PASS conditions may exist in natural soils below the depth of fill material in AEC-4. Other parts of the Stage 2 Area are considered to have low potential for PASS/ ASS to be present.

Despite the low potential for ASS/ PASS presence, the collection of field parameters (including pH) during groundwater sampling has been incorporated into the scope of this GWMP (provided in Section 3) to monitor for potential adverse effects associated with excavation of ASS.

2.3 Hydrogeology

A detailed summary of hydrogeology across the wider Western Area has been provided within the RSI Report (ERM, 2020a). A summary relevant to the Stage 2 Area is provided in Table 2-1 below.

Table 2-1 Hydrogeology Summary (Stage 2 Area)

Stage	Comment
Groundwater Depth	Groundwater is represented as a shallow unconfined water bearing zone within the fill material and estuarine-alluvial sediments at depths between 1-3 m bgl. Preferential pathways for groundwater flow have been identified as being present within sandy lenses within the fill and estuarine units along with anthropogenic structures, such as the on-site storm water drainage network.
Groundwater Flow Direction	Direction of groundwater flow may be subject to fluctuation following rainfall events and localised groundwater mounding, but has generally been established to be towards the bounding Duck and Parramatta Rivers. Inferred groundwater flow direction based upon recent gauging activities since demolition works in 2016 is towards the Duck River, to the south and south-east. Within AEC-4, groundwater flows radially in line with site topography from the central northern portion of the buried waste mound towards the Duck River in the south and south east. Groundwater contours indicate a westerly to south-westerly flow towards an unlined drainage channel west of the buried waste mound. Groundwater flow in the north east is effected by the localised mounding of groundwater associated with unsealed ground.
Hydraulic Gradient	Average hydraulic gradients calculated parallel to groundwater flow direction indicated the hydraulic gradient to range between 0.003 m/m along the up gradient portion of the Western Area to 0.011 m/m across the southern portions of the Western Area. Hydraulic gradients were found to increase with proximity to the Duck River (ERM, 2018).
Hydraulic Conductivity	Based on historical assessments undertaken: ■ Hydraulic conductivity has been established to be low across the large majority of the Site, with estimated hydraulic conductivity values estimated for wells that were screened across clay, sandy clay and gravelly clay typically ranging from $5x10^{-5}$ m / day to $6x10^{-3}$ m/day. ■ Higher hydraulic conductivity values were reported for wells screened across coarser grained sandy clay soils within the southern portion of the Site and are consistent with the more transmissive nature of these geologies. ■ Generally, hydraulic conductivity values increased from a minimum 5 x 10^{5} m/day at the up gradient site boundary to up to 4 x 10^{-2} m/day closer to the southern site boundary due to the presence of sand/silt estuarine deposits closer to the Duck River. ■ laterally continuous higher hydraulic conductivity lithological units are not expected to be encountered within the Stage 2 Area. Specifically to AEC-4: ■ estimated hydraulic conductivity values estimated for wells that were screened across fill (gravelly clay), sandy clay and clay ranged from $1x10^{-3}$ m / day to 3 m/day.
Tidal Influence	On the basis of static water level data obtained from monitoring wells adjacent to the Duck River (including AEC-4), tidal interaction of surface water within the Duck River with groundwater within is not considered likely to be occurring, and is consistent with tidal assessments undertaken within other area of the Clyde Terminal.

- The focus of investigation activities and resulting refinement of the CSM has been on assessment of the shallow water bearing unit. This is due to the nature of soil and groundwater sources within the Stage 2 Area being at or near surface (historical aboveground storage and pipework and near surface drainage). The presence of fill material underlain by impermeable clay lithology has limited vertical migration and confined impacts in soil and groundwater to within the surficial shallow water bearing unit. This is supported by soil analytical results indicating that COPCs in soil samples collected from within the clay layer (or at depths greater than 2 m bgl) do not exceed the applicable screening criteria.
- Based upon the understanding of geology and hydrogeology at the site, the lateral migration potential of COPCs in groundwater is limited by the low permeability of the lithology, relatively flat hydraulic gradient and low average groundwater velocity. This is supported by the limited extent of impacted groundwater reported, indicating that, where present, areas of impacted groundwater are relatively stable and do not appear to be migrating; and

Given the nature of soil and groundwater sources within the Stage 2 Area (aboveground storage and pipework and near surface drainage), the low permeability clay layer underlying fill material appears to have limited the vertical migration of COPCs. This is supported by the analytical results indicating that COPCs in soil samples collected from within the clay layer (or at depths greater than 2 m bgl) do not exceeded applicable screening criteria, with only a few exceptions (i.e. the Southern Buried Waste Area). This is further supported by soil data obtained from depths greater than 2 m bgl.

2.4 Conceptual Site Model Summary

The Western Area has been previously divided into Areas of Environmental Concern (AECs) based on spatial location, contaminants of potential concern (COPCs) and historical land-uses.

The CSM presented below was developed within the ERM (2020) HHERA based on information collected during previous investigations summarised within the RAP (ERM 2021b).

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	Ecological
AEC-1 Old Administration Area	Primary source areas within AEC-1 included former administration buildings and the former substation (11) which has been decommissioned and demolished. Potential sources of contamination are considered to be limited to on-site burial of fill materials. CoPCs assessed included: ■ TRH C6-C40, Metals, PAH, Phenols, Asbestos (fill) ■ PFAS (groundwater only)	Soil ■ Asbestos (ACM)	■ Inhalation of dusts or potential asbestos fibres from isolated ACM impacted soils (TP19/01) during excavation by current and future on-site intrusive maintenance workers or construction workers undertaking earthworks.	■ No potentially complete SPR linkages to ecological receptors identified
AEC-2 Buried Waste Area 8 – CDU tank farm sludge	Primary sources within AEC-2 include buried waste materials associated within the CDU tank farm sludge that at the time of this RSI remain in-situ. CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PAH, Phenols.	Soil ■ LNAPL	■ No exceedances of tier 1 screening criteria are noted for this AEC; ■ Based on the observed presence of LNAPL within the soil profile at TP18/29 within this AEC, aesthetics (odour/staining encountered during future earthworks) and the potential effects of hydrocarbons on future buried infrastructure should be considered within the detailed RAP and/or future Long Term Environmental Management Plans.	■ No potentially complete SPR linkages to ecological receptors identified

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	Ecological
AEC-3 Southern Contractor Area Including the following sub-areas refined based on SPR linkages: ■ AEC-3A (Former Laboratory Area) ■ AEC-3B (Former Laboratory Area – Asbestos impacts) ■ AEC-3C (Former Contactor Warehouse (PAH hotspot)) ■ AEC-3D (Former Contactor Warehouse) ■ AEC-3E (TRH hotspot TP21/79)	Potential historical sources of impacts which have been decommissioned / removed from AEC-3 included: ■ sample store and laboratory area (AEC-3A and 3B); ■ storage and handling of AFFF products around the former location of Tank 24 and the Former Fire Station area; ■ contractor warehouse (AEC-3D); ■ workshop area; ■ Epoxy resins Plant. Secondary sources include subsurface soils containing LNAPL and surface / surface materials potentially impacted with PFAS CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PAH, Phenols, VOC/SVOC, Asbestos Specific to the Epoxy resins plant area: ■ Epichlorohydrin ■ bisphenol-a (BPA) ■ SVOC, VOC. Specific to the Fire Station area: ■ PFAS	<u>Soil</u> ■ LNAPL ■ TRH C6-C10 (F1) ■ Asbestos (ACM) ■ Carcinogenic PAHs <u>Groundwater</u> ■ LNAPL <u>Soil Vapour</u> AEC-3D (SV19/03): ■ TRH >C8-C10 Aliphatic; ■ TRH >C10-C12 Aliphatic; ■ Naphthalene; ■ Methane (associated with LNAPL source) AEC-3A (SV19/05): ■ TRH >C6-C8 Aliphatic; ■ TRH >C8-C10 Aliphatic; ■ TRH >C8-C10 Aromatic; ■ Benzene; ■ Naphthalene; and	■ Inhalation of vapours from hydrocarbon impacted soil, and LNAPL within the soil profile by future on site commercial workers in indoor air (AEC-3A, AEC-3D, AEC-3E); ■ Inhalation of dusts or potential asbestos fibres from isolated ACM in soils (AEC-3B - TP19/32) during excavation by current and future on-site intrusive maintenance workers or construction workers undertaking earthworks. ■ Direct contact or ingestion of soils impacted with carcinogenic PAHs (AEC-3C - TP19/16) or TRH C16-C34 fractions by on-site intrusive maintenance workers or construction workers undertaking earthworks. ■ Based on the observed presence of LNAPL within soil/ and groundwater wells screening LNAPL soil sources within AEC-3A and AEC-3D, soil vapour and ground gas assessment undertaken, elevated LEL/ methane readings in soil vapour there is potential for pooling of ground gases within future excavations. Infiltration of ground gases (methane) into future indoor air spaces is to be addressed via source removal of LNAPL. ■ The potential effects of hydrocarbons on future buried infrastructure and aesthetics should also be considered within the detailed RAP and/or future Long Term Environmental Management Plans.	■ No potentially complete SPR linkages to ecological receptors identified

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	Ecological
		■ Methane (associated with LNAPL source)		
AEC-4 Southern Buried Waste Area	Primary sources within AEC-4 include buried waste materials that at the time of this remain in-situ. CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PAH, Phenols, SVOC, pH (associated with acids), Dioxins, PFAS, Asbestos	Soil ■ LNAPL ■ TRH C6-C40 ■ Benzene ■ Asbestos (ACM and fibres within fill) ■ Metals (hexavalent chromium) ■ Carcinogenic PAHs ■ PFAS Groundwater ■ LNAPL	Soil ■ Indoor inhalation of vapours by future commercial/industrial workers (benzene, TRH C6-C10 (F1) fractions) from LNAPL and hydrocarbon impacted soil. ■ Inhalation of dusts or potential asbestos fibres from ACM and fibrous asbestos and asbestos fines within soil in soils during excavation by current and future on-site intrusive maintenance workers or construction workers undertaking earthworks. ■ Direct contact or ingestion of impacted soils (TRH >C10-C16 (F2) Fraction, TRH >C16-C34 Fraction, carcinogenic PAHs, hexavalent chromium), by on-site intrusive maintenance workers or construction workers undertaking earthworks. ■ Based on the observed presence of LNAPL within soil/ and groundwater within this AEC, there is potential for pooling of ground gases within future excavations undertaken by on-site intrusive maintenance or construction workers as well in enclosed air spaces in future development of buildings. The potential effects of LNAPL on future buried infrastructure and aesthetics (particularly odour generation) should also be considered within the detailed RAP and/or future Long Term Environmental Management Plans for this AEC. Groundwater ■ No potentially complete SPR linkages were identified for on-site or off-site human health receptors	No potentially complete SPR linkages to ecological receptors identified. ■ PAHs (including naphthalene, anthracene, benzo(a)pyrene, fluoranthene, phenanthrene) exceeding ecological criteria in groundwater have been identified within the northern portion of AEC-4 but have been laterally delineated to below assessment criteria within the Site. ■ PFAS (specifically PFOS) has been identified in soil and soil leachate samples within the which within the northern portion of AEC-4 and given high solubility may contribute to future offsite groundwater migration. Requires ongoing monitoring as part of the groundwater monitoring program.

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	**Ecological**
AEC-5 Platformer 3	■ Primary sources areas within AEC-5 (platformer 3) have been decommissioned / removed. ■ Secondary sources include subsurface soils/groundwater containing LNAPL CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PAH, Phenols	Groundwater ■ LNAPL (MW11/17)	■ No exceedances of screening criteria are noted for this AEC; Based on the observed presence of LNAPL within shallow groundwater at MW11/17 within this AEC, aesthetics (odour/staining encountered during future earthworks) and the potential effects of hydrocarbons on future buried infrastructure should be considered within the detailed RAP and/or future Long Term Environmental Management Plans.	■ No potentially complete SPR linkages to ecological receptors identified
AEC-8 Tank farm J	■ Primary sources areas within AEC-8 included former fuel storage infrastructure, which has been decommissioned / removed. ■ Secondary sources include subsurface soils containing LNAPL CoPCs assessed included: ■ TRH C6-C40, BTEXN, PFAS	Soil ■ LNAPL	■ Based on the isolated presence of LNAPL within the soil profile at TP18/31 within this AEC, there is potential for pooling of ground gases within future excavations undertaken by on-site intrusive maintenance or construction workers. The potential effects of hydrocarbons on future buried infrastructure and aesthetics should also be considered within the detailed RAP and/or future Long Term Environmental Management Plans for this area.	■ No potentially complete SPR linkages to ecological receptors identified
AEC-11 Tank farms A1, A2, A3	■ Primary sources areas within AEC-11 included fuel storage infrastructure, which at the time of this RSI remain onsite. ■ Secondary sources include subsurface soils containing LNAPL and surface / surface materials potentially impacted with PFAS CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PCB, PFAS, Dioxins	Soil ■ LNAPL	■ Based on the observed presence of LNAPL within soil within this AEC, there is potential for pooling of ground gases within future excavations undertaken by on-site intrusive maintenance or construction workers. The potential effects of hydrocarbons on future buried infrastructure and aesthetics should also be considered within the detailed RAP and/or future Long Term Environmental Management Plans.	■ No potentially complete SPR linkages to ecological receptors identified.

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	Ecological
AEC-13 Substation Areas and Transformer Yards	■ Primary sources areas within AEC-13 include former substation infrastructure, which has been decommissioned / removed. Substation areas assessed include substation and transformer footprints, as identified on Figure 6 of the RSI Report (ERM, 2020a). ■ Substations 9 and 23 were unable to be sampled due to their ongoing operation at the time of the investigation. CoPCs assessed included: ■ BTEXN, Metals, PCBs, Asbestos	Nil	■ No potentially complete SPR linkages to human health receptors identified.	■ No potentially complete SPR linkages to ecological receptors identified.
AEC-14 Subsurface drainage network Including the following sub-areas refined based on SPR linkages: ■ AEC-14A (Compromised Pipe 18D300-5) ■ AEC-14B (Compromised Pipes 15D100-4, 15D100-5)	■ Primary sources areas within AEC-14 include compromised or leaking subsurface drainage infrastructure, which contained hydrocarbon/oily water from product storage and handling areas. ■ Secondary sources include subsurface soils containing LNAPL and surface materials potentially impacted with PFAS CoPCs assessed included: ■ TRH C6-C40, BTEXN, Metals, PAH, Phenols, SVOC, pH (associated with acids), Dioxins, PFAS, Asbestos	Soil ■ LNAPL ■ TRH C6-C10 ■ TRH >C10-C12 (Aliphatic) ■ TRH >C12-C16 (Aromatic) ■ Carcinogenic PAHs	■ Indoor inhalation of vapours from volatile TRH fractions (C6-C16) by future on site commercial workers from hydrocarbon impacted soils at: ▪ AEC-14A (TP20/28) ▪ AEC-14B (TP20/29a, TP20/29b, TP20/29c, TP20/30, TP21/07) ■ Direct contact with contaminated soils (carcinogenic PAHs) by future on-site construction workers undertaking intrusive works: ▪ AEC14B (TP20/30, TP21/07) The presence of LNAPL and soils exceeding TRH management limits associated with the drainage network in Stage 2 as shown on Figures 6A-6C requires management under a LTEMP for aesthetic/ odour impacts identified during future works.	■ No potentially complete SPR linkages to ecological receptors identified.
AEC-15 General Site Areas (not	■ Primary sources areas within AEC-15 include a range of former processing and fuel	Soil ■ LNAPL	■ No exceedances of screening criteria are noted for this AEC;	■ No potentially complete SPR linkages to ecological receptors identified.

Area Of Environmental Concern	Potential Sources/ Assessed COPCs	Remaining COPCs	Potentially Complete SPR Linkages	
			Human Health	Ecological
covered within other AECs)	storage infrastructure, which has been removed. ■ Secondary sources include subsurface soils containing LNAPL CoPCs assessed included: ■ BTEXN, TRH C6-C40, Metals, PAH, Phenols, Asbestos (fill)		The presence of LNAPL of management limit exceedances for TRH fractions as shown on Figures 6A-6C will require management under a LTEMP for aesthetic/ odour impacts potentially encountered during future excavation works. As identified in the HHERA, inhalation of dusts or potential asbestos fibres from isolated ACM in soils (MW11/14) was conservatively identified as a potential risk based on the presence of asbestos (which was not quantified). Further investigation and quantification in this area was undertaken and it was subsequently found to be compliant with commercial/ industrial criteria (TP21/12).	

2.4.1 Groundwater Impacts

2.4.1.1 LNAPL

LNAPL has been identified during previous groundwater monitoring events at the following monitoring wells located within the Stage 2 Area:

- MW11/17 (AEC-5) – located immediately south of former Platformer 3 Location;
- MW12/01 (AEC-4) – situated within the Southern Buried Waste Area;
- MW20/06 (AEC-4) – situated within the Southern Buried Waste Area;
- MW18/24 (AEC-3A) – situated within the footprint of the former laboratory.

Groundwater monitoring of nearby wells has demonstrated no downgradient migration of LNAPL from these isolated areas. Associated dissolved phase concentrations are limited in extent and are delineated to within the Stage 2 boundary.

2.4.1.2 Dissolved Phase

Concentrations of COPCs in groundwater have been reported below the adopted SSTLs for on-site human health. The following exceedances of off-site criteria for human health and ecological receptors have been reported in the groundwater monitoring dataset during groundwater monitoring events undertaken in the last 5 years (2016 – 2021):

- Naphthalene exceeding offsite ecological criteria at MW12/03 (AEC-3D), MW20/03 and MW20/13 (AEC-4);
- Polycyclic Aromatic Hydrocarbons (PAHs) including phenanthrene, fluoranthene, anthracene and benzo(a)pyrene MW20/01A, MW20/03, MW20/06, MW20/07, BH116, MW20/13 (AEC-4):;
- Hexavalent chromium exceeding ecological criteria at MW11/06; and
- Benzene exceeding offsite recreational (human health) criteria at MW20/03 and MW20/13 (AEC-4).

Within soil leachate analysed from soil samples collected within the buried waste mound within AEC-4, naphthalene and zinc were identified to exceed the adopted ecological water criteria in leachate samples collected. Perfluorooctanesulfonic acid (PFOS) and TRH C10-C40 fractions were detected at concentrations exceeding the laboratory Limit of Reporting (LOR) in ASLP analysis conducted on soils but were less than the assessment criteria in groundwater.

Down gradient delineation of the above COPCs has been demonstrated through monitoring data to below relevant criteria in groundwater and therefore potential risks to offsite receptors (Duck River) have not been identified.

2.4.1.3 Baseline Sampling Results

The Quarter 4 2020 Groundwater Monitoring Event (ERM, 2021b) represents the baseline understanding of groundwater conditions within the Western Area at the time of Detailed RAP preparation. The following conclusions were made regarding groundwater conditions within the Western Area:

- The direction of groundwater flow in the Western Area is generally consistent with previous GMEs and flows to the south east towards the bounding Duck River. Localised radial flow towards the south-west has been identified in the south-west portion of the Western Area (AEC-4) following recent investigation;

- LNAPL observed within the monitoring well network is considered to be consistent in spatial extent with previous groundwater monitoring undertaken. Lateral delineation of LNAPL to within the site boundary has been achieved via gauging and sampling of down gradient wells;
- No exceedances of risk-based SSTLs were reported for on-site receptors in any groundwater monitoring wells sampled as part of the Q4 2020 GME;
- No exceedances of offsite ecological criteria were reported at the site boundary;
- Evidence of stable groundwater conditions and natural attenuation processes continue to be identified as per previous monitoring events, including:
  - No statistically significant increasing trends of key petroleum hydrocarbon contaminants of concern identified during the Q4 2020 GME;
  - The presence of a high proportion of polar compounds in groundwater samples, as indicated by widespread detections of TRH C10-C40 fractions versus non-detect following silica gel clean-up analysis. Polar metabolites are formed via microbial degradation of petroleum hydrocarbon source areas;
- Potential for adverse changes in groundwater conditions (migration or increased contaminant concentrations) are considered to be low given the removal of primary sources from the site and that sources of groundwater impacts are limited to residual impacted soils and highly weathered and immobile LNAPL in the subsurface; and
- The nature and extent of LNAPL and dissolved phase hydrocarbon impacts are currently considered to be stable, well characterised in the context of the current approved land use and the monitoring well network is considered suitable to assess potential changes in environmental conditions as well as source/pathway/receptor linkages.

Groundwater monitoring undertaken as part of the Q4 2020 GME was focused on petroleum hydrocarbons and demonstration of stable to decreasing trends. However, the following was noted with regard to other COPCs during the Q4 2019 GME:

- Concentrations of heavy metals were reported within the Western Area exceeding adopted ecological screening criteria for copper, lead, mercury, nickel and zinc. The distribution of metals exceedances did not appear to be confined to a particular portion of the Western Area, and were considered likely to be related to regional background water quality, associated with imported fill materials across the camellia peninsula.
- Based on the groundwater dataset for Per- and Polyfluoroalkyl Substances (PFAS) in groundwater in the Western Area, ecological exceedances for PFAS (specifically PFOS) in individual wells were considered consistent with the findings of previous sampling events and were not considered to alter the existing findings of the CSM and mass flux assessment previously undertaken (ERM, 2018). Specifically:
  - Recreational water quality criteria for PFOS + PFHxS were also exceeded in monitoring wells in the following areas of the Western Area:
    - Nearby Former AFFF foam storage Tank 24, (north of AEC-3);
  - Ecological direct toxicity trigger values were exceeded for PFOS in the following areas of the Western Area:
    - At the up-gradient site boundary (AEC-1) and within AEC-3; and
    - MW12/23 on the southern site boundary.

3. GROUNDWATER MONITORING PROGRAM

Existing groundwater monitoring wells have been selected for gauging and sampling based on the following objectives:

- **Monitoring during remediation** – to demonstrate remediation works do not have short-term adverse effects on localised groundwater quality or the Duck River and implement contingency actions (if required); and
- **Monitoring post-remediation –** To demonstrate ongoing stability of groundwater conditions and that residual groundwater impacts do not present a risk to the ecological values of receptors, specifically the Duck River.

3.1 Monitoring During Remediation

Project activities identified in the EIS which have potential to cause impacts on groundwater include:

- Excavations which penetrate the impermeable silty clay layer leading to increased infiltration of surface water and therefore increased groundwater volumes and potential migration of contamination off-site;
- Dewatering of excavations potentially leading to mobilisation of contaminated groundwater or LNAPL;
- Spills and leaks during the Project which could contaminate the ground and groundwater;
- dewatering activities which result in PASS being exposed, oxidising and generating acidic conditions which have the potential to impact the Duck River and cause ecological harm (either directly or indirectly eg via mobilisation of metals).

While potential for ASS/PASS is considered to be low based on recent assessment, collection of pH readings will be used to demonstrate no acidification of groundwater to have occurred from the works.

Groundwater within the Western Area is present at depths generally between 1 – 3 m bgl. Remediation works may require excavation and/or in-situ remediation to a maximum depth of 2 m bgl in AEC-3A and 3D and will be less than 2m bgl in other excavations completed across the Western Area.

Excavations proposed to extend below the water table may require management of groundwater which will be limited to excavations of depths greater than 1 m bgl.

Based on hydraulic testing data summarised in Section 3.2, hydraulic conductivity values for wells within the vicinity of proposed excavations AEC-3A and AEC-3D, including MW11/18 (6×10^{-3} m/day) and MW11/19 (9×10^{-4} m/day) indicate low potential for groundwater infiltration into excavations associated with clay lithologies.

Although there has been identified low potential for infiltration, due to excavation below the minimum depth of measured groundwater table, these excavations represent highest potential for altered groundwater flow regimes which may lead to mobilisation of contaminants in the subsurface. As such, groundwater monitoring during remediation works will focus on monitoring wells within or adjacent to the following excavations:

- AEC-3A (Former Laboratory Area) – proposed remediation depth of 2 m bgl;
- AEC-3D (Former Contractor Warehouse) - proposed remediation depth of 2 m bgl; and

While excavation AEC-14A has a proposed remediation depth of 1.8 m bgl, the overall footprint of this excavation is minor at 50m^2 and anticipated to have no notable affect on overall groundwater conditions at the Site which may be measured by the existing monitoring well network.

The proposed extent of these excavations is shown on Figure 1, Appendix A.

Viva Energy and an appropriately qualified validation consultant will be responsible for ensuring the completion of groundwater monitoring requirements during execution of remediation.

Specific groundwater monitoring wells selected for monitoring during remediation are shown on Figure 1, Appendix A.

3.2 Monitoring Post Remediation

Monitored natural attenuation of petroleum hydrocarbon impacts in groundwater has been proposed as a passive management strategy following the active remediation of source areas at the site which have been identified as driving risk to receptors. It is anticipated that groundwater conditions are likely to improve further prior to, during and following remediation works based on the following:

- Primary sources (e.g. above ground storage tanks) have been removed prior to the soil remediation commencing as part of the Clyde Terminal Conversion Project (SSD 5147). Remnant subsurface infrastructure (such as below ground pipework) has been decontaminated and decommissioned, with residual impacts assessed as providing negligible risk to groundwater when managed under an LTEMP;
- Shallow and Light Non-Aqueous Phase Liquid (LNAPL) impacts within the soil profile would be addressed as part of the remediation works by the excavation of LNAPL impacted soil to the extent practicable where potential risks are identified. As part of these works, impacted water may accumulate in these excavations and may be removed via pumping from excavations. LNAPL impacted water would be required to be disposed offsite;
- LNAPL and dissolved phase hydrocarbon impacts which are proposed to be managed in-situ have been assessed as stable and having no current or future migration or exposure pathways when managed passively in accordance with a future LTEMP; and
- The source removal and soil remediation process itself is likely to significantly improve groundwater conditions over the long term, assisted by natural attenuation (this process involves allowing naturally occurring micro-organisms in the ground to biodegrade hydrocarbon contamination).

Viva Energy will remain responsible for ensuring the completion of ongoing groundwater monitoring requirements. The requirement for future occupiers of portions of the Western Area to provide access for ongoing monitoring following completion of remediation will be outlined within relevant Long-Term Environmental Management Plans prepared following completion of remediation activities.

The objectives of the post remediation groundwater monitoring program are as follows:

- Provide confirmation of no ongoing risk to receptors, including future site users and Duck River by residual groundwater impacts following remediation;
- Demonstrate natural attenuation processes via continued stable to decreasing concentrations of petroleum hydrocarbons in groundwater.

Given the current assessment that hydrocarbon concentrations are stable to decreasing, it is expected that the remediation works proposed will enhance the current natural attenuation processes.

3.3 Groundwater Assessment Criteria

The groundwater assessment criteria outlined below represent trigger levels for the contingency actions outlined within Section 3.7 of this GWMP.

Assessment Criteria to be utilised as part of this GWMP are provided in Appendix C. The rationale for selection of assessment criteria is provided in the following subsections.

3.3.1 On-Site Monitoring

Groundwater data obtained as part of this GWMP will primarily be assessed against the Tier 2 Site Specific Target Levels (SSTLs) for groundwater, which were developed within the HHERA (ERM, 2020b) to target COPCs which exceeded tier 1 screening values for human health based on the consolidated historical dataset. Specific assumptions and input parameters used in development of these values are provided within the HHERA (ERM, 2020b). Adopted Groundwater SSTLs are provided as Appendix C.

In lieu of SSTLs for a particular COPC, groundwater data will be assessed against the 'Tier 1' investigation criteria published in *Schedule B1 Guideline on the Investigation Levels for Soil and Groundwater* of the ASC NEPM, which references the following guidance for protection of human health receptors:

- Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), *Technical Report No. 10: Health Screening Levels in Soil and Groundwater (2011)*. Health Screening Levels (HSLs) for vapour intrusion – Commercial/Industrial 'D' and HSLs for Intrusive Maintenance Workers (shallow trench).

The human health assessment criteria adopted assumes no future beneficial groundwater use, potable or non –potable, based on the saline nature of groundwater generally encountered and the low yields expected. As such, drinking water guidelines are not relevant for tier 1 screening of groundwater.

3.3.2 Boundary Monitoring

Assessment Criteria protective off-site ecological and recreational users of the Duck and Parramatta River systems have been sourced from the below guidance:

- National Health and Medical Research Council (NHMRC), *Guidelines for Managing Risk in Recreational Waters (2008)*, to assess potential direct contact risks to recreational users of the Parramatta and Duck Rivers; and
- Australian and New Zealand Governments (ANZG) (2018), Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Trigger values for marine water, level of protection 95% species and trigger values for marine water.
- The PFAS National Environmental Management Plan, Version 2.0 ('the NEMP'), prepared by the Heads of EPA (HEPA, 2020) for Tier 1 screening values for offsite human health and ecological receptors for groundwater.

It is noted that PFAS assessment for groundwater has been undertaken within the Western Area and was not identified as a target contaminant of concern for remediation within the Auditor endorsed RSI report (ERM, 2020a). As such, further PFAS assessment is limited to monitoring within and around AEC-4, given detections in soils identified to remain in-situ. Ongoing monitoring outside of this area is not proposed to be undertaken to meet the objectives of this GWMP given the existing CSM which indicates negligible risk from the flux assessment undertaken (ERM, 2018).

A summary of Tier 1 screening criteria for PFAS is provided below in Table 3-1.

Table 3-1 Adopted Groundwater Screening Criteria (PFAS)

Receptor	Adopted Screening Criteria	Source	Comments
Off-site recreational users of the Parramatta and Duck River (via direct contact)	Recreational Water Quality Guideline	Guidance on Per and Polyfluoroalkyl Substances (PFAS) in Recreational Water (NHMRC, 2019)	The recreational values are conservative for the activities down gradient of the site (primarily boating and rowing). The recreational values assume swimming activities with much higher direct contact rates.
On-site and offsite Ecological receptors (via direct contact)	Freshwater Trigger Values (95% Species Protection – slightly to moderately disturbed systems)	ANZECC – technical draft guideline values (as referenced in PFAS NEMP (HEPA, 2020))	Freshwater values used in lieu of regulator endorsed Marine Criteria, as per the guidance in the NEMP.
Indirect exposure for off-site ecological receptors (via consumption of PFAS containing biota (bioaccumulation)).	Freshwater Trigger Values (99% Species Protection – high conservation value systems)	ANZECC – technical draft guideline values (as referenced in PFAS NEMP (HEPA, 2020))	The ANZG (2018) Water quality guidelines advise the use of the 99% trigger value for slightly to moderately disturbed systems for chemicals which bio accumulate and bio magnify in wildlife. It is noted that the 99% protection value for PFOS is below the laboratory limit of reporting.

ERM has adopted the above ecological guidelines based on the assumption that the upper Parramatta River catchment is a moderately disturbed ecosystem, as it receives road and storm water runoff from adjacent industry and residential properties. Additionally, the rivers within this area are considered to be within an upper estuarine environment, therefore receiving ecosystem is considered marine.

The boundary monitoring assessment criteria adopted are consistent with routine groundwater monitoring undertaken (formerly under the requirements of EPL570).

3.4 Data Quality Objectives

3.4.1 Step 1 - State the Problem

Collection of appropriate groundwater monitoring data is required to evaluate the following in accordance with the conditions of consent for the Clyde Western Area Remediation Project (SSD 9302):

- groundwater levels and quality during remediation works and following demobilisation;
- verify that natural attenuation of groundwater contamination is occurring over time following demobilisation.

A GWMP is required to:

- include trigger levels for investigating potential adverse impacts to the Duck River, including triggers for indicating if further remediation of groundwater is required;
- outline contingency actions to be implemented if monitoring indicates that natural attenuation is not occurring, or groundwater is having an adverse impact on the Duck River;
- monitor the effectiveness of management measures and contingency actions for reducing impacts;
- Document procedures for reporting changes to groundwater conditions that have the potential to create unacceptable risks to the Duck River.

3.4.2 Step 2 – Identify the Decisions/Goal of the Study

The data is required to enable a decision to be made that:

- mitigation measures for protection of groundwater during remediation are effective in preventing adverse effects to groundwater;
- concentrations of contaminants of concern continue to not represent a risk to human health or ecological receptors;
- concentrations of contaminants of concern continue to not represent unacceptable risks to sensitive receptors following remediation;
- Ongoing management of groundwater via natural attenuation remains an appropriate long term strategy, such that contingency measures, including groundwater remediation are not required; and
- no further groundwater monitoring is necessary.

This point will be reached when the groundwater assessment criteria are met.

3.4.3 Step 3 – Identify Inputs to the Decisions

The inputs required to make the above decisions are as follows:

- appropriate groundwater gauging data including water levels and LNAPL (if identified);
- appropriate groundwater analytical data (including obtaining data from appropriate monitoring wells and appropriate analysis);
- concentration trend analysis (Mann-Kendall) for relevant COCs, where an appropriate dataset is available;
- analytical results assessed against the assessment criteria;
- establishment of a monitoring and assessment schedule; and

- information, comments or advice provided by the relevant stakeholders, including Viva Energy, the Site Auditor, and the Planning Secretary.

3.4.4 Step 4 – Define the Study Boundaries

The study boundary is the Stage 2 Area, which forms a portion of the Clyde Western Area. The extent of the Stage 2 Area is shown on Figure 1, Appendix A.

Previous investigations and groundwater monitoring events have indicated soil and groundwater impacts are limited to the surficial water bearing unit and remedial excavations will be limited to the upper 2m. As such, groundwater monitoring will be limited to the shallow water bearing unit.

This GWMP applies to monitoring works conducted during remediation works, and biannual ongoing sampling events completed post-remediation a review of the monitoring schedule and potential for discontinuing monitoring will be undertaken at least annually.

The ability for completion of ongoing monitoring is expected to be limited by the sale and redevelopment of the Stage 2 Area. Should these limitations inhibit completion of future ongoing monitoring, the requirement will be assessed by the Site Auditor.

3.4.5 Step 5 – Develop a Decision Rule (or Analytical Approach)

The initial analytical approach proposed is semi-annual (6 monthly) groundwater monitoring events of a selection of groundwater monitoring wells within the study area. Trend and natural attenuation analysis is initially proposed to be conducted annually.

Following completion of two rounds of groundwater data collection, the analytical program should be reviewed. A scaling back of the frequency and number of monitoring locations required is envisaged progressively, contingent upon the monitoring results.

Monitoring of sufficient wells to provide representation of the areas surrounding areas where source removal has been undertaken must be maintained until such time as the groundwater assessment criteria are met or via consultation with the Site Auditor.

Relevant COPCs in groundwater are limited to BTEX, naphthalene and TRH C_6-C_{40}.

Groundwater quality during and following remediation will be evaluated primarily via comparison of groundwater analytical data with the relevant assessment criteria to assess potential for ongoing risk to receptors. In addition to dissolved phase concentrations, the occurrence of visible or measurable LNAPL in wells where not previously identified would trigger the implementation of contingency actions outlined in Section 3.7.

Demonstration of continued natural attenuation and stability of dissolved phase groundwater impacts is occurring over time will include evaluation of primary and secondary lines of evidence presented within *CRC Care Technical Report 15: A technical guide for demonstrating monitored natural attenuation of petroleum hydrocarbons in groundwater* (Beck & Mann, 2010). It is noted that tertiary lines of evidence (microcosm studies) are currently not considered necessary given primary and secondary lines of evidence have already demonstrated natural attenuation processes to have occurred at the Western Area.

Statistical Trend Analysis (Mann Kendall) will be utilised to evaluate spatial and temporal trends of COPC concentrations over time. Generally, stable to decreasing trends of COPCs will be a primary indicator that natural attenuation processes are occurring. Where statistically significant trends are unable to be established, results will be considered in the context of risk to receptors and/or mass flux.

In addition to establishing trends for dissolved phase COPCs, collection of natural attenuation indicators (dissolved oxygen, oxidation reduction potential, nitrate, sulfate, ferrous iron and methane) at selected up gradient, plume centre and plume edge locations will enable a secondary line of evidence of the occurrence of natural attenuation.

It is likely that in some wells statistically significant trends will prove impossible to establish, even when other assessment criteria are met. If this occurs, a critical evaluation of the dataset for particular monitoring wells will be undertaken using a 'lines of evidence' approach. Potential reasons for inability to establish statistically significant trends include the below:

- TRH concentrations include breakdown compounds that develop as natural attenuation proceeds. As a result, concentrations in some fractions (particularly the lower carbon chain lengths) can increase. The effect is a long period of low but fluctuating TRH concentrations without a clear trend. It is noted that TRH >C10 fractions in groundwater have been demonstrated to be heavily influenced by the presence of polar metabolites during recent monitoring events, which have been interpreted to be a product of natural biodegradation processes. As such, trend analysis will utilise results following silica gel cleanup as an indicator of petroleum hydrocarbon concentrations in the >C10- C40 range;
- Some wells will have limited datasets (particularly TRH silica gel analysis). Monitoring data was unable to be collected within former operational areas which were inaccessible for several years during demolition;
- Some wells may experience a change in conditions as a result of the source remediation work, such that post-remediation concentrations are significantly different from pre-remediation concentrations. In most instances this will be a reduction, however increases may occur. In these cases the long term dataset may be unsuitable to represent the current trend. Where considered appropriate, use of a post remediation period as a time frame for trend analysis will be considered;
- COC concentrations at some wells will be close to the laboratory Limit of Reporting (LOR), and a statistically significant trend is unlikely for results fluctuating around a LOR. This should be taken into account when assessing trends.

In order to provide a case for reduction or cessation of monitoring, concentrations within individual wells (or based on flux assessment) must be compliant with risk-based assessment criteria provided in Section 3.3 at the boundary with the Duck River and not exceed SSTLs within on-site areas throughout a period of post remediation monitoring. If rebound is recorded during post-remediation monitoring rounds, it may be necessary to extend the duration of post-remediation monitoring.

3.4.6 Step 6 – Specify Limits on Decision Errors

A decision error would be an incorrect determination on whether groundwater assessment criteria have been met, or an incorrect assessment of statistical trends.

The acceptable limits on decision errors applied during the review of the results will be based on the Data Quality Indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness (PARCC) in accordance with the *ASC NEPM Schedule B (3) - Guidelines on Laboratory Analysis.*

The potential for significant decision errors will be minimised by:

- completing a robust QA/QC assessment of the assessment data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error would be 5% that a conclusive statement may be incorrect;
- assessing whether appropriate sampling and analytical density (both laterally and vertically throughout the fill and soil profiles) has been achieved for the purposes of meeting the Project objectives; and
- ensuring that the criteria set was appropriate for continuing use consistent with current and proposed usage under the Site's zoning (IN3 – Heavy Industrial) and the receiving environment of the Duck River;

- Mann Kendall trend analysis will be conducted on data using a significance level of 0.05, (or 95% confidence) which is considered suitable for sensitive land use.

3.4.7 Step 7 – Optimise the Plan

Review of the data set and concentration trends, and consideration of the appropriateness of the monitoring schedule will be undertaken annually. Revisions to the monitoring schedule (if required) should be made on the basis of the interpretation of the results. Outliers should be identified and contingency measures implemented if needed.

3.5 Sampling, Analysis and Quality Plan

3.5.1 Sampling Locations and Rationale

Table 1 and 2 of Appendix B presents the rationale for monitoring of specific existing groundwater monitoring wells.

Existing groundwater monitoring wells have been selected for gauging and sampling based on the following objectives:

- **Monitoring during remediation** – to demonstrate remediation works do not have short-term adverse effects on localised groundwater quality or the Duck River and implement contingency actions (if required). The monitoring program during the remediation phase is presented as Table B1, Appendix B; and
- **Monitoring post-remediation –** To demonstrate ongoing stability of groundwater conditions and that residual groundwater impacts do not present a risk to the ecological values of receptors, specifically the Duck River. The monitoring program to be implemented post-remediation is presented as Table B2, Appendix B.

Monitoring wells selected in Tables 1 and 2 of Appendix B form part of the existing monitoring well network. Should these monitoring wells be damaged, or unable to be located on site, an assessment of the adequacy of the remaining monitoring well network to meet the objectives of this GWMP will be undertaken. The re-installation of monitoring wells will only be considered if the existing network becomes unsuitable for its intended purpose.

Selected monitoring locations to be monitored during the remediation phase and the proposed analytical suite are listed in Table B1, Appendix B along with the rationale for their selection. The locations of these monitoring wells are shown on *Figure 1, Appendix A.* It is noted that wells designated for monitoring during remediation will only be applicable to where active remediation is being undertaken. For instance, only wells within the Stage 1 monitoring network will be monitored throughout the duration of Stage 1 remediation works.

Table 3-2 Groundwater Monitoring Requirements – During Remediation

Monitoring Area	Rationale	Frequency	Data Collected
Excavation Areas (nearby wells)	■ Sampling for adverse changes in dissolved phase COPC concentrations from remediation activities ■ Although considered unlikely to occur, an indication of potential ASS issues created during remediation may be assessed via collection of field parameters.	■ Baseline sampling prior to commencement of remediation works ■ Within 3 months following completion of remediation works	■ laboratory analysis for target COPCs (excavation specific), ■ collection of field parameters (including pH)
Excavation Areas (nearby wells)	■ Gauging to monitor potential alteration to groundwater levels/ flow regime;	■ Gauging weekly during excavation and/or dewatering	■ Gauging Data (water levels,

Monitoring Area	Rationale	Frequency	Data Collected
	■ Monitor potential for LNAPL mobilisation		LNAPL presence/ thickness);
Down-gradient boundary	■ Demonstrate groundwater at the boundary is not adversely impacted by remediation works or causing environmental harm to the Duck River; ■ Monitor potential for LNAPL mobilisation from remediation works	■ monthly during active remediation conducted up-gradient;	■ Gauging data (water levels, LNAPL presence/ thickness); ■ grab sample for collection of field parameters (including pH)

It is noted that wells designated for monitoring during remediation will only be applicable to where active remediation is being undertaken. For instance, only wells nominated within AEC-3A will be monitored throughout the duration of excavation works in this area.

Selected monitoring locations to be monitored post-remediation and the proposed analytical suite are listed in Table B2, Appendix B, along with the rationale for selection. The locations of these monitoring wells are shown on *Figure 2, Appendix A.*

Table 3-3 Groundwater Monitoring Requirements - Post remediation

Monitoring Area	Rationale	Frequency	Data collected
Excavation Areas (nearby wells)	■ Gauging to monitor potential for alteration to groundwater levels/ flow regime or LNAPL mobilisation	■ Completion of a single post-remediation sampling event (within 3 months of completion of remediation work)	■ laboratory analysis for TRH, BTEXN and MNA parameters ■ collection of field parameters ■ Gauging Data (water levels, LNAPL presence/ thickness).
Downgradient boundary	■ Demonstrate groundwater at the boundary is not impacted by remediation works or causing environmental harm to the Duck River; ■ Monitor potential for LNAPL mobilisation from remediation works	■ Biannually (every 6 months) following completion of post remediation sampling event ■ Requirement for ongoing sampling is to be reviewed at least annually (ie every two GMEs) based on trend analysis and reported concentrations	■ laboratory analysis for TRH, BTEXN and MNA parameters ■ collection of field parameters; ■ Gauging Data (water levels, LNAPL presence/ thickness); ■ collection of field parameters (including pH)
Downgradient boundary (AEC-4)	■ Demonstrate groundwater at the site boundary does not present an unacceptable risk to offsite receptors (Duck River) via mobilisation of contaminants from by in-situ managed buried waste material; ■ Monitor potential for LNAPL mobilisation and groundwater flow alteration following installation of surface capping.	■ Biannually (every 6 months) following completion of post remediation sampling event ■ Requirement for ongoing sampling is to be reviewed annually (ie every two GMEs) based on trend analysis and reported concentrations	■ Laboratory analysis for Contaminants of concern specific to AEC-4: ○ TRH C6-C40, BTEXN and MNA parameters ○ PAHs ○ Hexavalent Chromium ○ PFAS ■ Collection of field parameters

Monitoring Area	Rationale	Frequency	Data collected
			■ Gauging Data (water levels, LNAPL presence/ thickness)

3.5.2 Groundwater Sampling Method

Consistent with recent sampling methodologies employed since 2014, sampling via the use of no-purge ‘Hydrasleeve’ groundwater samplers is proposed.

To facilitate collection of representative groundwater samples, Hydrasleeve samplers will be installed a minimum of 24 hours prior to sample collection to allow for equilibration of the water column.

Water quality parameters, including pH, conductivity, dissolved oxygen (DO), temperature and redox potential (redox) will be measured during the groundwater sampling activities immediately following collection of groundwater samples from no purge samplers.

Where routine sampling of a well is required, samplers will be deployed for the next groundwater monitoring event following collection of samples.

3.5.3 Quality Assurance/Quality Control Plan

Appropriate quality assurance measures such as use of equipment that is calibrated and appropriately decontaminated between each sample location will be implemented. Samples will be placed in appropriate sample containers that are clearly labelled and stored in insulated boxes on ice.

Field quality control (QC) samples shall be collected including field duplicates, trip blanks, trip spikes and equipment rinsates. The number of field QC samples proposed is indicated in *Tables 1 and 2, Appendix B*.

Laboratory QA/QC procedures will be undertaken in accordance with *Schedule B(3) - Guidelines on Laboratory Analysis of Potentially Contaminated Soils* of the ASC NEPM (NEPC 2013) and will comprise matrix spikes, method blanks and surrogate recoveries. The results of the quality control testing will be presented in the laboratory reports. Duplicate testing will also be undertaken by the laboratories to compare the results obtained in analysing samples.

A comprehensive QA/QC assessment will be included within the annual summary report. However, the data quality will be evaluated after each event such that non-compliances are identified and resolved in a timely manner.

3.6 Data Evaluation and Reporting

Field and laboratory data collected as part of the groundwater monitoring program will be reviewed and evaluated continuously throughout the delivery of the Project to monitor compliance during and following completion of remediation works. Groundwater Monitoring reporting requirements are as follows:

Report	**Timing**	**Description**
Remediation Phase – Annual Groundwater compliance report	Annually throughout completion of remediation works	Factual presentation of groundwater data collected during remediation for demonstration of compliance. Report will summarise the results of monthly reporting and be incorporated into the Annual Report for the Development Consent (Section 6.2 of the REMP)

Report	Timing	Description
Remediation Phase – Monthly Factual Reporting	Monthly following completion of monitoring events during each stage of the remediation	Factual presentation of groundwater data collected during remediation for demonstration of compliance to the regulator throughout the duration of remediation works.
Ongoing Monitoring – Event 1 Factual Report	Following completion of first GME	Factual GME Report presenting laboratory results and field data
Ongoing Monitoring Event 2 and Annual Summary	Annual. The ongoing monitoring event 2 and annual summary report will be reported within 3 months of the completion of monitoring and provided to NSW EPA and Local Council (Parramatta City Council) in accordance with the requirements of the relevant LTEMPs	Interpretive GME report including: ■ Interpretation of dataset collected over the preceding year in relation to the historical dataset ■ Concentration and trend analysis and assessment of the progress of natural attenuation ■ Review of GWMP and provide amendment as necessary, including any proposed changes to monitoring (as appropriate) ■ Completion of interpretive QA/QC assessment for the preceding year's dataset

Based on the extensive existing dataset, which is demonstrating the occurrence of pre-existing natural attenuation processes, it is anticipated that ongoing groundwater monitoring of boundary monitoring wells will be required to be conducted for a minimum 1-2 years after the completion of remediation works to establish a sufficient post-remediation dataset for statistical purposes. Any reduction in the monitoring program will be reviewed in consultation with the Site Auditor in the context of the DQOs outlined in Section 3.4.

3.6.1 Non-Compliance Reporting

A non-compliance is defined within the REMP as "an occurrence, set of circumstances or development that is a breach of the requirements of the REMP, Development Consent, EPL or associated management plans, including exceedance of monitoring limits…".

Non-compliances (i.e. exceedances of monitoring limits which present risks to receptors) may be identified via the groundwater monitoring program and should be reported to the NSW DPIE, along with corrective actions in accordance with the procedure provided within Section 6.4 of the REMP.

3.7 Contingency Plan

If mobilisation of LNAPL or a spike in contaminant concentrations indicated via groundwater monitoring wells, the following actions should be taken:

- check whether concentrations are within the historical range, conducting re-analysis or additional sampling to confirm concentrations;
- Sample LNAPL to determine if composition of COPCs constitutes a risk to human health;
- evaluate surrounding wells to determine if there are pockets of groundwater in which attenuation does not appear to be occurring, or whether the situation appears isolated to one well. Monitor additional locations if needed to determine this;

- Revisit risk assessment in the context of mass flux to assess potential contaminant contributions to receptors;

If a risk to receptors is identified through the above actions or poses an immediate risk to the environment, consideration of short-term active LNAPL remediation solutions, such as mobile Multi-Phase Vacuum Extraction and/or in-situ chemical oxidation (ISCO) would be made in consultation with the Site Auditor.

3.8 Monitoring Well Decommissioning

When monitoring wells have been identified as being no longer required, decommissioning of these wells is recommended. Recommendations for the decommissioning of specific monitoring wells will be included in the Q4 reports.

Monitoring well decommissioning should be completed in accordance with the decommissioning requirements set out within the *Minimum Construction Requirements for Water Bores in Australia* (NUDLC, 2012).

3.9 GWMP Evaluation, Review and Completion

The monitoring program outlined within *Table 1 and 2 of Appendix B* should be reviewed at least annually (following completion of each Annual GME Summary report).

The requirements of the GWMP will be met for ongoing monitoring, enabling monitoring to cease when concentrations of contaminants of concern shown to have met the groundwater assessment criteria and are demonstrating statistically decreasing or stable trends following remediation.

A case for the reduction or cessation of monitoring will be provided to the Site Auditor for consideration and endorsement in consideration of the DQOs outlined in Section 3.4.

Complete cessation of monitoring may be presented in the same way, or may be prepared as a separate report for consideration by the Site Auditor.

3.10 Amendments

If the reviews described above recommend amendments, then this GWMP must be amended and re-issued. Any amendments must be reviewed by Viva Energy and the Site Auditor and documented within the Amendment Register at the front of this GWMP.

Amendments to the GMP and this GWMP must be documented in accordance with the requirements specified in Section 6.5 of the REMP and will be undertaken in consultation with the Site Auditor

4. REFERENCES

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Department of Land & Water Conservation (1998) *The NSW Groundwater Quality Protection Policy*

ERM 2018. *PFAS Conceptual Site Model and Flux Assessment* (0466133_Clyde PFAS PSI_FINAL) Clyde Terminal, Durham Street, Rosehill, NSW. December 2018.

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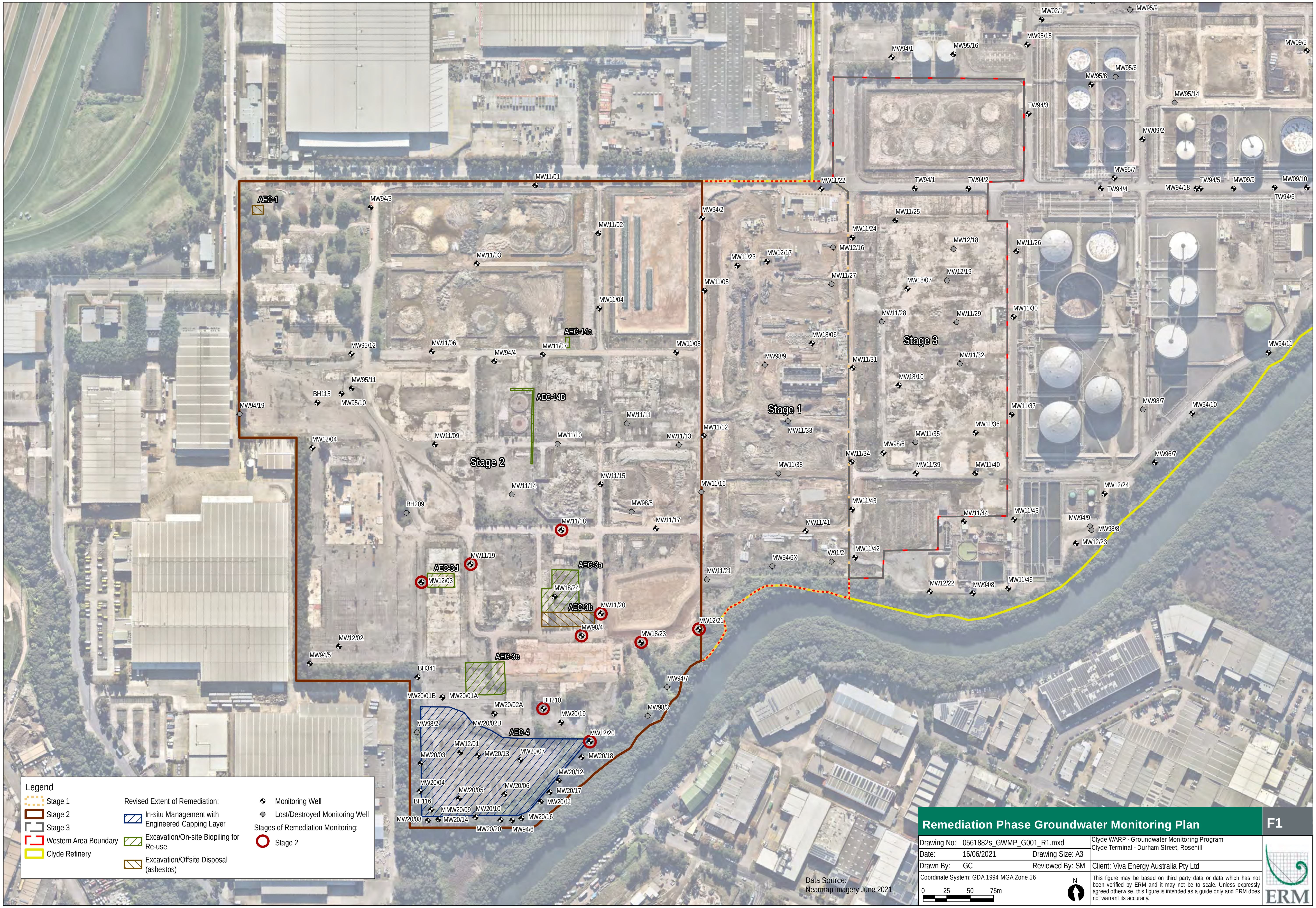
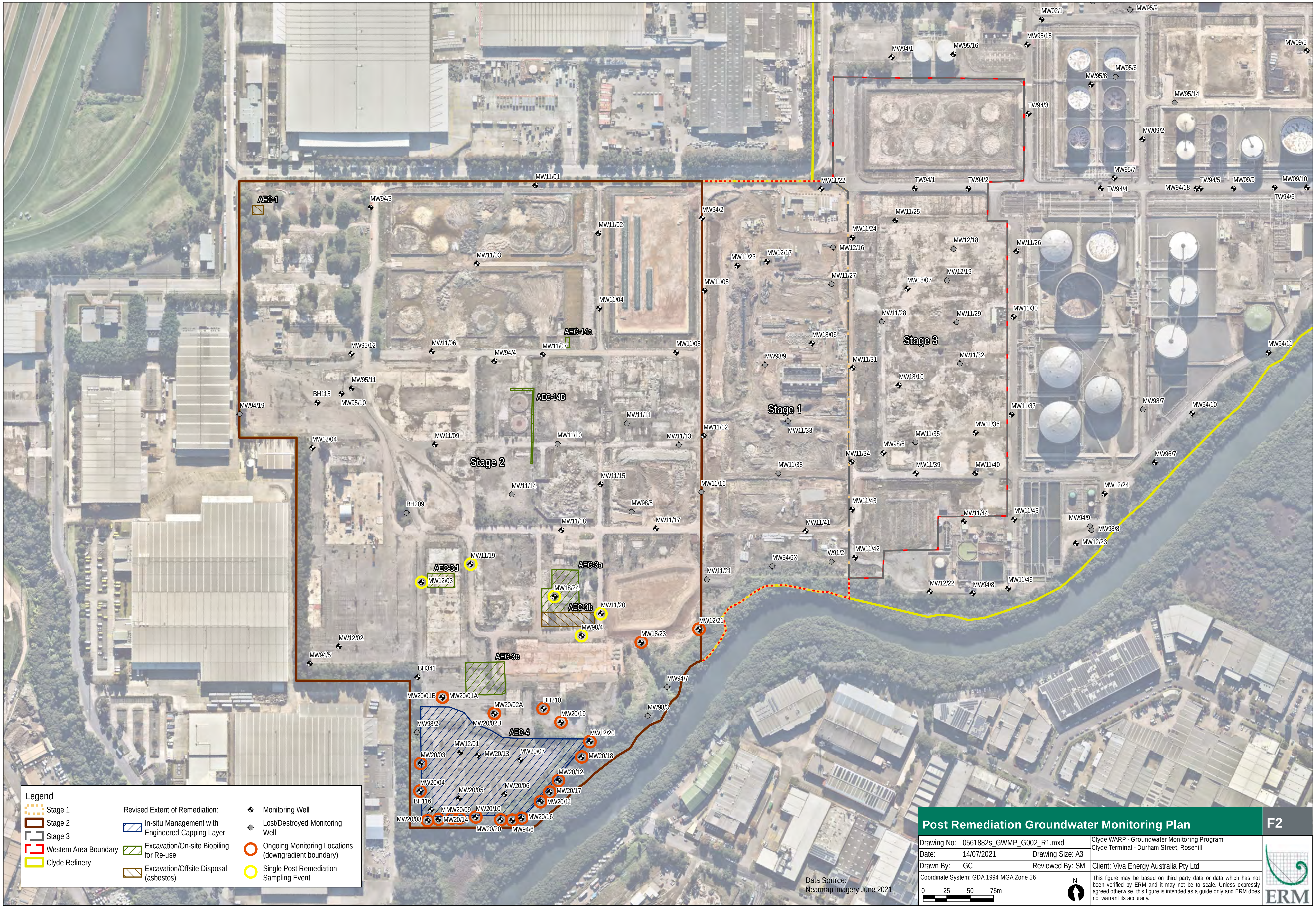
APPENDIX A FIGURES



Stage 1
Stage 2
Stage 3
AEC-1
AEC-14a
AEC-14B
AEC-3a
AEC-3b
AEC-3d
AEC-3e
AEC-4
MW11/01
MW94/3
MW94/2
MW11/02
MW11/03
MW11/04
MW11/05
MW11/06
MW11/07
MW11/08
MW94/4
MW95/12
MW95/11
MW95/10
BH115
MW94/19
MW12/04
MW11/09
MW11/10
MW11/11
MW11/12
MW11/13
MW11/14
MW11/15
MW11/16
MW11/17
MW11/18
MW11/19
MW11/20
MW11/21
MW12/21
MW98/5
BH209
MW12/03
MW18/24
MW98/4
MW18/23
MW12/02
MW94/5
BH341
MW94/7
MW98/3
MW20/01B
MW20/01A
MW20/02A
MW20/02B
BH210
MW20/19
MW12/20
MW98/2
MW12/01
MW20/03
MW20/13
MW20/07
MW20/18
MW20/12
MW20/04
MW20/06
MW20/05
MW20/17
MW20/11
BH116
MW20/09
MW20/10
MW20/08
MW20/14
MW20/16
MW20/20
MW94/6
MW02/1
MW95/9
MW95/15
MW94/1
MW95/16
MW09/5
MW95/6
MW95/8
MW95/14
TW94/3
MW09/2
MW95/7
MW11/22
TW94/1
TW94/2
TW94/4
MW94/18
TW94/5
MW09/9
MW09/10
TW94/6
MW11/25
MW11/24
MW12/16
MW12/18
MW11/26
MW11/23
MW12/17
MW11/27
MW12/19
MW18/07
MW11/28
MW11/29
MW11/30
MW18/06
MW98/9
MW11/31
MW11/32
MW94/11
MW18/10
MW11/37
MW98/7
MW94/10
MW11/33
MW11/36
MW11/35
MW98/6
MW11/34
MW11/38
MW11/39
MW11/40
MW96/7
MW12/24
MW11/43
MW11/45
MW11/44
MW94/9
MW98/8
MW11/41
MW12/23
MW94/6X
W91/2
MW11/42
MW12/22
MW94/8
MW11/46
Legend
Stage 1
Stage 2
Stage 3
Western Area Boundary
Clyde Refinery
Revised Extent of Remediation:
In-situ Management with Engineered Capping Layer
Excavation/On-site Biopiling for Re-use
Excavation/Offsite Disposal (asbestos)
Monitoring Well
Lost/Destroyed Monitoring Well
Stages of Remediation Monitoring:
Stage 2
Data Source:
Nearmap imagery June 2021
Remediation Phase Groundwater Monitoring Plan
F1
Drawing No: 0561882s_GWMP_G001_R1.mxd
Date: 16/06/2021
Drawing Size: A3
Drawn By: GC
Reviewed By: SM
Clyde WARP - Groundwater Monitoring Program
Clyde Terminal - Durham Street, Rosehill
Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
0 25 50 75m
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Post Remediation Groundwater Monitoring Plan

F2

Drawing No: 0561882s_GWMP_G002_R1.mxd		Clyde WARP - Groundwater Monitoring Program Clyde Terminal - Durham Street, Rosehill	
Date: 14/07/2021	Drawing Size: A3		
Drawn By: GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd	
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.	

APPENDIX B GROUNDWATER MONITORING PROGRAM SUMMARY TABLES

				Baseline Monitoring (prior to remediation commencement) Completion Monitoring (<3 months following completion of remediation excavation)				During Remediation		
Sample ID	**Remediation Stage**	**Purpose/ Rationale**	**Remediation Excavation Area**	**Gauging**	**Sampling**	**Analysis [2]**	**Field Parameters[1]**	**Frequency**	**Gauging**	**Field Parameters [1]**
BH210	Stage 2	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW98/4	Stage 2	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW11/18	Stage 2	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW11/19	Stage 2	Excavation Area Monitoring	AEC-3d	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW11/20	Stage 2	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW12/03	Stage 2	Excavation Area Monitoring	AEC-3d	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW12/20	Stage 2	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW18/23	Stage 2	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW12/21	Stage 2	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y

QA/QC Samples

Sample Type	Required Frequency
Intra-laboratory duplicates	1 per 10 primary samples
Inter-laboratory duplicates	1 per 20 primary samples
Trip Blanks	1 per laboratory batch
Trip Spikes	1 per laboratory batch
Rinsate Blanks	1 per day of sampling

Notes:

1) Field Parameters include pH, conductivity, dissolved oxygen (DO), temperature and redox potential (redox)

2) All TRH analysis to include Silica Gel Cleanup results in addition to regular analysis

Sample ID	Remediation Stage	Purpose/ Rationale	Remediation Excavation Area	Ongoing monitoring (biannual)						
				Gauging	Sampling	Field Parameters[1]	TRH C6-C40 (SGC[2]), BTEXN	MNA Parameters[3]	PAH / Speciated Cr (ultra trace[4])	PFAS (28)
MW11/21	Stage 2	Boundary Monitoring	-	1	1	1	1	1	-	-
MW12/21	Stage 2	Boundary Monitoring	-	1	1	1	1	1	-	-
MW18/23	Stage 2	Boundary Monitoring	-	1	1	1	1	1	-	-
MW20/01A	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/01B	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/02A	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/02B	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/03	Stage 2	Source Area (north)	AEC-4	1	1	1	1	1	1	1
MW20/04	Stage 2	Source Area (south)	AEC-4	1	1	1	1	1	1	1
MW20/08	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/09	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/10	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/11	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/12	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/14	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/15	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/16	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/17	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/18	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW20/19	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
BH210	Stage 2	Upgradient Monitoring	AEC-4	1	1	1	1	1	1	1
MW12/20	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
MW94/6	Stage 2	Downgradient Boundary Monitoring	AEC-4	1	1	1	1	1	1	1
TOTAL				**23**	**23**	**23**	**23**	**23**	**20**	**20**

QA/QC Samples

Sample Type	Required Frequency
Intra-laboratory duplicates	1 per 10 primary samples
Inter-laboratory duplicates	1 per 20 primary samples
Trip Blanks	1 per laboratory batch
Trip Spikes	1 per laboratory batch
Rinsate Blanks	1 per day of sampling

Notes:
1) Field Parameters include pH, conductivity, dissolved oxygen (DO), temperature and redox potential (redox)
2) All TRH analysis to include Silica Gel Cleanup results in addition to regular analysis
3) Monitored Natural Attenuation (MNA) parameters include nitrate, ferrous iron, methane and sulphate
4 ltra Trace PAH re uired below A G 2 1 Marine Trigger alues. Laboratory Limit of Reporting 4.4 ug L re uired for hexavalent chromium

APPENDIX C GROUNDWATER SITE SPECIFIC LEVELS

COPC	Groundwater		
	VI (mg/L)		
	Commercial (1.8mbgl)	IMW	Construction
Benzene	5.0	NL	NL
Naphthalene	13	NL	NL
Benzo(a)pyrene TEQ	-	-	-
Total Chromium[a]	-	-	-
Chromium VI	-	-	-
TRH C6-C10 (less BTEX)	6.2	NL	NL
TRH C6-C10	-	-	-
TRH C10-C16 (less N)	NL	NL	NL
TRH C10-C16	-	-	-
TRH C16-C34	-	-	-
TRH C34-C40	-	-	-
TPH (EC5-6) aliphatic	-	-	-
TPH (>EC6-8) aliphatic	NL	NL	NL
TPH (>EC8-10) aliphatic	4	NL	NL
TPH (>EC10-12) aliphatic	NL	NL	NL
TPH (>EC12-16) aliphatic	NL	NL	NL
TPH (>EC16-21) aliphatic	-	-	-
TPH (>EC21-34) aliphatic	-	-	-
TPH (>34) aliphatic	-	-	-
TPH (>EC8-10) aromatic	NL	NL	NL
TPH (>EC10-12) aromatic	NL	NL	NL
TPH (>EC12-16) aromatic	NL	NL	NL
TPH (>EC16-21) aromatic	-	-	-
TPH (>EC21-34) aromatic	-	-	-
TPH (>34) aromatic	-	-	-
Trimethylbenzene, 1,2,4-			
Trimethylbenzene, 1,3,5-			
Cyclohexane			
Heptane, N-			
Hexane, N-			
Isooctane			
Propene			

Notes:
NL = Non-Limiting

ChemName	MatrixType	ActionLevelSource	ActionLevel	Units	Comments
1,1-dichloroethene	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
1,2-dichlorobenzene	water	NHMRC (2008) Recreational Water - Health	15	mg/L	
1,2-dichloroethane	water	NHMRC (2008) Recreational Water - Health	0.03	mg/L	
1,2-dichloroethene	water	NHMRC (2008) Recreational Water - Health	0.6	mg/L	
1,3-Dichloropropene	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
1,4-dichlorobenzene	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
2,2-DPA	water	NHMRC (2008) Recreational Water - Health	5	mg/L	
2,4,5-T	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
2,4,6-trichlorophenol	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
2,4-D [(2,4-Dichlorophenoxy) acetic acid]	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
2,4-dichlorophenol	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
2-chlorophenol	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Acephate	water	NHMRC (2008) Recreational Water - Health	0.08	mg/L	
Acrylamide	water	NHMRC (2008) Recreational Water - Health	0.002	mg/L	
Aldicarb	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Aldrin & Dieldrin	water	NHMRC (2008) Recreational Water - Health	0.003	mg/L	
Ametryn	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Amitraz	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Amitrole	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Antimony	water	NHMRC (2008) Recreational Water - Health	0.03	mg/L	
Arsenic	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Asulam	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Atrazine	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Azinphos-methyl	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Barium	water	NHMRC (2008) Recreational Water - Health	20	mg/L	
Benomyl	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
Bentazone	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Benzene	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Benzo-(a)-pyrene	water	NHMRC (2008) Recreational Water - Health	0.0001	mg/L	
Beryllium	water	NHMRC (2008) Recreational Water - Health	0.6	mg/L	
Bioresmethrin	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Boron	water	NHMRC (2008) Recreational Water - Health	40	mg/L	
Bromacil	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Bromate	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Bromophos-ethyl	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Bromoxynil	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Cadmium	water	NHMRC (2008) Recreational Water - Health	0.02	mg/L	
Captan	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Carbaryl	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Carbendazim	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
Carbofuran	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Carbon tetrachloride	water	NHMRC (2008) Recreational Water - Health	0.03	mg/L	
Carbophenothion	water	NHMRC (2008) Recreational Water - Health	0.005	mg/L	
Carboxin	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Carfentrazone-ethyl	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Chlordane	water	NHMRC (2008) Recreational Water - Health	0.02	mg/L	
Chlorfenvinphos	water	NHMRC (2008) Recreational Water - Health	0.02	mg/L	
chloroacetic acid	water	NHMRC (2008) Recreational Water - Health	1.5	mg/L	
Chlorobenzene	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Chlorothalonil	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Chloroxuron	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Chlorpyrifos	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Chlorsulfuron	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Chromium (as Cr(VI))	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Clopyralid	water	NHMRC (2008) Recreational Water - Health	20	mg/L	
Copper	water	NHMRC (2008) Recreational Water - Health	20	mg/L	
Cyanide	water	NHMRC (2008) Recreational Water - Health	0.8	mg/L	
Cyanogen chloride (as cyanide)	water	NHMRC (2008) Recreational Water - Health	0.8	mg/L	
Cyfluthrin,Beta-cyfluthrin	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Cypermethrin isomers	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Cyprodinil	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
DDT	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Deltamethrin	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
di(2-ethylhexyl) phthalate	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Diazinon	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Dicamba	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Dichlobenil	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
dichloroacetic acid	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Dichloromethane (methylene chloride)	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Dichloroprop / Dichlorprop-P	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Dichlorvos	water	NHMRC (2008) Recreational Water - Health	0.05	mg/L	
Difenzoquat	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Diflubenzuron	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Dimethoate	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Diphenamid	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Diuron	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
EDB	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Endosulfan	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Endothal	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Epichlorohydrin	water	NHMRC (2008) Recreational Water - Health	0.005	mg/L	
EPTC	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Esfenvalerate	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Ethion	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Ethoprophos	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Ethylbenzene	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Ethylenediamine tetraacetic acid (EDTA)	water	NHMRC (2008) Recreational Water - Health	2.5	mg/L	
Etridiazole	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Fenamiphos	water	NHMRC (2008) Recreational Water - Health	0.005	mg/L	
Fenarimol	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Fenitrothion	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Fenoprop	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Fensulfothion	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Fenthion	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Fenvalerate	water	NHMRC (2008) Recreational Water - Health	0.6	mg/L	

ChemName	MatrixType	ActionLevelSource	ActionLevel	Units	Comments
Fipronil	water	NHMRC (2008) Recreational Water - Health	0.007	mg/L	
Flamprop-methyl	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Fluometuron	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Fluoride	water	NHMRC (2008) Recreational Water - Health	15	mg/L	
Flupropionate	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Formaldehyde	water	NHMRC (2008) Recreational Water - Health	5	mg/L	
Formothion	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Fosamine	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Glyphosate	water	NHMRC (2008) Recreational Water - Health	10	mg/L	
Haloxyfop	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Heptachlor	water	NHMRC (2008) Recreational Water - Health	0.003	mg/L	
Hexachlorobutadiene	water	NHMRC (2008) Recreational Water - Health	0.007	mg/L	
Hexaflurate	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Hexazinone	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Imazapyr	water	NHMRC (2008) Recreational Water - Health	90	mg/L	
Iodide	water	NHMRC (2008) Recreational Water - Health	5	mg/L	
Iprodione	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Lead	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Lindane	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Maldison (Malathion)	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Mancozeb	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Manganese	water	NHMRC (2008) Recreational Water - Health	5	mg/L	
MCPA	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Mercury	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Metaldehyde	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Metham	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Methidathion	water	NHMRC (2008) Recreational Water - Health	0.06	mg/L	
Methiocarb	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Methomyl	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Methyl bromide	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Metiram	water	NHMRC (2008) Recreational Water - Health	0.09	mg/L	
Metolachlor/s– Metolachlor	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Metribuzin	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Metsulfuron-methyl	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Mevinphos	water	NHMRC (2008) Recreational Water - Health	0.05	mg/L	
Microcystins	water	NHMRC (2008) Recreational Water - Health	13	µg/L	
Molinate	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Molybdenum	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Monochloramine	water	NHMRC (2008) Recreational Water - Health	30	mg/L	
Monocrotophos	water	NHMRC (2008) Recreational Water - Health	0.02	mg/L	
Napropamide	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Nicarbazin	water	NHMRC (2008) Recreational Water - Health	10	mg/L	
Nickel	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Nitrate (as nitrate)	water	NHMRC (2008) Recreational Water - Health	500	mg/L	
Nitrilotriacetic acid	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Nitrite (as nitrite)	water	NHMRC (2008) Recreational Water - Health	30	mg/L	
N-Nitrosodimethylamine (NDMA)	water	NHMRC (2008) Recreational Water - Health	0.001	mg/L	
Norflurazon	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Omethoate	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Oryzalin	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Oxamyl	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Paraquat	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Parathion	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Parathion-methyl	water	NHMRC (2008) Recreational Water - Health	0.007	mg/L	
Pebulate	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Pendimethalin	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Pentachlorophenol	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Permethrin	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Picloram	water	NHMRC (2008) Recreational Water - Health	3	mg/L	
Piperonyl butoxide	water	NHMRC (2008) Recreational Water - Health	6	mg/L	
Pirimicarb	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Pirimiphos methyl	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
Pirimiphos-ethyl	water	NHMRC (2008) Recreational Water - Health	0.005	mg/L	
Polihexanide	water	NHMRC (2008) Recreational Water - Health	7	mg/L	
Profenofos	water	NHMRC (2008) Recreational Water - Health	0.003	mg/L	
Propachlor	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Propanil	water	NHMRC (2008) Recreational Water - Health	7	mg/L	
Propargite	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Propazine	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Propiconazole	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Propyzamide	water	NHMRC (2008) Recreational Water - Health	0.7	mg/L	
Pyrasulfotole	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Pyrazophos	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Pyroxsulam	water	NHMRC (2008) Recreational Water - Health	40	mg/L	
Quintozene	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Selenium	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Silver	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Simazine	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Spirotetramat	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Styrene (vinylbenzene)	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Sulprofos	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Temephos	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Terbacil	water	NHMRC (2008) Recreational Water - Health	2	mg/L	
Terbufos	water	NHMRC (2008) Recreational Water - Health	0.009	mg/L	
Terbuthylazine	water	NHMRC (2008) Recreational Water - Health	0.1	mg/L	
Terbutryn	water	NHMRC (2008) Recreational Water - Health	4	mg/L	
Tetrachloroethene	water	NHMRC (2008) Recreational Water - Health	0.5	mg/L	
Tetrachlorvinphos	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Thiobencarb	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Thiometon	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Thiophanate	water	NHMRC (2008) Recreational Water - Health	0.05	mg/L	
Thiram	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Toltrazuril	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Toluene	water	NHMRC (2008) Recreational Water - Health	8	mg/L	

ChemName	MatrixType	ActionLevelSource	ActionLevel	Units	Comments
Triadimefon	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
tributyltin oxide	water	NHMRC (2008) Recreational Water - Health	0.01	mg/L	
Trichlorfon	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
trichloroacetic acid	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Trichlorobenzenes (total)	water	NHMRC (2008) Recreational Water - Health	0.3	mg/L	
Triclopyr	water	NHMRC (2008) Recreational Water - Health	0.2	mg/L	
Trifluralin	water	NHMRC (2008) Recreational Water - Health	0.9	mg/L	
Trihalomethanes (THMs) (Total)	water	NHMRC (2008) Recreational Water - Health	2.5	mg/L	
Uranium	water	NHMRC (2008) Recreational Water - Health	0.17	mg/L	
Vernolate	water	NHMRC (2008) Recreational Water - Health	0.4	mg/L	
Vinyl chloride	water	NHMRC (2008) Recreational Water - Health	0.003	mg/L	
Xylene	water	NHMRC (2008) Recreational Water - Health	6	mg/L	
Chloral hydrate (Trichloroacetaldehyde)	water	NHMRC (2008) Recreational Water - Health	1	mg/L	
Chlorite	water	NHMRC (2008) Recreational Water - Health	8	mg/L	
Dicofol	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Disulfoton	water	NHMRC (2008) Recreational Water - Health	0.04	mg/L	
Chlorine	water	NHMRC (2008) Recreational Water - Health	50	mg/L	
Diclofop-methyl	water	NHMRC (2008) Recreational Water - Health	0.05	mg/L	
Diquat	water	NHMRC (2008) Recreational Water - Health	0.07	mg/L	
Chromium	water	NEPM (1999) GIL - Marine Water	4.4	µg/L	
Mercury	water	NEPM (1999) GIL - Marine Water	0.1	µg/L	
Cadmium	water	NEPM (1999) GIL - Marine Water	0.7	µg/L	
Copper	water	NEPM (1999) GIL - Marine Water	1.3	µg/L	
Nickel	water	NEPM (1999) GIL - Marine Water	7	µg/L	
Zinc	water	NEPM (1999) GIL - Marine Water	15	µg/L	
2,4-Dichlorophenol	water	NEPM (1999) GIL - Marine Water	160	µg/L	
1,1,2-Trichloroethane	water	NEPM (1999) GIL - Marine Water	1900	µg/L	
1,2,4-Trichlorobenzene	water	NEPM (1999) GIL - Marine Water	20	µg/L	
2,4,6-Trichlorophenol	water	NEPM (1999) GIL - Marine Water	20	µg/L	
Lead	water	NEPM (1999) GIL - Marine Water	4.4	µg/L	
Phenol	water	NEPM (1999) GIL - Marine Water	400	µg/L	
2-Chlorophenol	water	NEPM (1999) GIL - Marine Water	490	µg/L	
Naphthalene	water	NEPM (1999) GIL - Marine Water	50	µg/L	
Benzene	water	NEPM (1999) GIL - Marine Water	500	µg/L	
1,1,2-Trichloroethane	water	NEPM (1999) GIL - Marine Water	6500	µg/L	
Zinc	water	NEPM (1999) GIL - Marine Water	8	µg/L	
Arsenic	water	NEPM (1999) GIL - Marine Water	2.3	µg/L	
Anthracene	water	NEPM (1999) GIL - Marine Water	0.01	µg/L	
Fluoranthene	water	NEPM (1999) GIL - Marine Water	1.4	µg/L	
Toluene	water	NEPM (1999) GIL - Marine Water	180	µg/L	
1,2-Dichloroethane	water	NEPM (1999) GIL - Marine Water	1900	µg/L	
Phenanthrene	water	NEPM (1999) GIL - Marine Water	2	µg/L	
Carbon tetrachloride	water	NEPM (1999) GIL - Marine Water	240	µg/L	
1,1-Dichloroethane	water	NEPM (1999) GIL - Marine Water	250	µg/L	
1,1,1-Trichloroethane	water	NEPM (1999) GIL - Marine Water	270	µg/L	
meta- & para-Xylene	water	NEPM (1999) GIL - Marine Water	275	µg/L	
Trichloroethene	water	NEPM (1999) GIL - Marine Water	330	µg/L	
ortho-Xylene	water	NEPM (1999) GIL - Marine Water	350	µg/L	
Chloroform	water	NEPM (1999) GIL - Marine Water	370	µg/L	
1,1,2,2-Tetrachloroethane	water	NEPM (1999) GIL - Marine Water	400	µg/L	
Dichloromethane	water	NEPM (1999) GIL - Marine Water	4000	µg/L	
Tetrachloroethene	water	NEPM (1999) GIL - Marine Water	70	µg/L	
1,1-Dichloroethene	water	NEPM (1999) GIL - Marine Water	700	µg/L	
Pentachloroethane	water	NEPM (1999) GIL - Marine Water	80	µg/L	
Benzene	water	NEPM (1999) GIL - Marine Water	950	µg/L	
Selenium	water	NEPM (1999) GIL - Marine Water	3	µg/L	
Ethylbenzene	water	NEPM (1999) GIL - Marine Water	5	µg/L	
Benzo(a)pyrene	water	NEPM (1999) GIL - Marine Water	0.2	µg/L	
Benzo(a)pyrene TEQ	water	NEPM (1999) GIL - Marine Water	0.2	µg/L	
Benzene	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
Ethylbenzene	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
Naphthalene	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
Toluene	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
TRH >C10-C16 excluding naphthalene (F2)	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
TRH C6 - C10 excluding BTEX (F1)	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
Xylene Total	water	CRC Care (2011) Intrusive Maint. Worker - Sar	NL	µg/L	
Ammonia	water	ANZG (2018) TV - Marine water (95%)	910	µg/L	Moderate Reliability
Cadmium	water	ANZG (2018) TV - Marine water (95%)	5.5	µg/L	High Reliability
Chlorpyrifos	water	ANZG (2018) TV - Marine water (95%)	0.009	µg/L	Low Reliability
Chromium (CrVI)	water	ANZG (2018) TV - Marine water (95%)	4.4	µg/L	Very high Reliability
Cobalt	water	ANZG (2018) TV - Marine water (95%)	1	µg/L	High Reliability
Endosulfan	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Moderate Reliability
Endrin	water	ANZG (2018) TV - Marine water (95%)	0.008	µg/L	Moderate Reliability
Lead	water	ANZG (2018) TV - Marine water (95%)	4.4	µg/L	Low Reliability
Mercury (inorganic)	water	ANZG (2018) TV - Marine water (95%)	0.4	µg/L	Very high Reliability
Naphthalene	water	ANZG (2018) TV - Marine water (95%)	70	µg/L	Moderate Reliability
Nickel	water	ANZG (2018) TV - Marine water (95%)	70	µg/L	High Reliability
Phenol	water	ANZG (2018) TV - Marine water (95%)	400	µg/L	Low Reliability
Silver	water	ANZG (2018) TV - Marine water (95%)	1.4	µg/L	Moderate Reliability
Zinc	water	ANZG (2018) TV - Marine water (95%)	15	µg/L	Very high Reliability
1,1,1-Trichloroethane	water	ANZG (2018) TV - Marine water (95%)	270	µg/L	Unknown level of species protection; Unknown Reliability
1,1,2,2-Tetrachloroethylene	water	ANZG (2018) TV - Marine water (95%)	70	µg/L	Unknown level of species protection; Unknown Reliability
1,1,2-Trichloroethylene	water	ANZG (2018) TV - Marine water (95%)	330	µg/L	Unknown level of species protection; Unknown Reliability
1,2,3,4-Tetrachlorobenzene	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
1,2,3,5-Tetrachlorobenzene	water	ANZG (2018) TV - Marine water (95%)	3	µg/L	Unknown level of species protection; Unknown Reliability
1,2,3-Trichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	3	µg/L	Unknown level of species protection; Unknown Reliability
1,2,4,5-Tetrachlorobenzene	water	ANZG (2018) TV - Marine water (95%)	5	µg/L	Unknown level of species protection; Unknown Reliability
1,2-Dichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	160	µg/L	Unknown level of species protection; Unknown Reliability
1,2-Dichloroethane	water	ANZG (2018) TV - Marine water (95%)	1900	µg/L	Unknown level of species protection; Unknown Reliability
1,2-Dinitrobenzene	water	ANZG (2018) TV - Marine water (95%)	0.6	µg/L	Unknown level of species protection; Unknown Reliability
1,3,5-Trichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	8	µg/L	Unknown level of species protection; Unknown Reliability
1,3-Dichloropropane	water	ANZG (2018) TV - Marine water (95%)	1100	µg/L	Unknown level of species protection; Unknown Reliability
1,3-Dichloropropene	water	ANZG (2018) TV - Marine water (95%)	0.8	µg/L	Unknown level of species protection; Unknown Reliability
1,3-Dinitrobenzene	water	ANZG (2018) TV - Marine water (95%)	13	µg/L	Unknown level of species protection; Unknown Reliability

ChemName	MatrixType	ActionLevelSource	ActionLevel	Units	Comments
1,4-Dichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	60	µg/L	Unknown level of species protection; Unknown Reliability
1-Chloro-2-nitrobenzene	water	ANZG (2018) TV - Marine water (95%)	15	µg/L	Unknown level of species protection; Unknown Reliability
1-Chloro-3-nitrobenzene	water	ANZG (2018) TV - Marine water (95%)	12	µg/L	Unknown level of species protection; Unknown Reliability
1-Chloro-4-nitrobenzene	water	ANZG (2018) TV - Marine water (95%)	1	µg/L	Unknown level of species protection; Unknown Reliability
1-Chloronaphthalene	water	ANZG (2018) TV - Marine water (95%)	0.7	µg/L	Unknown level of species protection; Unknown Reliability
2,3,4,5-Tetrachlorophenol	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
2,3,4,6-Tetrachlorophenol	water	ANZG (2018) TV - Marine water (95%)	10	µg/L	Unknown level of species protection; Unknown Reliability
2,3,4-Trichlorophenol	water	ANZG (2018) TV - Marine water (95%)	4	µg/L	Unknown level of species protection; Unknown Reliability
2,3,5,6-Tetrachlorophenol	water	ANZG (2018) TV - Marine water (95%)	1.4	µg/L	Unknown level of species protection; Unknown Reliability
2,3,5-Trichlorophenol	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
2,3,6-Trichlorophenol	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
2,4,5-Trichlorophenol	water	ANZG (2018) TV - Marine water (95%)	4	µg/L	Unknown level of species protection; Unknown Reliability
2,4-Dichloroaniline	water	ANZG (2018) TV - Marine water (95%)	7	µg/L	Unknown level of species protection; Unknown Reliability
2,4-Dichlorophenol	water	ANZG (2018) TV - Marine water (95%)	120	µg/L	Unknown level of species protection; Unknown Reliability
2,4-Dimethylphenol	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
2,4-Dinitrophenol	water	ANZG (2018) TV - Marine water (95%)	45	µg/L	Unknown level of species protection; Unknown Reliability
2,4-Dinitrotoluene	water	ANZG (2018) TV - Marine water (95%)	16	µg/L	Unknown level of species protection; Unknown Reliability
2,5-Dichlorophenol	water	ANZG (2018) TV - Marine water (95%)	3	µg/L	Unknown level of species protection; Unknown Reliability
2,6-Dichlorophenol	water	ANZG (2018) TV - Marine water (95%)	34	µg/L	Unknown level of species protection; Unknown Reliability
2-Chlorophenol	water	ANZG (2018) TV - Marine water (95%)	340	µg/L	Unknown level of species protection; Unknown Reliability
2-Nitrophenol	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
2-Nitrotoluene	water	ANZG (2018) TV - Marine water (95%)	110	µg/L	Unknown level of species protection; Unknown Reliability
4-Nitrophenol	water	ANZG (2018) TV - Marine water (95%)	58	µg/L	Unknown level of species protection; Unknown Reliability
4-Nitrotoluene	water	ANZG (2018) TV - Marine water (95%)	120	µg/L	Unknown level of species protection; Unknown Reliability
Acetonitrile	water	ANZG (2018) TV - Marine water (95%)	160	µg/L	Unknown level of species protection; Unknown Reliability
Acrylonitrile	water	ANZG (2018) TV - Marine water (95%)	8	µg/L	Unknown level of species protection; Unknown Reliability
Aldrin	water	ANZG (2018) TV - Marine water (95%)	0.003	µg/L	Unknown level of species protection; Unknown Reliability
Amitrole	water	ANZG (2018) TV - Marine water (95%)	22	µg/L	Unknown level of species protection; Unknown Reliability
Aniline	water	ANZG (2018) TV - Marine water (95%)	8	µg/L	Unknown level of species protection; Unknown Reliability
Anthracene	water	ANZG (2018) TV - Marine water (95%)	0.1	µg/L	Unknown level of species protection; Unknown Reliability
Antimony	water	ANZG (2018) TV - Marine water (95%)	270	µg/L	Unknown level of species protection; Unknown Reliability
Aroclor 1242	water	ANZG (2018) TV - Marine water (95%)	0.3	µg/L	Unknown level of species protection; Unknown Reliability
Aroclor 1254	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Unknown level of species protection; Unknown Reliability
Atrazine	water	ANZG (2018) TV - Marine water (95%)	13	µg/L	Unknown level of species protection; Unknown Reliability
Azinphos methyl	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Unknown level of species protection; Unknown Reliability
Benzo(a)pyrene	water	ANZG (2018) TV - Marine water (95%)	0.1	µg/L	Unknown level of species protection; Unknown Reliability
Bromacil	water	ANZG (2018) TV - Marine water (95%)	180	µg/L	Unknown level of species protection; Unknown Reliability
Carbofuran	water	ANZG (2018) TV - Marine water (95%)	0.06	µg/L	Unknown level of species protection; Unknown Reliability
Carbon disulfide	water	ANZG (2018) TV - Marine water (95%)	20	µg/L	Unknown level of species protection; Unknown Reliability
Carbon tetrachloride	water	ANZG (2018) TV - Marine water (95%)	240	µg/L	Unknown level of species protection; Unknown Reliability
Chlordane	water	ANZG (2018) TV - Marine water (95%)	0.001	µg/L	Unknown level of species protection; Unknown Reliability
Chloroethylene	water	ANZG (2018) TV - Marine water (95%)	100	µg/L	Unknown level of species protection; Unknown Reliability
Chloroform	water	ANZG (2018) TV - Marine water (95%)	370	µg/L	Unknown level of species protection; Unknown Reliability
Cumene (isopropylbenzene)	water	ANZG (2018) TV - Marine water (95%)	30	µg/L	Unknown level of species protection; Unknown Reliability
DDE	water	ANZG (2018) TV - Marine water (95%)	0.0005	µg/L	Unknown level of species protection; Unknown Reliability
DDT	water	ANZG (2018) TV - Marine water (95%)	0.0004	µg/L	Unknown level of species protection; Unknown Reliability
Deltamethrin	water	ANZG (2018) TV - Marine water (95%)	0.0001	µg/L	Unknown level of species protection; Unknown Reliability
Demeton-S	water	ANZG (2018) TV - Marine water (95%)	0.3	µg/L	Unknown level of species protection; Unknown Reliability
Demeton-S-methyl	water	ANZG (2018) TV - Marine water (95%)	4	µg/L	Unknown level of species protection; Unknown Reliability
Di(2-ethylhexyl)phthalate	water	ANZG (2018) TV - Marine water (95%)	1	µg/L	Unknown level of species protection; Unknown Reliability
Diazinon	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Unknown level of species protection; Unknown Reliability
Dichloromethane	water	ANZG (2018) TV - Marine water (95%)	4000	µg/L	Unknown level of species protection; Unknown Reliability
Dicofol	water	ANZG (2018) TV - Marine water (95%)	0.1	µg/L	Unknown level of species protection; Unknown Reliability
Dieldrin	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Unknown level of species protection; Unknown Reliability
Dimethoate	water	ANZG (2018) TV - Marine water (95%)	0.15	µg/L	Unknown level of species protection; Unknown Reliability
Dimethylformamide	water	ANZG (2018) TV - Marine water (95%)	1000	µg/L	Unknown level of species protection; Unknown Reliability
Diphenylnitrosamine	water	ANZG (2018) TV - Marine water (95%)	6	µg/L	Unknown level of species protection; Unknown Reliability
Diquat	water	ANZG (2018) TV - Marine water (95%)	1.4	µg/L	Unknown level of species protection; Unknown Reliability
Diuron	water	ANZG (2018) TV - Marine water (95%)	1.8	µg/L	Unknown level of species protection; Unknown Reliability
Esfenvalerate	water	ANZG (2018) TV - Marine water (95%)	0.001	µg/L	Unknown level of species protection; Unknown Reliability
Ethanol	water	ANZG (2018) TV - Marine water (95%)	1400	µg/L	Unknown level of species protection; Unknown Reliability
Ethylbenzene	water	ANZG (2018) TV - Marine water (95%)	5	µg/L	Unknown level of species protection; Unknown Reliability
Ethylene glycol	water	ANZG (2018) TV - Marine water (95%)	50000	µg/L	Unknown level of species protection; Unknown Reliability
Fenitrothion	water	ANZG (2018) TV - Marine water (95%)	0.001	µg/L	Unknown level of species protection; Unknown Reliability
Fluoranthene	water	ANZG (2018) TV - Marine water (95%)	1	µg/L	Unknown level of species protection; Unknown Reliability
Heptachlor	water	ANZG (2018) TV - Marine water (95%)	0.0004	µg/L	Unknown level of species protection; Unknown Reliability
Hexachlorobenzene	water	ANZG (2018) TV - Marine water (95%)	0.05	µg/L	Unknown level of species protection; Unknown Reliability
Hexachlorocyclopentadiene	water	ANZG (2018) TV - Marine water (95%)	0.05	µg/L	Unknown level of species protection; Unknown Reliability
Hexachloroethane	water	ANZG (2018) TV - Marine water (95%)	290	µg/L	Unknown level of species protection; Unknown Reliability
Isophorone	water	ANZG (2018) TV - Marine water (95%)	130	µg/L	Unknown level of species protection; Unknown Reliability
Lindane	water	ANZG (2018) TV - Marine water (95%)	0.007	µg/L	Unknown level of species protection; Unknown Reliability
Malathion	water	ANZG (2018) TV - Marine water (95%)	0.05	µg/L	Unknown level of species protection; Unknown Reliability
Manganese	water	ANZG (2018) TV - Marine water (95%)	80	µg/L	Unknown level of species protection; Unknown Reliability
MCPA	water	ANZG (2018) TV - Marine water (95%)	1.4	µg/L	Unknown level of species protection; Unknown Reliability
Methomyl	water	ANZG (2018) TV - Marine water (95%)	3.5	µg/L	Unknown level of species protection; Unknown Reliability
Methoxychlor	water	ANZG (2018) TV - Marine water (95%)	0.004	µg/L	Unknown level of species protection; Unknown Reliability
Mirex	water	ANZG (2018) TV - Marine water (95%)	0.04	µg/L	Unknown level of species protection; Unknown Reliability
Molinate	water	ANZG (2018) TV - Marine water (95%)	3.4	µg/L	Unknown level of species protection; Unknown Reliability
Monochlorobenzene	water	ANZG (2018) TV - Marine water (95%)	55	µg/L	Unknown level of species protection; Unknown Reliability
m-Xylene	water	ANZG (2018) TV - Marine water (95%)	75	µg/L	Unknown level of species protection; Unknown Reliability
Nitrobenzene	water	ANZG (2018) TV - Marine water (95%)	550	µg/L	Unknown level of species protection; Unknown Reliability
o-Xylene	water	ANZG (2018) TV - Marine water (95%)	350	µg/L	Unknown level of species protection; Unknown Reliability
Paraquat	water	ANZG (2018) TV - Marine water (95%)	0.5	µg/L	Unknown level of species protection; Unknown Reliability
Parathion	water	ANZG (2018) TV - Marine water (95%)	0.004	µg/L	Unknown level of species protection; Unknown Reliability
Pentachlorobenzene	water	ANZG (2018) TV - Marine water (95%)	1.5	µg/L	Unknown level of species protection; Unknown Reliability
Pentachloroethane	water	ANZG (2018) TV - Marine water (95%)	80	µg/L	Unknown level of species protection; Unknown Reliability
Phenanthrene	water	ANZG (2018) TV - Marine water (95%)	0.6	µg/L	Unknown level of species protection; Unknown Reliability
Profenofos	water	ANZG (2018) TV - Marine water (95%)	0.002	µg/L	Unknown level of species protection; Unknown Reliability
p-Xylene	water	ANZG (2018) TV - Marine water (95%)	200	µg/L	Unknown level of species protection; Unknown Reliability
Tebuthiuron	water	ANZG (2018) TV - Marine water (95%)	2.2	µg/L	Unknown level of species protection; Unknown Reliability
Thallium	water	ANZG (2018) TV - Marine water (95%)	17	µg/L	Unknown level of species protection; Unknown Reliability
Thiobencarb	water	ANZG (2018) TV - Marine water (95%)	2.8	µg/L	Unknown level of species protection; Unknown Reliability
Thiram	water	ANZG (2018) TV - Marine water (95%)	0.01	µg/L	Unknown level of species protection; Unknown Reliability
Toluene	water	ANZG (2018) TV - Marine water (95%)	180	µg/L	Unknown level of species protection; Unknown Reliability

ChemName	MatrixType	ActionLevelSource	ActionLevel	Units	Comments
Toxaphene	water	ANZG (2018) TV - Marine water (95%)	0.0006	µg/L	Unknown level of species protection; Unknown Reliability
Xylene (m & p)	water	ANZG (2018) TV - Marine water (95%)	275	µg/L	Unknown level of species protection; Unknown Reliability
1,1,2-Trichloroethane	water	ANZG (2018) TV - Marine water (95%)	1900	µg/L	Very Low Reliability
1,2,4-Trichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	80	µg/L	Moderate Reliability
3,4-Dichloroaniline	water	ANZG (2018) TV - Marine water (95%)	150	µg/L	Low Reliability
Benzene	water	ANZG (2018) TV - Marine water (95%)	700	µg/L	Moderate Reliability
Chromium (CrIII)	water	ANZG (2018) TV - Marine water (95%)	27.4	µg/L	Low Reliability
Copper	water	ANZG (2018) TV - Marine water (95%)	1.3	µg/L	Very high Reliability
Cyanide	water	ANZG (2018) TV - Marine water (95%)	4	µg/L	Very Low Reliability
Pentachlorophenol	water	ANZG (2018) TV - Marine water (95%)	22	µg/L	
Poly(acrylonitrile-co-butadiene-co-styrene)	water	ANZG (2018) TV - Marine water (95%)	250	µg/L	Low Reliability
Temephos	water	ANZG (2018) TV - Marine water (95%)	0.05	µg/L	Moderate Reliability
Tributyltin (as µg Sn/L)	water	ANZG (2018) TV - Marine water (95%)	0.006	µg/L	High Reliability
Vanadium	water	ANZG (2018) TV - Marine water (95%)	100	µg/L	High Reliability
1,1-Dichloroethylene	water	ANZG (2018) TV - Marine water (95%)	700	µg/L	Unknown level of species protection; Unknown Reliability
1,2-Dichloropropane	water	ANZG (2018) TV - Marine water (95%)	900	µg/L	Unknown level of species protection; Unknown Reliability
1,2-Diphenylhydrazine	water	ANZG (2018) TV - Marine water (95%)	2	µg/L	Unknown level of species protection; Unknown Reliability
1,3,5-Trinitrobenzene	water	ANZG (2018) TV - Marine water (95%)	4	µg/L	Unknown level of species protection; Unknown Reliability
1,3-Dichlorobenzene	water	ANZG (2018) TV - Marine water (95%)	260	µg/L	Unknown level of species protection; Unknown Reliability
1,4-Dinitrobenzene	water	ANZG (2018) TV - Marine water (95%)	0.6	µg/L	Unknown level of species protection; Unknown Reliability
2,3-Dichlorophenol	water	ANZG (2018) TV - Marine water (95%)	31	µg/L	Unknown level of species protection; Unknown Reliability
2,4,5-T	water	ANZG (2018) TV - Marine water (95%)	36	µg/L	Unknown level of species protection; Unknown Reliability
2,4,6-Trichlorophenol	water	ANZG (2018) TV - Marine water (95%)	3	µg/L	Unknown level of species protection; Unknown Reliability
2,4,6-Trinitrotoluene	water	ANZG (2018) TV - Marine water (95%)	140	µg/L	Unknown level of species protection; Unknown Reliability
3-Chloropropene	water	ANZG (2018) TV - Marine water (95%)	3	µg/L	Unknown level of species protection; Unknown Reliability
3-Nitrotoluene	water	ANZG (2018) TV - Marine water (95%)	75	µg/L	Unknown level of species protection; Unknown Reliability
4-Chlorophenol	water	ANZG (2018) TV - Marine water (95%)	220	µg/L	Unknown level of species protection; Unknown Reliability

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APPENDIX F GROUND GAS MONITORING PROGRAM

Post Remediation Ground Gas Monitoring Plan

Clyde Western Area Remediation Project – Proposed Lot 64

PREPARED FOR
Viva Energy Pty Ltd

DATE
7 May 2024

REFERENCE
0561882

DOCUMENT DETAILS

DOCUMENT TITLE	Post Remediation Ground Gas Monitoring Plan
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SIGNATURE PAGE

Post Remediation Ground Gas Monitoring Plan

Clyde Western Area Remediation Project – Proposed Lot 64

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CONTENTS

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

Acronyms	Description
ACM	Asbestos Containing Material
AEC-4	Area of Environmental Concern 4
Ave	Average
BOM	Bureau of Meteorology
BTEXN	Benzene, toluene, ethylbenzene, xylene and naphthalene
Costin Roe	Costin Roe Consulting
CS	Characteristic Situation
CSM	Conceptual Site Model
EPS	EnviroPacific Services
ERM	Environmental Resources Management Australia Pty Ltd
ESA	Environmental Site Assessment
GGMP	Ground Gas Monitoring Plan
GSV	Gas Screening Values
Ha	Hectare
LLDPE	Linear low density polyethylene
LNAPL	Light, non-aqueous phase liquid
LTEMP	Long-term Environmental Management Plan
m BGL	Metres below ground level
Max	Maximum
Min	Minimum
NSW EPA	New South Wales Environmental Protection Agency
PAH	Polycyclic aromatic hydrocarbons
PFAS	Per- and poly- fluoroalkyl substances
QAQC	Quality assurance and quality control
RAP	Remedial Action Plan
SPR	Source-pathway-receptor
SSTLs	Site Specific Target Levels
Stage 2 RAP	ERM (2021a) *Stage 2 Detailed Remediation Action Plan*. Clyde Western Area Remediation Project
SVOC	Semi-volatile organic compounds
TRH	Total recoverable hydrocarbons
Viva Energy	Viva Energy Australia Pty Ltd
WARP	Western Area Remediation Project

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Viva Energy Australia Pty Ltd (Viva Energy) to prepare this Ground Gas Monitoring Plan (GGMP) for a portion of the Clyde Western Area, referred to as 'Proposed Lot 64' to outline the required ongoing gas monitoring requirements as described in the Long Term Environmental Management Plan (LTEMP) for Proposed Lot 64 (ERM, 2024[1]).

Proposed Lot 64 is proposed subdivision of the former under State Significant Development (SSD-10459), and forms a portion of the the 'Stage 2 Area' of the Clyde Western Area Remediation Project (WARP) (SSD-9302). The site location of the WARP, Proposed Lot 64 and Proposed Lot 64 is presented as *Figure 1, Appendix A.*

The extent of Proposed Lot 64 subject this monitoring plan is shown on *Figure 2, Appendix A.* The extent is defined by the boundaries of those parts of Lot 1, DP1271927 forming Proposed Lot 64, as authorised for subdivision under State Significant Development Consent 10459.
Background

The LTEMP for Proposed Lot 64 describes the requirement for monthly gas monitoring of Proposed Lot 64 for a period of six months, post-remediation of the area by encapsulation. The purpose of the ongoing monitoring is to verify the stability of ground gases and efficacy of the constructed capping surface at Proposed Lot 64 in mitigating the vertical and lateral migration of hazardous ground gases within Proposed Lot 64.

1.1 OBJECTIVES

The purpose of this monitoring plan are to provide an appropriate monitoring program and management controls for Proposed Lot 64, post-remediation by encapsulation of AEC-4.

The objectives of this monitoring plan are to:

- Provide monitoring and controls for the ongoing management of Proposed Lot 64 to identify migration of associated ground gases of the buried waste area to other on-site areas;
- Verify assumption that there is no additional ongoing gas accumulation potential within enclosed spaces within the capped extent; and
- Provide action requirements for exceedances of criteria and trigger levels of ground gases, if identified.

1.2 MONITORING SCOPE

The scope of monitoring is based on assessment of existing historical dataset obtained from within Proposed Lot 64, the requirements of the New South Wales Environmental Protection Agency (NSW EPA) (2016) *Solid Waste Landfills* guidelines, and the monitoring requirements specified in the LTEMP (ERM, 2024). The scope includes:

- Monitoring of sub-surface gas in the perimeter gas monitoring wells;
- Monitoring of sub-surface gas within identified enclosed structures installed above the capping liner (stormwater pits); and
- Monitoring of surface gas emissions from the capped surface and immediate surrounding areas.

[1] ERM (2024a) *Proposed Lot 64 – Long Term Environmental Management Plan, Clyde Western Area Remediation Project.* Preliminary Draft 21 March 2024.

2. SITE OVERVIEW

2.1 SITE DETAILS

The Site is located at Devon Street, Rosehill NSW as shown on *Figure 1, Appendix A.* Site details have been included in *Table 2-1* below. The site is suitable for commercial / industrial land uses, however infrastructure for occupation (without appropriate mitigations), basement structures or beneficial re-use of groundwater is precluded following remediation works. The environmental setting of Proposed Lot 64 has been detailed in the Supplementary Environmental Site Assessment Further details are provided within the LTEMP.

2.2 OVERVIEW OF REMEDIATION (2023 – 2024)

Remediation of Proposed Lot 64 took place between 2023 to 2024. Proposed Lot 64 has been subject to remediation activities as prescribed in the Stage 2 RAP, which involved *in-situ* management of residual soil contamination under an engineered capping. Details of the design and engineering and construction of the cap is detailed in the Proposed Lot 64 – AEC-4 Capping Construction Technical Specification (ERM 2024b). Remediation activities were conducted between December 2023 and May 2024, and included the following scope of works:

- Decommissioning of monitoring wells;
- Vegetation clearing and grubbing;
- Landforming and surface grading;
- Subgrade preparation;
- Excavation of shared anchor / service trenches;
- Installation of cushion geotextile;
- Installation of linear low-density polyethylene (LLDPE) geomembrane;
- Installation of a marker layer; and
- Laying of covering material and finishing with asphalt.

2.2.1 REFINED CONCEPTUAL SITE MODEL SUMMARY

The Refined Conceptual Site Model (CSM), provided in *Table 2-1* below, has been further refined to reflect the risks associated with the current nature of Proposed Lot 64, post-remediation.

Due to the nature and extent of contaminants of concern identified in AEC-4 and the chosen remediation option (in-situ management under engineered cap), the post-remediation use of the land will be a concrete slab predominantly used for outdoor storage under commercial / industrial land-use. It is noted that at this stage, no enclosed buildings exist or are proposed within Proposed Lot 64. However, should any future buildings be proposed, the design must include appropriate management controls and measures assessed consistent with the *Hazardous Ground Gas Guidelines*[2]*.*

[2] NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases*. May 2020.

TABLE 2-1 REFINED CONCEPTUAL SITE MODEL – AEC-4

Residual Contamination Contained within the Capped Extent	Potentially Complete SPR Linkages Without LTEMP Controls	
	Human Health	**Ecological**
SOIL • LNAPL - visual evidence of free-phase petroleum hydrocarbons in unsaturated soils, • TRH C_{10}-C_{34}, • Benzene, • Asbestos (ACM and fibres within fill), • Metals (hexavalent chromium), • Carcinogenic PAHs, • PFAS. GROUNDWATER • LNAPL (contained within AEC-4). GROUND GASES • Methane	SOIL No potentially complete SPR linkages through soil contamination were identified for on-site commercial/industrial or intrusive maintenance workers following completion of remediation. GROUNDWATER No potentially complete SPR linkages were identified for on-site or off-site human health receptors via groundwater under the current and proposed commercial/industrial land-use. GROUND GASES A detailed assessment of ground gas in relation to AEC-4 is summarised as follows: • There are no identified potential exposure pathways for receptors, given a well-ventilated open-air environment (i.e. no buildings, service trenches and pits within the entirety of Proposed Lot 64). • The presence of buildings and sub-surface structures and confined spaces are precluded within the remediated Proposed Lot 64. The preclusion of buildings and sub-surface structures within this area mitigates potential risks associated with confined spaces (i.e. asphyxiation from carbon dioxide rich, oxygen depleted atmospheres or generation of hazardous/flammable atmospheres). • Given the presence of the Duck River downgradient (south) and drainage infrastructure located to the west and south o the capped area, lateral migration of bulk ground gases is considered unlikely. Existing drainage infrastructure provide a barrier between Proposed Lot 64 to off-site receptors through restriction of flow and pore space below the ground surface.	No potentially complete SPR linkages to ecological receptors identified (limited to offsite - Duck River), noting the below incomplete exposure pathways for exceedances of offsite groundwater criterion: • Concentrations of PAHs exceeding ecological criteria in groundwater have been delineated to the boundary of Proposed Lot 64 • Concentrations of PFAS (including PFOS) exceeding ecological direct toxicity criteria in downgradient wells from AEC-4 are considered consistent with the magnitude of concentrations assessed via mass flux estimates of groundwater at the site boundary for other areas of Stage 2 (ERM 2018). Previous assessments have concluded: ∘ potential direct toxicity risks to offsite receptors were unlikely considering low mass contribution and overall volume of receiving water body. ∘ Indirect human exposure via consumption of PFAS containing seafood is unlikely given existing fishing bans. ∘ Offsite assessment of bioaccumulative effects of PFAS in waterways are unlikely to provide meaningful input into site-based PFAS management given magnitude of other offsite contributions to these systems.

3. GROUND GAS MONITORING PLAN

The ongoing GGMP, post-remediation of Proposed Lot 64, is detailed in the following sub-sections. The monitoring plan has been summarised for ease interpretation and use as *Appendix B.*

3.1 DATA QUALITY OBJECTIVES

Required Information	Requirements
Step 1: State the problem	**Define the problem:** Collection of appropriate gas monitoring data is required to evaluate the effectiveness of the engineered capping layer, and to verify that gas accumulation is not occurring at a level that may pose risks to commercial/industrial receptor in and around the capping layer. The GGMP is required to: • include trigger levels for assessing the efficacy of the engineered capping layer; • monitor for potential adverse impacts of vertical migration of hazardous ground gasses in Lot 64; • outline contingency actions to be implemented if monitoring indicates that ground gas accumulation and/or migration is occurring; • outline contingency actions for reducing risks; and • document procedures for reporting changes to gas conditions that have the potential to create unacceptable risks to commercial/industrial receptors. AEC-4 is considered to be remediated by the construction of an engineered cap, and implementation of the LTEMP. The LTEMP describes the requirement for ongoing monthly monitoring of gas at Proposed Lot 64 for a period of six months, in order to identify any risk of gas migration and accumulation beneath the capped area. This GGMP has been prepared to demonstrate the efficacy of the remedial strategy i.e. the engineered cap remedial per the requirements of the LTEMP.
	Identify the project team: The project team related to the monitoring plan consist of the landowners of Proposed Lot 64 (Viva Energy), the Validation Consultant (ERM), and the Site Auditor (Andrew Kohlrusch, GHD).
Step 2: Identify the decision/goal of the study	**Goal of the study:** The objectives of this GGMP are to provide an appropriate monitoring program and controls for Proposed Lot 64 in order to satisfy the LTEMP and generate data for an assessment of the efficacy of the engineered cap construction.
	Primary study question(s): • Has any migrating or accumulating gas within Proposed Lot 64 been identified? • Is an assessment of the efficacy of the engineered cap construction required?
Step 3: Identify the information inputs	**Information inputs:** Monthly collection of gas monitoring data for a period of six months, consisting of: • Sub-surface gas accumulation monitoring of 12 monitoring well locations situated around the perimeter of the capped area; • Sub-surface gas accumulation monitoring of three stormwater pit locations; and • Surface gas emissions survey (25m grid) of the surface of Proposed Lot 64. The sampling locations described above are presented in *Figure 3, Appendix A*.
Step 4: Define the boundaries of the study	**Study area:** The study area is approximately 2.35 ha in size. The extent of AEC-4, within Proposed Lot 64 is defined in *Section 2* of this plan and presented as *Figure 2, Appendix A.*
	Temporal limits: The monitoring plan will collect data for a period of six months, upon the completion of the remediation and validation works in May 2024. The requirement for further monitoring will be assessed in consultation with the Site Auditor beyond the 6 month period.

Required Information	Requirements
Step 5: Develop the analytical approach	The monitoring plan approach for the project is outlined within *Section 4* of this plan and summarised below. Monitoring will consist of; • Sub-surface gas monitoring using a GA5000 gas analyser, for monitoring of methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide and flow rate. • Surface gas monitoring using a portable methane laser detector, for monitoring methane. • Sub-surface gas accumulation monitoring of three stormwater pit locations using a GA5000 gas analyser, for monitoring of methane, carbon dioxide, oxygen, carbon monoxide, hydrogen sulphide and flow rate. Weather condition requirements for gas monitoring are outlined within *Section 4.1* of this plan.
Step 6: Specify performance or acceptance criteria	The LTEMP describes the requirement for ongoing monthly monitoring of gas at Proposed Lot 64 for a period of six months, in order to identify any risk of gas migration and accumulation on the surface of, beneath and in enclosed spaces of the capped area at Lot 64. If monthly monitoring during a six monthly period demonstrates a lack of exceedances of trigger levels, monitoring of ground gasses as described within this GGMP should be undertaken on a six-monthly basis. The action requirements for exceedances of compliance criteria for sub-surface gas monitoring, enclosed structure gas monitoring and surface emissions monitoring are presented in *Section 6* of this GGMP. Exceedances of trigger levels for methane require notification to the NSW EPA, while an exceedance of adopted trigger levels for carbon dioxide require investigation and corrective action to be undertaken by the occupier. Additional to notification to the NSW EPA, exceedances of compliance criterion will initiate an assessment of the efficacy of the installed cap over Proposed Lot 64, and re-evaluation of the LTEMP (ERM, 2024a) per *Section 5* of this GGMP. **Data quality assessment:** The method for ensuring the quality assurance and quality control (QAQC) of collected data is defined in *Section 3.4* of this plan. QAQC for the monitoring plan is limited to: • Ensuring the monitoring equipment is calibrated, zeroed and fit for use prior to monitoring; • Ensuring field staff are well trained and qualified for use of scientific equipment; • Ensuring satisfactory field note collection procedures are adhered to.
Step 7: Develop the plan for obtaining data	The DQOs have been developed based on review of existing data, the selected remedial strategy and discussions with Viva Energy and the Site Auditor.

3.2 MONITORING LOCATIONS

The current available monitoring locations at Proposed Lot 64 comprises (refer to *Figure 3, Appendix A)*:

- Twelve perimeter sub-surface gas monitoring wells outs the encapsulated area;
- Three enclosed structures in the form of stormwater pits (ES01 to ES03); and
- A 25 m grid survey of the capped surface area, including a 25 m buffer from the encapsulated perimeter.

Well construction details for the sub-surface gas monitoring wells are included as *Appendix C.*

3.3 GROUND GAS MONITORING PROGRAM

A summary of the GGMP is presented in *Table 3-1* below. The full monitoring plan including analytes and reporting limits is included in *Appendix B.*

TABLE 3-1 GROUND GAS MONITORING PLAN

Type of monitoring	Frequency	Description	Proposed Monitoring Locations	Appendix B Reference
Subsurface gas	Monthly (total of six months)	• Leak test; • Measurement of gas concentrations, pressure and flow within the well; and • Standing water level measurement.	MW12/20, MW20/08, MW20/09, MW20/10, MW20/11, MW20/12, MW20/14, MW20/15, MW20/16, MW20/17, MW20/18, and MW20/20. Refer to *Figure 3, Appendix A.*	C-1
Enclosed structures	Monthly (total of six months)	• Measurement of gas concentrations in enclosed structures.	ES01, ES02, and ES03. Refer to *Figure 3, Appendix A*	C-2
Surface gas emissions	Monthly (total of six months)	• Measure gas concentration 50 mm above capped surface on a 25 m grid, and within a 25 m buffer from the encapsulated perimeter. Measurements should target the corner of each 25 m grid.	25 m grid survey. Refer to *Figure 3, Appendix A*.	C-3

3.4 FIELD QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality Assurance and Quality Control (QAQC) actions relevant to GGMP are limited to the calibration of field equipment by a certified equipment specialist prior to monitoring events, and daily in-field calibration by bump and fresh air testing directly prior to monitoring. Additionally, weather condition requirements for surface gas emissions monitoring are detailed below in *Section 4.1.*

4. MONITORING METHODOLOGY

The required methodologies for conducting monitoring of Proposed Lot 64 are summarised below.

4.1 WEATHER CONDITIONS

The Bureau of Meterology (BOM) weather data for the nearest weather station (Sydney Olympic Park Weather Station, Station 066212) should be checked prior to the site visit to ensure conditions are appropriate for monitoring.

The following weather parameters shall be recorded and included in the report for each monitoring event:

- Wind speed (average and maximum (max)) on the days of the monitoring event;
- Temperature (max and minimum (min)) on the days of the monitoring event;
- Atmospheric pressure (max and min) on the days of the monitoring event; and
- Rainfall (daily average) on the days of the monitoring event and five days prior to the event.

Surface emissions monitoring requires low wind speeds (<10 km/hr) and stable pressure (<101.3 kPa) and is preferably conducted in dry conditions, as saturated soils impede gas flow and clay swelling would reduce the width of an cracks beneath the capped area.

Where possible, sampling events should be targeted on days of stable pressure or falling pressure.

4.2 SUBSURFACE GAS MONITORING

All sub-surface gas monitoring in wells will be conducted using a suitable hand-held landfill gas monitoring instrument, such as a GA5000. The instrument must be capable of providing the measurements and meeting the detection limits that are specified in *Appendix B-1.* Sub-surface gas monitoring shall include the following methodology:

- Landfill gas analyser is to be connected to the well, gas tap opened and analytes as per *Appendix B-1* are to be recorded, with gas readings to be taken after the pump has purged for 60 seconds, then has sampled for 60 seconds to allow gas readings to stabilise;
- Following disconnection of the monitoring instrument, standing water level in the well is to be measured and recorded using an oil-water interface probe. The measurement required is depth to water, relative to the top of the well casing (elevation provided in *Appendix C*).

A proposed field form for documenting the gas monitoring is attached as *Appendix D.*

4.3 ENCLOSED STRUCTURES GAS ACCUMULATION MONITORING

Enclosed structures at Proposed Lot 64 are limited to three stormwater pits, labelled ES01, ES02 and ES03. The pits are connected and are part of a drainage system which collects run off from Proposed Lot 64 and wider WARP.

A GA5000 or equivalent landfill gas analyser will be used for measurements of the enclosed structures (specification as per *Appendix B-2*). Tubing from the landfill gas analyser is to be fed into the stormwater pit and purged for 60 seconds before results are recorded.

4.4 CAPPED SURFACE METHANE EMISSIONS

Surface gas emissions of methane from the capped surface shall be undertaken in dry, calm conditions of relatively low, stable atmospheric pressure (wind speeds not exceeding 10 km / hr and atmospheric pressure below 101.3 kPa. If this is not possible, the actual weather conditions should be recorded, and an assessment conducted of the potential implications of collected data.

Surface monitoring shall be undertaken using a infra-red laser spectroscopy analyser or equivalent instrument with specification in accordance with that provided in *Appendix B-3.* Wind speed should be measured using a hand-held anemometer.

At each event, measurement of methane concentration at no more than 50 mm above the capped surface should be taken in each of the 25 m grid squares within the capped area and within the 25 m buffer from the perimeter of the capped area. The extent of the capped area and the 25 m buffer is presented in *Figure 4, Appendix A.* Measurements of wind speed and direction are to be recorded at each location.

A proposed field form for documenting the surface monitoring is attached as *Appendix D.*

5. ASSESSMENT CRITERIA, THRESHOLD LEVELS AND COMPLIANCE CRITERIA

The objective of this post-remediation GGMP is to utilise the collected dataset to assess the efficacy of the remediation strategy of Proposed Lot 64 by encapsulation.

The assessment criteria adopted for Proposed Lot 64 has been provided by the New South Wales Environmental Protection Agency (NSW EPA), Environmental Guidelines: Solid waste landfill (2016). The guidelines provide both threshold levels for investigation and corrective action, and compliance criteria in which requires notification to the EPA.

It is noted that Proposed Lot 64, although not defined as a landfill, has adopted these guidelines and compliance criterion due to the nature of the sub-surface contamination and historical land uses of the "buried waste area".

The actions required in the event that monitoring results fail to meet the assessment criteria are provided in *Section 6*, and presented in *Table 5-1* below.

TABLE 5-1 ASSESSMENT CRITERIA FOR GROUND GAS MONITORING

Monitoring type	Gas	Criteria	Action Requirements	Guideline	Comment
Sub-surface gas monitoring	Methane (CH_4)	1 % v/v	*Section 6.1*	NSW EPA 2016	Exceedance requires notification to the NSW EPA.
	Carbon dioxide (CO_2)	1.5 % above background levels	*Section 6.1*	NSW EPA 2016	Threshold level for further investigation and corrective action.
Enclosed structures gas accumulation monitoring (stormwater pits)	Methane (CH_4)	1 % v/v	*Section 6.2*	NSW EPA 2016	Exceedance requires notification to the NSW EPA.
	Carbon dioxide (CO_2)	1.5 % v/v[1]	*Section 6.2*	-	-
Surface gas emissions	Methane (CH_4)	500 ppm	*Section 6.3*	NSW EPA 2016	Threshold level for further investigation and corrective action.
	Carbon dioxide (CO_2)	-[2]	-	-	-

Notes:

1. *The NSW EPA guidelines do not specify a threshold for CO2 accumulation in enclosed structures. However, carbon dioxide is toxic at concentrations of 2-5% v/v in air, and on this basis, a threshold of 1.5% v/v is considered a reasonable assessment criterion that would indicate potential health hazard.*
2. *CO_2 measurements are not relevant to surface emissions monitoring, as CO_2 related risks are specific to confined spaces.*

6. ACTION REQUIREMENTS

Exceedances of the adopted screening criteria for gas monitoring at Proposed Lot 64 will initiate differing action requirements as defined by the NSW EPA (2016) guidelines.

Exceedances of trigger levels for methane require notification to the NSW EPA, while an exceedance of adopted trigger levels for carbon dioxide will require investigation and corrective action to be undertaken by the occupier.

Additional to notification to the NSW EPA, exceedances of compliance criterion will initiate an assessment of the efficacy of the installed cap over Proposed Lot 64, and re-evaluation of the LTEMP (ERM, 2024a).

The action requirements for exceedances of compliance criteria for sub-surface gas monitoring, enclosed structure gas monitoring and surface emissions monitoring are presented in the following subsections.

6.1 EXCEEDANCE OF COMPLIANCE CRITERION IN PERIMETER SUB-SURFACE GAS WELLS

As per the NSW EPA (2016) guidelines, if methane is detected at concentrations above 1% v/v in sub-surface gas monitoring wells, the occupier must notify the EPA *promptly*. Within 14 days, the occupier must submit a plan to the EPA for further investigation and/or remediation of the elevated gas levels.

Specific to Proposed Lot 64, this plan may include (but is not limited to) one or more of the following corrective actions:

- An increase in monitoring frequency;
- The installation of additional monitoring wells;
- Volumetric/gas flow determinations to assess the significance of gas generation rates and the potential scale of off-site gas migration; and
- Notifications to potentially affected persons.

6.2 EXCEEDANCE OF COMPLIANCE CRITERION IN ENCLOSED STRUCTURES

Enclosed structures are limited to stormwater pits within the proposed Lot 64. As per the NSW EPA (2016) guidelines, if methane is detected at concentrations above 1% v/v in enclosed structures, the occupier must notify the EPA within *24 hours.* Within 14 days, the occupier must submit a plan to the EPA for further investigation and/or remediation of the elevated gas levels.

Specific to Proposed Lot 64, this plan may include (but is not limited to) one or more of the following corrective actions:

- Daily testing of the building or enclosed structure until ventilation or other measures have been put in place to eliminate the methane build-up; and
- Further sub-surface monitoring to delineate any potential migration of landfill gas

6.3 EXCEEDANCE OF COMPLIANCE CRITERION IN SURFACE GAS EMISSIONS

As per the NSW EPA (2016) guidelines, if methane is detected at concentrations above 500 parts per million (ppm), the occupier must implement investigation and corrective actions, specific to Proposed Lot 64.

Corrective actions may include (but not limited to):

- Flux (emissions) monitoring to quantify emission rates and help identify the extent of gas loss (surface scans give a concentration, not a flow rate); and
- The installation of additional monitoring wells.

7. REFERENCES

Environmental Resources Management Australia (ERM), 2024a*. Proposed Lot 64 – Long Term Environmental Management Plan,* Clyde Western Area Remediation Project. Preliminary Draft 21 March 2024.

ERM, 2021a – *Stage 2 – Detailed Remediation Action Plan,* Clyde Western Area Remediation Project. 8 July 2021.

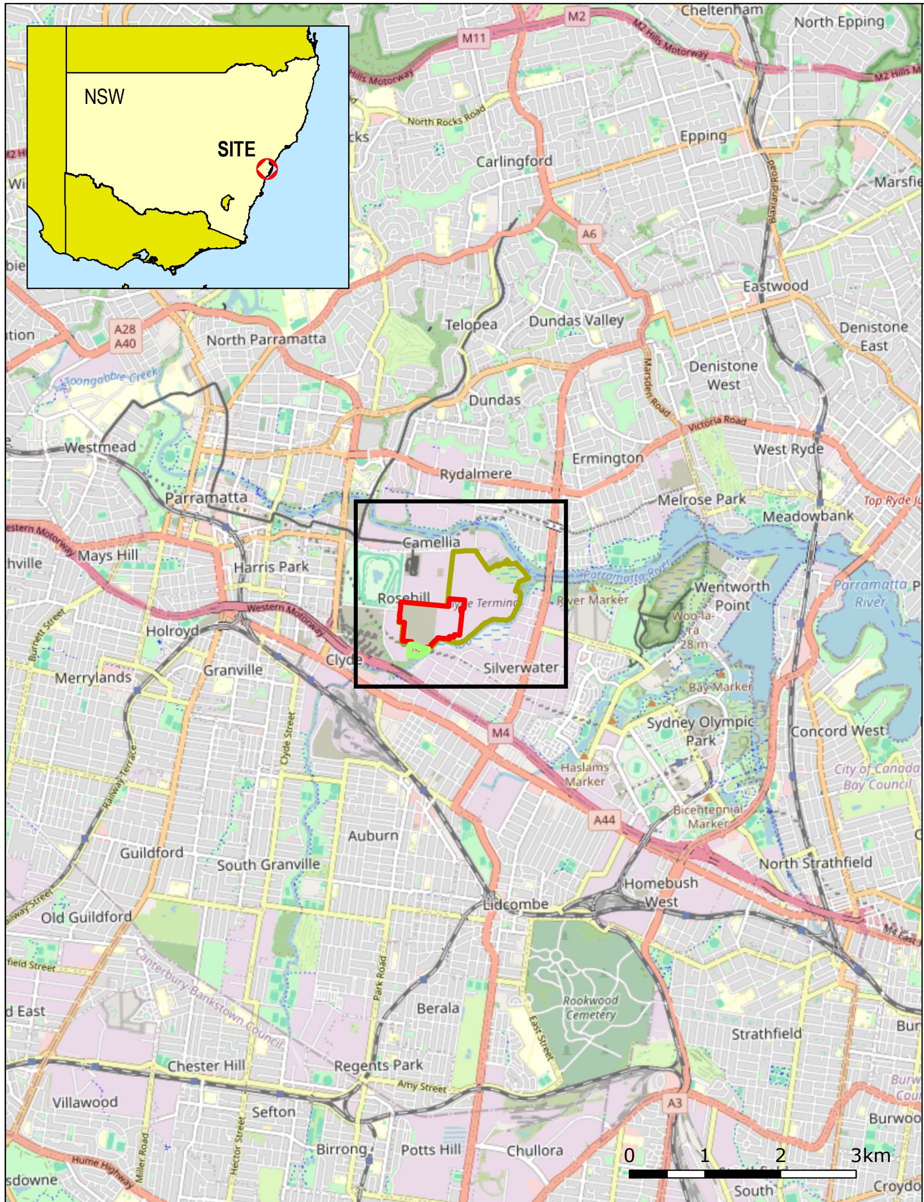
ERM, 2021b. *Supplementary Environmental Site Assessment – Southern Buried Waste Area (AEC-4),* Clyde Western Area Remediation Project. June 2021.

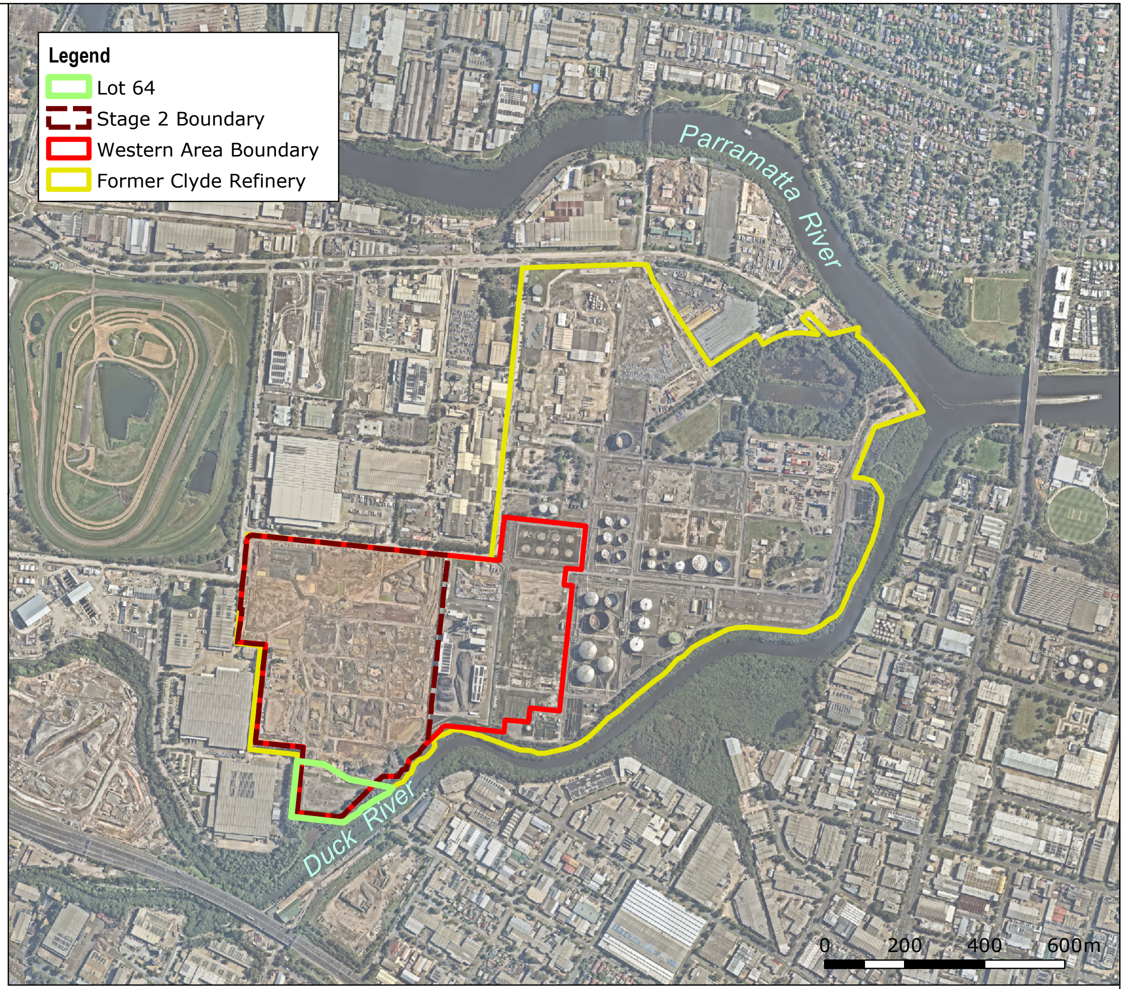
ERM, 2023. *Proposed Lot 64 – Baseline Ground Gas Monitoring Event,* Clyde Western Area Remediation Project. 14 July 2023.

ERM, 2024b. *Proposed Lot 64 – AEC-4 Capping Construction Technical Specification*, Clyde Western Area Remediation Project. 14 March 2024.

New South Wales Environmental Protection Agency (NSW EPA), 2016. *Solid Waste Landfills*, Solid Waste Guidelines. Second Edition, 2016.

APPENDIX A FIGURES





General Area Land Use:
Industrial
General Hydrogeology of Locality:
1. Soil Type:
Residual clay with minor silt and sand
2. Depth to aquifer:
0.5-2.5m bgs

Aquifer Usage:
No on-site extraction

Data Source:
Nearmap Imagery February 2024
Locality: Esri, OpenStreetMap 2023

Coordinate System:
GDA 1994 MGA Zone 56

Date: 10/04/2024
Created By: MF / FS
Drawing Size: A4

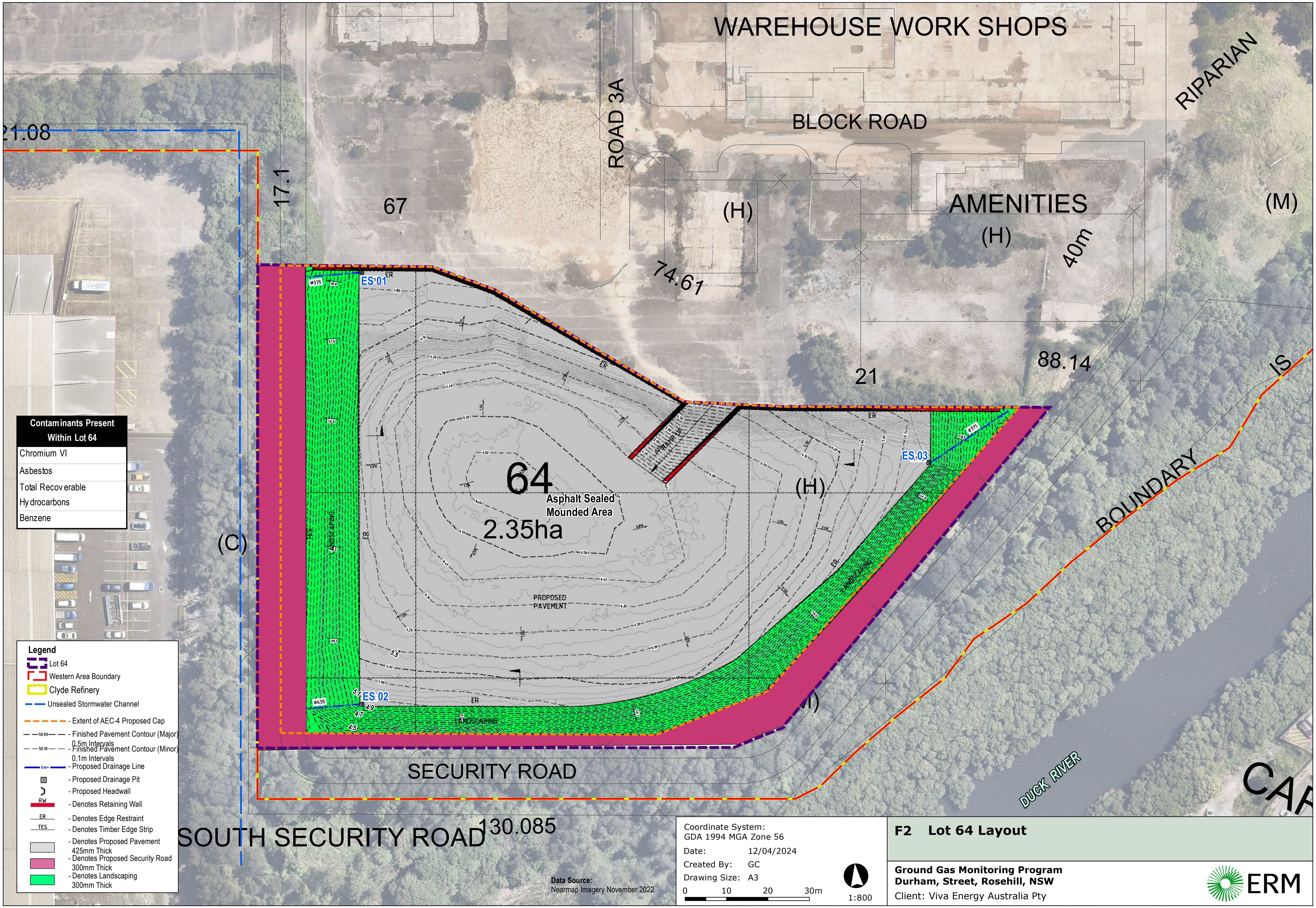
1:18,875

F1 - Site Location

Ground Gas Monitoring Program
Durham Street, Rosehill NSW
Viva Energy Australia Pty Ltd

ERM

0561682_L64GMP_G001_R0.mxd

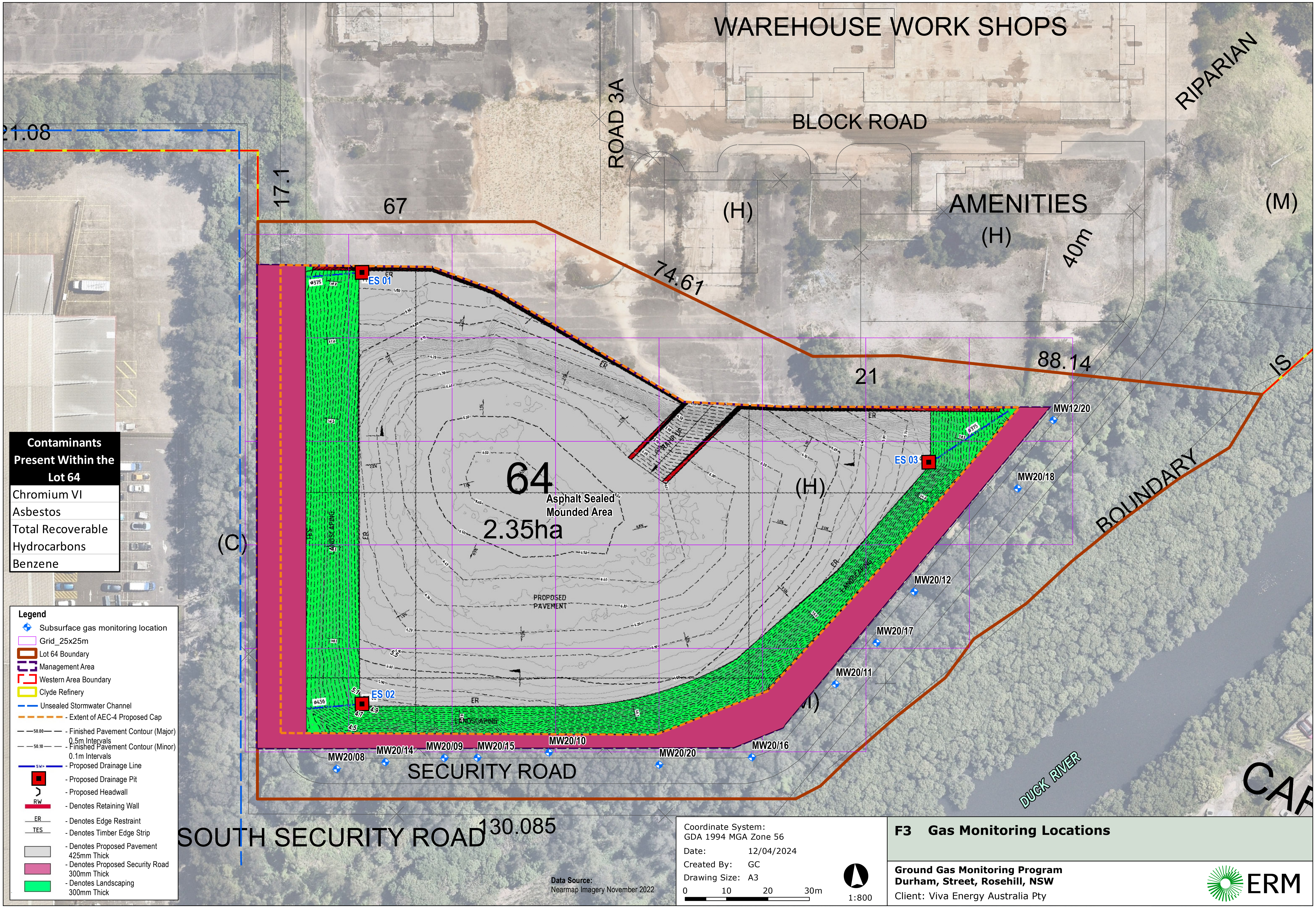


Coordinate System:
GDA 1994 MGA Zone 56
Date: 12/04/2024
Created By: GC
Drawing Size: A3

F2 Lot 64 Layout

Ground Gas Monitoring Program
Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty

ERM



Coordinate System:
GDA 1994 MGA Zone 56

Date: 12/04/2024

Created By: GC

Drawing Size: A3

F3 Gas Monitoring Locations

Ground Gas Monitoring Program
Durham, Street, Rosehill, NSW
Client: Viva Energy Australia Pty

ERM

APPENDIX B MONITORING PLAN

Media	Frequency	Analytes	Detection Limits	Units
Ambient Air	Monthly (total of six months)	Stabilised CH4	0.1	% v/v
		Stabilised CO2	0.1	% v/v
Sub-surface gas	Monthly (total of six months)	Peak CH4	0.1	% v/v
		Stabilised CH4	0.1	% v/v
		Peak CO2	0.1	% v/v
		Stabilised CO2	0.1	% v/v
		Minimum O2	0.1	% v/v
		Stabilised O2	0.1	% v/v
		CO	1	ppm
		HS	1	ppm
		Flow Rate	0.1	L / hr
		Barometric Pressure	N/A	Mb
		Relative Pressure	N/A	Mb
Groundwater	Monthly (total of six months)	Standing Water Level	0.001	Metres below top of casing (m btoc)

Abbreviations:

CH4	Methane
CO2	Carbon dioxide
O2	Oxygen
CO	Carbon monoxide
HS	Hydrogen sulphide

Media	Frequency	Analytes	Detection Limits	Units
Sub-surface gas	Monthly (total of six months)	Peak CH4	0.1	% v/v
		Stabilised CH4	0.1	% v/v
		Peak CO2	0.1	% v/v
		Stabilised CO2	0.1	% v/v
		Minimum O2	0.1	% v/v
		Stabilised O2	0.1	% v/v
		CO	1	ppm
		HS	1	ppm

Abbreviations:

CH4	Methane
CO2	Carbon dioxide
O2	Oxygen
CO	Carbon monoxide
HS	Hydrogen sulphide

Media	Frequency	Analytes	Detection Limits	Units
Surface Gas	Monthly (total of six months)	Methane	1	ppm
		Wind speed	N/A	km/hr
		Wind direction	N/A	N/A

Surface Gas Analyser Specifications		
Item	**Value**	
Response Times	TP90 standard:	4.5 seconds
	TP10 standard:	2 seconds
	TP90 with suction rod:	6 seconds
	TP10 with suction rod:	<3.5 seconds
Analytes measured		Methane by laser spectroscopy
Measurement Range - ppm		0 - 10,000 ppm
Measurement Range - Volume Gas		0 - 100% volume gas
Detection Limit		1 ppm
Certification		94/9/CE directive dated March 23, 1994
ATEX Certification		112G Ex ib IIB T4

APPENDIX C WELL CONSTRUCTION DETAILS

Well ID	Date of Installation	Longitude	Latitude	Top of Casing Elevation (m AHD)	Ground Elevation (m AHD)	Screen Length (m)	Top of Screen (mb TOC)	Bottom of Screen (mb TOC)
MW12/20	2012	-33.8325951	151.033354	2.940	2.940	3.0	1.000	4.000
MW20/08	2020	-33.8331558	151.0313852	4.876	3.930	3.0	2.946	5.946
MW20/09	2020	-33.8331613	151.0316674	4.864	3.871	3.0	2.993	5.993
MW20/10	2020	-33.8331775	151.0319402	4.697	3.728	3.0	2.969	5.969
MW20/11	2020	-33.8331071	151.0327049	3.949	3.022	3.0	2.927	5.927
MW20/12	2020	-33.8329285	151.032938	4.368	2.985	3.0	3.383	6.383
MW20/14	2020	-33.8331545	151.0315129	4.810	3.836	3.0	2.974	5.974
MW20/15	2020	-33.8331697	151.0317531	4.825	3.834	3.0	2.991	5.991
MW20/16	2020	-33.8332425	151.0324642	3.482	2.656	3.0	2.826	5.826
MW20/17	2020	-33.8330284	151.0328242	4.051	3.012	3.0	3.039	6.039
MW20/18	2020	-33.8327332	151.0332393	3.629	2.589	3.0	3.040	6.040
MW20/20	2020	-33.8332338	151.0322217	4.077	2.566	3.0	3.511	6.511

ERM

APPENDIX D EXAMPLE FIELD SHEETS

Project: EPL Monitoring Point 1
Date: Surface Gas
Time:

Location	CH4 (ppm)	Windspeed (m/s)	Wind Direction	Comments	NSW EPA Threshold (ppm)
A1					**500**
A2					**500**
A3					**500**
A4					**500**
A5					**500**
A6					**500**
A7					**500**
A8					**500**
A9					**500**
B1					**500**
B2					**500**
B3					**500**
B4					**500**
B5					**500**
B6					**500**
B7					**500**
B8					**500**
B9					**500**
C1					**500**
C2					**500**
C3					**500**
C4					**500**
C5					**500**
C6					**500**
C7					**500**
C8					**500**
C9					**500**
D1					**500**
D2					**500**
D3					**500**
D4					**500**
D5					**500**
D6					**500**
D7					**500**
D8					**500**
D9					**500**
E1					**500**
E2					**500**
E3					**500**
E4					**500**
E5					**500**
E6					**500**
E7					**500**
E8					**500**
E9					**500**
F1					**500**
F2					**500**
F3					**500**
F4					**500**
F5					**500**
F6					**500**
F7					**500**
F8					**500**
F9					**500**

Location	CH4 (ppm)	Windspeed (m/s)	Wind Direction	Comments	NSW EPA Threshold (ppm)
G1					500
G2					500
G3					500
G4					500
G5					500
G6					500
G7					500
G8					500
G9					500
H1					500
H2					500
H3					500
H4					500
H5					500
H6					500
H7					500
H8					500
H9					500
I1					500
I2					500
I3					500
I4					500
I5					500
I6					500
I7					500
I8					500
I9					500
J1					500
J2					500
J3					500
J4					500
J5					500
J6					500
J7					500
J8					500
J9					500
K1					500
K2					500
K3					500
K4					500
K5					500
K6					500
K7					500
K8					500
L1					500
L2					500
L3					500
L4					500
L5					500
L6					500
L7					500
M1					500
M2					500
M3					500
M4					500
M5					500

ERM *The business of sustainability*

Project: 0449086

Date:

Technician:

Time:

Instrument: GA 5000

Barometric pressure (start):

Barometric pressure (finish):

Weather:

Ground conditions:

Location	Date	Well Location inside /outside trench?	Flow	Barometric Pressure	Standing Water Level	Pump Duration	Fluctuation (+/- %v/v) or rate of change in concentraion (+/- %v/v per 10 sec)	Criteria		Peak		Min	Stabilised							Comments
								CH_4 Criteria	CO_2 Criteria*	CH_4	CO_2	O_2	CH_4	CO_2	O_2	Balance	H_2S	CO	Relative Pressure	
ID number			l/hr	mb	mBTOC	Sec			% v/v	% v/v	% v/v	% v/v	% v/v	% v/v	% v/v	% v/v	ppm	ppm	mb	
							--	1.0	--											
								1.0	--											
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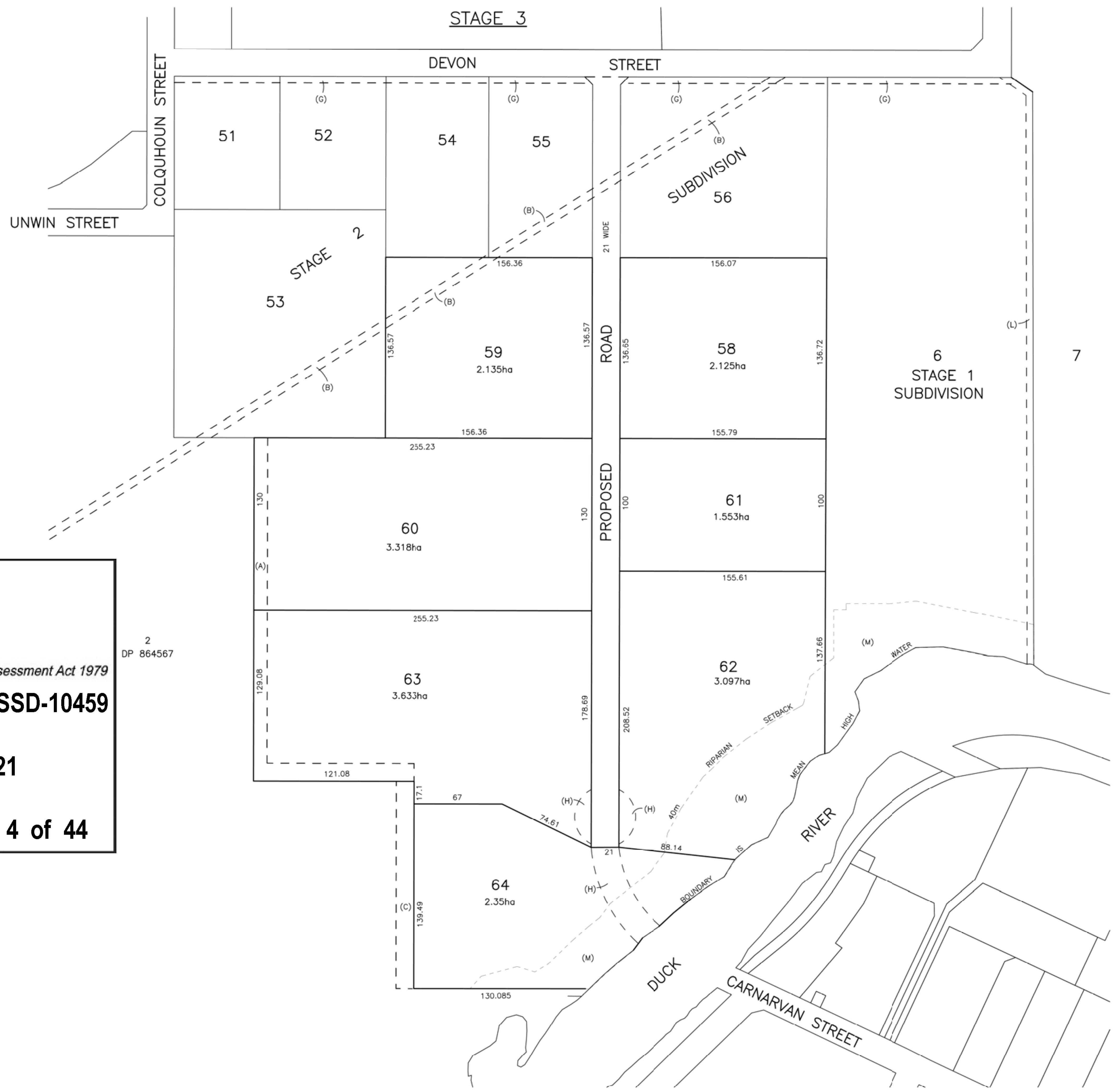
APPENDIX E SITE SURVEY



Planning, Industry & Environment

NSW GOVERNMENT

Issued under the Environmental Planning and Assessment Act 1979

Approved Application No: SSD-10459

Granted on: 31 January 2021

Signed: JF **Sheet No: 4 of 44**

NOTES:
1. ALL DIMENSIONS SHOWN HEREON ARE APPROXIMATE AND SUBJECT TO FINAL SURVEY
2. NO CADASTRAL SURVEY HAS BEEN UNDERTAKEN

(A) EASEMENT TO DRAIN WATER 10.2 & 13.4 WIDE (AC 424785)
(B) EASEMENT 6.095 WIDE (B309159) – SYDNEY WATER PIPELINE
(C) EASEMENT TO DRAIN WATER 13.4 WIDE (AC424784)
(G) PROPOSED EASEMENT FOR SERVICES 5 WIDE
(H) RIGHT OF ACCESS 21 WIDE AND VARIABLE WIDTH
(L) EASEMENT FOR OVERLAND FLOW 5 WIDE
(M) EASEMENT FOR PEDESTRIAN ACCESS 40 WIDE & VARIABLE WIDTH

20 0 40 100 140m

SCALE 1:1500

CLIENT

VE PROPERTY PTY LTD

PROJECT

PLAN OF PROPOSED SUBDIVISION OF LOT 57 OF STAGE 2 OF SUBDIVISON OF LOT 100 IN DP1168951 STAGE 3

NOTES

The title boundaries shown hereon were not marked at the time of survey and have been determined by plan dimensions only and not by field survey.

Services shown hereon have been located where possible by field survey. If not able to be so located, services have been plotted from the records of relevant authorities where available and have been noted accordingly on the plan. Where such records do not exist or are inadequate a notation has been made hereon.

Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

8	GKO	23/11/2020	LOT 61 & 62 AMENDED
7	GKO	11/11/2020	AMEND RIPARIAN SETBACK & (H)
6	GKO	02/11/2020	LANDSCAPE SETBACK REMOVED
5	GKO	29/10/2020	PLAN AMENDED
4	GKO	20/10/2020	LOT BOUNDARIES AMENDED
3	GKO	24/07/2020	EASEMENTS DETAIL ADDED
2	GKO	17/07/2020	EASEMENT AMENDED
1	GKO	22/06/2020	INITIAL ISSUE

CODE	DESCRIPTION	CODE	DESCRIPTION
BIN	BIN	OFM	OPTICAL FIBRE MARKER
BM	BENCH MARK	OFP	OPTICAL FIBRE PIT
BO	BOLLARD	TM	PALM TREE
DJM	DRAINAGE MANHOLE	SE	SEAT
EFP	ELEC FUSE BOX	TS	SHRUB
ELP	ELEC GARDEN LIGHT	TCA	TELSTRA PIT
EL	ELEC GREEN PILLAR	SLH	SEWER LAMP HOLE
LP	ELEC LIGHT POLE	SMH	SEWER MANHOLE
EP	ELECT SINGLE PIT	SVP	SEWER VENT PIPE
SPL	ELEC STAY POLE	SI	SIGN
PP	ELEC POWER POLE	BUS	BUS STOP SIGN
ELP	ELEC POLE/LIGHT	T	TREE
TRANS	ELE POLE/TRANSFORM	SGL	TRAFFIC LIGHT
FD	FUEL DIP	SCL	TRAFFIC CONTROLLER
GM	GAS MAIN	SJX	TRAFFIC JUNCTION BOX
GMR	GAS METER	US	UNKNOWN SERVICE
GAS	GAS VALVE	WAV	WATER AIR VALVE
AG	GATE	WMR	WATER METER
GUL	GULLY PIT	WEP	WATER PUMP
HYD	HYDRANT	WSV	WATER STOP VALVE
BOR	BOREHOLE	WTP	WATER TAP

Symbols shown are indicative only. The symbol size and orientation does not necessarily represent the real size or orientation of the feature.

DRAINAGE PIPE U/G
DRAIN
ELECT. CABLE A/G
ELEC. CABLE U/G
GAS PIPE
FENCE LINE
SEWERAGE PIPE
TELSTRA CABLE
WATER PIPE

LANDPARTNERS
built environment consultants

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Level 2, 23-29 South Street
Rydalmere NSW 2116
PO Box 1144
Dundas NSW 2117

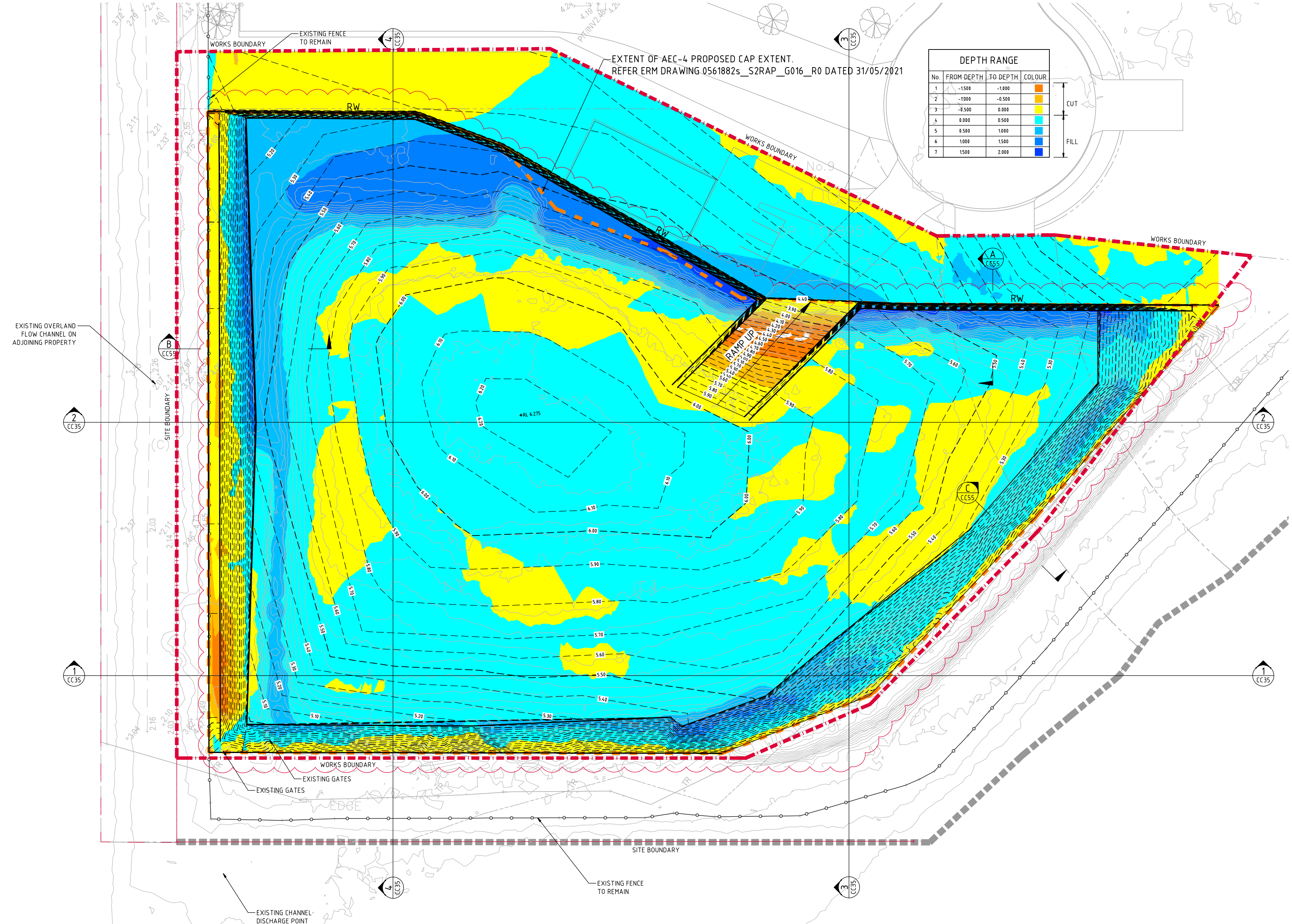
t (02) 9685 2000
e info@landpartners.com.au
w www.landpartners.com.au

HEIGHT DATUM AHD	LOCAL AUTHORITY CITY OF PARRAMATTA
HEIGHT ORIGIN N/A	SCALE 1:1500 (A1)
MERIDIAN 56	CONTOUR INTERVAL N/A
CO-ORD SYSTEM MGA	SURVEYOR N/A — DATE OF SURVEY -
CCAD FILE 74707 ver 9 final subdivision	DRAWN SF/CLP — DATE 23/11/2020
AUTOCAD FILE SY074707.000.13.8	CHECKED GKO — DATE 23/11/2020
ARCHIVE FILE SY074707.000.13.6	APPROVED GKO — DATE 23/11/2020

PLAN NUMBER SHEET 1 OF 1

SY074707.000.13.8

APPENDIX G CIVIL DESIGN PLANS



DEPTH RANGE				
No.	FROM DEPTH	TO DEPTH	COLOUR	
1	-1.500	-1.000		CUT
2	-1.000	-0.500		CUT
3	-0.500	0.000		CUT
4	0.000	0.500		FILL
5	0.500	1.000		FILL
6	1.000	1.500		FILL
7	1.500	2.000		FILL

PROPOSED EARTHWORKS PLAN
SCALE 1:250

SITE PREPARATION NOTES:

1. ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT SYDGE289002-AB PROVIDED BY TETRA TECH COFFEY DATED 17 AUGUST 2021.
2. EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY ERM TITLED 0561882s_S2RAP_G016_R0 DATED 31 MAY 2021..
3. STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
4. COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
5. PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
6. AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
7. SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
8. IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
9. ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE LAYER. FURTHER, LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (AS1289.5.4.1) OR HILF TEST METHOD (AS1289.5.7.1). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS SHOULD BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION
10. ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS [IN THE STATED PERIOD] ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION.
11. PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
12. EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
13. MATCH EXISTING LEVELS AT BATTER INTERFACE.
14. CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
15. DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

ALLOWANCES FOR STRUCTURE

	DEPTH OF PAVEMENT
PAVEMENT	725mm
LANDSCAPING	300mm

EARTHWORK ESTIMATES

SITE AREA	= 1.65 Ha
CUT	= - 700m³
FILL	= +3,400m³
ALLOWANCES	
RETAINING WALLS	= -1,000m³ (APPROX. TBC)
STORMWATER	= - 100m³ (APPROX. TBC)
SERVICES TRENCH	= - 600m³ (APPROX. TBC)
DIFFERENCE	= +1,000m³ (i.e. FILL OVER CUT)

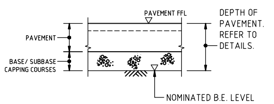
NOTE:
VOLUMES BASED ON NO TOPSOIL/ PAVEMENT STRIP OVER THE NOMINATED AREA. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED EXCAVATION RELATED TO CONSTRUCTION ACTIVITIES. DETAILED EXCAVATION ALLOWANCE IS APPROXIMATE ONLY AND ACCOUNTS FOR RETAINING WALL CONSTRUCTION. THE ALLOWANCES VOLUMES ARE TO BE CONFIRMED BY THE CONTRACTOR. REFER ANY CONCERNS TO ENGINEER.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY ERM DATED 31 MAY 2021.

50.00 - EXISTING CONTOUR
50.00 - B.E.L. CONTOUR (MAJOR 0.5m)
50.10 - B.E.L. CONTOUR (MINOR 0.1m)
50.000 - B.E.L. SPOT LEVEL
- CAPPING BOUNDARY
- WORKS BOUNDARY



NOMINATED B.E.L. DETAIL
NTS

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED	05.03.24	C
REVISED AS CLOUDED	16.02.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT
LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	CO13919.06-CC30

CONSULT AUSTRALIA

Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box N419 Sydney NSW 1220
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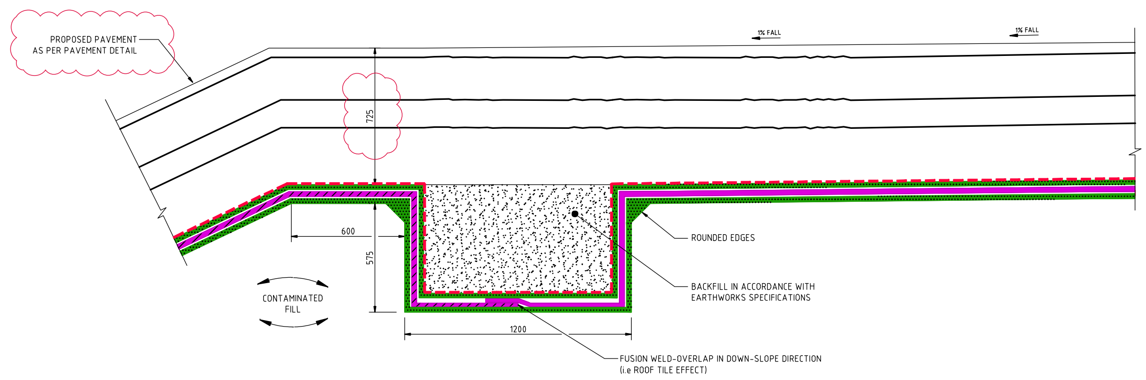
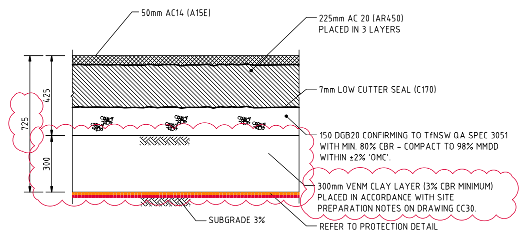
e: mail@costinroe.com.au w: costinroe.com.au
CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
PROPOSED EARTHWORKS PLAN

DRAWING No CO13919.06-CC30
ISSUE C

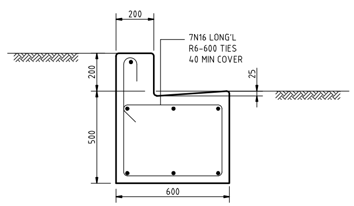


ANCHOR TRENCH TYPICAL DETAIL
SCALE 1:10

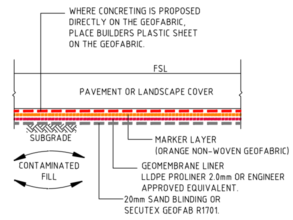


PAVEMENT DETAIL
SCALE 1:10
DESIGN TRAFFIC OF 1 x 10^7 ESA's
DESIGN CBR VALUE OF 3.0%
CBR OF SUBGRADE TO BE CONFIRMED TO ENGINEER FOR FINAL PAVEMENT OPTIMISATION AND DESIGN.

NOTE:
CONFIRMATION OF PAVEMENT DESIGN SUBJECT TO CONFIRMATION OF EXISTING SUBGRADE BY GEOTECHNICAL ENGINEER.



KERB & GUTTER EDGE RESTRAINT (ER)
SCALE 1:10



PROTECTION DETAIL
SCALE 1:10

PAVEMENT MAINTENANCE NOTES:

DURING THE LIFE OF THE PAVEMENT, DAMAGE IN VARIOUS FORMS IS LIKELY TO OCCUR. GOOD MAINTENANCE WILL KEEP PROBLEMS TO A MINIMUM AND EXTEND THE LIFE OF PAVEMENTS. THE FOLLOWING LIKELY AREAS OF DAMAGE MAY OR MAY NOT OCCUR DURING THE LIFE OF THE PAVEMENTS:

SLAB PAVEMENTS :
1. DAMAGE TO JOINTS SUCH AS FRETTING OR BREAKING AWAY OF PIECES SHOULD BE REPAIRED USING CONCRETE REPAIR PRODUCTS AND THE JOINTING MATERIAL MADE GOOD.
2. CRACKING OF SLABS WHICH MAY OCCUR OVER THE LIFE OF THE SLAB SHOULD BE REPAIRED BY EPOXY GROUTING AS SOON AS POSSIBLE TO PREVENT LOCAL FRETTING AND BREAKING AWAY. THE DEFINITION OF A CRACK WHICH MAY BECOME DETRIMENTAL IS ONE WHICH IS GREATER THAN 0.3mm.
3. LOCAL DAMAGE DUE TO MECHANICAL PROCESSES OR PALLETS (WITH PROTRUDING NAILS) SHOULD BE REPAIRED AS SOON AS POSSIBLE WITH AN EPOXY CONCRETE REPAIR PRODUCT.
4. LOCAL MOVEMENT OF SLABS CAUSED BY EXTERNAL SOURCES SUCH AS INGRESS OF WATER SHOULD BE REFERRED TO THE ENGINEER TO DETERMINE THE BEST METHOD OF REPAIR.
5. JOINT SEALANTS WILL GENERALLY BREAKDOWN AND NEED REPLACEMENT AFTER 12 MONTHS WHEN MOST OF THE SLAB SHRINKAGE HAS TAKEN PLACE. RESEALING NEEDS TO BE CARRIED OUT TO ENSURE ONGOING SUPPORT TO SLAB EDGES.

ASPHALT PAVEMENTS :
1. UNLESS NOTED OTHERWISE, FLEXIBLE PAVEMENTS SHOWN ON THESE DRAWINGS ARE THE MINIMUM NECESSARY TO SUPPORT LIGHT CAR PARKING FOR A MINIMUM DESIGN LIFETIME.
2. CRACKING OF THE ASPHALT SURFACE AND OTHER DEFECTS SHOULD BE REPAIRED QUICKLY TO PREVENT INGRESS OF WATER TO THE SUBGRADE, WHICH WILL ACCELERATE DETERIORATION OF PAVEMENTS.
3. DRAINAGE GRADES SHOULD BE MAINTAINED TO AVOID PONDING OF SURFACE WATER WHICH MAY CONTRIBUTE TO DETERIORATION.

NOTE:

- LLDPE GEO-MEMBRANE PANELS TO BE PLACED IN ACCORDANCE WITH APPROVED PANEL LAYOUT PLAN. PREPARED BY CONTRACTOR IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION (SECTION 5.5.7.4)
- SINGLE SIDED TEXTURED GEO-MEMBRANE ON SLOPED SIDES, TEXTURED SIDE DOWN.
- MATERIALS TO MEET SPECIFICATIONS, TESTING AND APPROVAL REQUIREMENTS OUTLINED IN TECHNICAL SPECIFICATIONS.

LEGEND:

- CUSHION GEO-TEXTILE
- LLDPE - SMOOTH GEO-MEMBRANE
- LLDPE - SINGLE-SIDED TEXTURED GEO-MEMBRANE
- MARKER LAYER

100mm 0 200 400 600 800 1000mm
SCALE 1:10 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED FOR PAVEMENT CLAY LAYER	05.03.24	B
ISSUED FOR CONSTRUCTION CERTIFICATE	30.05.23	A

CLIENT: VIVA Energy Australia
CLIENT: DBL PROPERTY

PROJECT: LOT 64 CAPPING WORKS
CENTRAL SYDNEY INDUSTRIAL ESTATE
9 DEVON STREET, CLYDE, NSW, 2142

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	MAY '23	XC	A0	AS SHOWN	C013919.06-CC56

Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box N419 Sydney NSW 1220
Level 4, 8 Windmill Street, Millers Point NSW 2000
p: +61 2 9251 7699 f: +61 2 9241 3731
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CRC COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE: TYPICAL DETAILS SHEET 2
DRAWING No: C013919.06-CC56
ISSUE: B

ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING COUNTRIES AND TERRITORIES WORLDWIDE

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
Portugal
Romania
Senegal
Singapore
South Africa
South Korea
Spain
Switzerland
Taiwan
Tanzania
Thailand
UAE
UK
US
Vietnam

Appendix F

NSW EPA and Council Correspondence

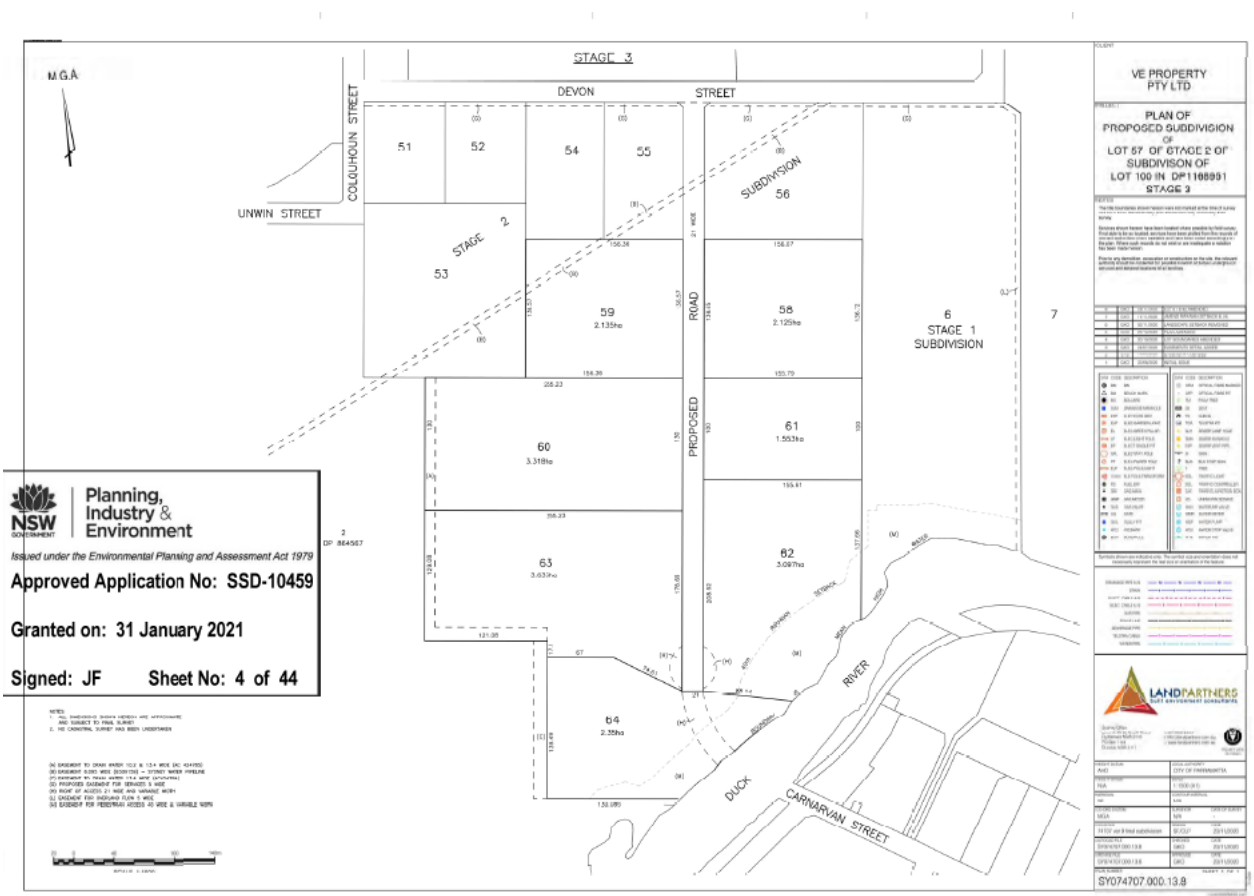
Daniela Balbachevsky

From: Andrew Kohlrusch
Sent: Friday, 17 May 2024 9:23 AM
To: Stuart Pike
Cc: Daniela Balbachevsky
Subject: Site audit statement - Proposed lot 64 of Viva Western Aree Remediation project
Attachments: 20240507 Clyde WARP Lot 64 LTEMP (F)_V3.pdf

CompleteRepository 2127799
Description: Viva Clyde Audit
JobNo: 2127799
OperatingCentre: 21
RepoEmail: 2127799@ghd.com
RepoType: Project

Good morning Stuart,

We are in the process of completing the site audit for Lot 64 of the WARP.
Similar to previous areas of the WARP, a long term management plan (LTEMP) has been prepared. The LTEMP for Lot 64 relates to the presence of waste that was formerly buried in this portion of the WAR. Viva has replaced the former cap of this area with a low density polyethylene surface cover. The land will remain in Viva's ownership.
Lot 64 is located in the south western corner of the WARP, adjacent to the Duck River.



Would you be able to arrange for notification on the Section 10.7 planning certificate that the use of the site is subject to the LTEMP?
The preparation of the LTEMP was a condition of consent for SSD 9302.

If you need anything else, please let me know.

Regards
Andrew Kohlrusch | A GHD PRINCIPAL
Senior Technical Director – Contamination and Remediation
NSW EPA and WA DWER accredited site auditor

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D 61 2 9239 7187 **M** 61 447 685 055

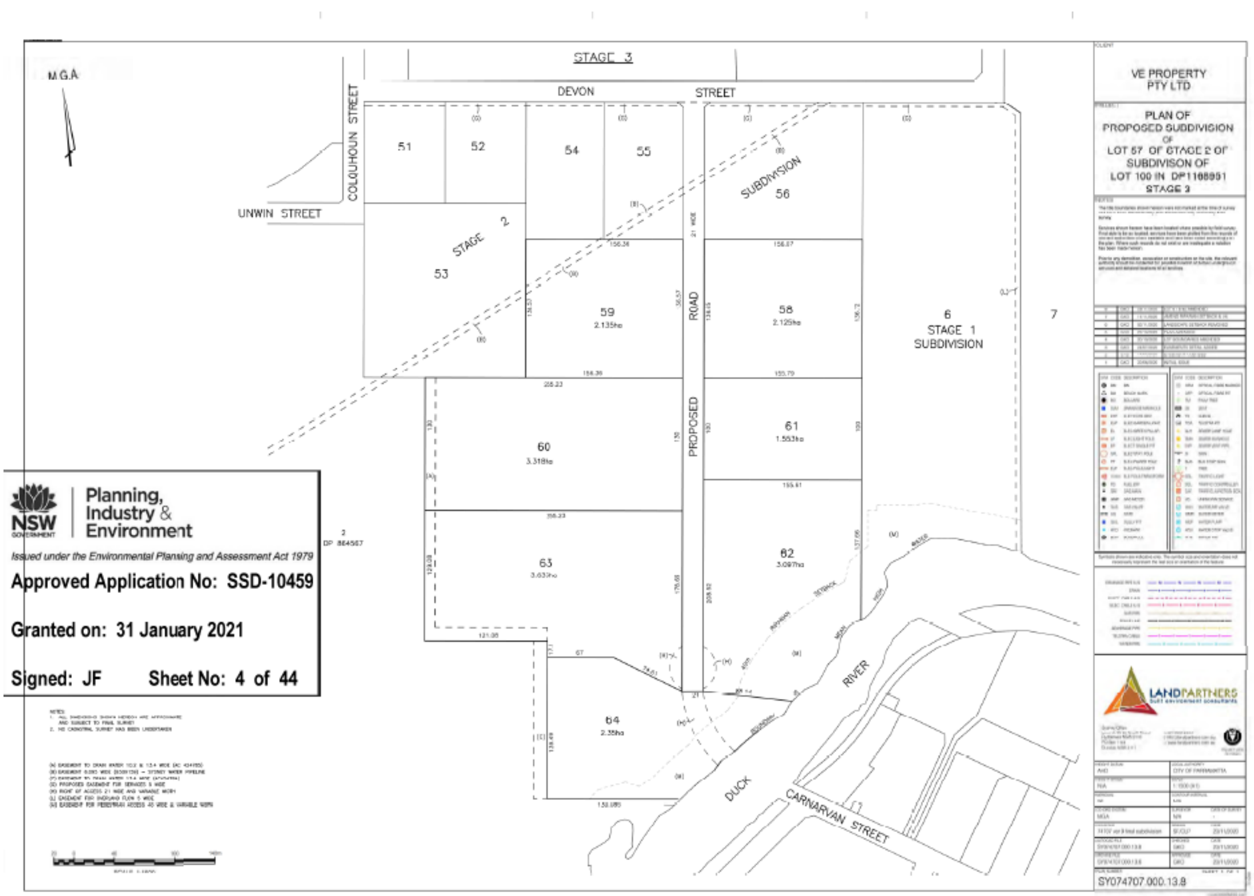
Daniela Balbachevsky

From: Andrew Kohlrusch
Sent: Friday, 17 May 2024 9:29 AM
To: Ulli Manuel
Cc: Daniela Balbachevsky
Subject: Site audit statement - Proposed lot 64 of Viva Western Aree Remediation project, LTEMP
Attachments: 20240507 Clyde WARP Lot 64 LTEMP (F)_V3.pdf

CompleteRepository: 2127799
Description: Viva Clyde Audit
JobNo: 2127799
OperatingCentre: 21
RepoEmail: 2127799@ghd.com
RepoType: Project

Good morning Ulli,

We are in the process of completing the site audit for Lot 64 of the WARP.
Similar to previous areas of the WARP, a long term management plan (LTEMP) has been prepared. The LTEMP for Lot 64 relates to the presence of waste that was formerly buried in this portion of the WAR. Viva has replaced the former cap of this area with a low density polyethylene surface cover. The land will remain in Viva's ownership.
Lot 64 is located in the south western corner of the WARP, adjacent to the Duck River.



There has been correspondence with the council requesting notification on the Section 10.7 planning certificate that the use of the site is subject to the LTEMP?

We are in the final stages of completing the audit.
If you have any questions about the LTEMP, please let me know.

Regards
Andrew Kohlrusch | A GHD PRINCIPAL
Senior Technical Director – Contamination and Remediation
NSW EPA and WA DWER accredited site auditor

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Appendix G

Site audit visits photolog

Site Visit - 19 February 2024

On 19 February 2024, Andrew Kohlrusch and Daniela Balbachevsky (GHD) conducted a site visit accompanied by Jeffrey Lord (DB Property), Adam Speers (Viva Energy), Stephen Mulligan (ERM) to verify the site conditions during the beginning of the remediation activities. The following observations were made by GHD:

– The Stage 2 AA4 currently has no formal use. Access to this area is restricted and controlled by Viva Energy. A thought site induction and health and safety protocols are in place and only personnel wearing a full set of personal protective equipment (PPE) are given access to the site.
– A site walkover within proposed Lots 61, 62, 64, and a portion of the Proposed Roadway, which includes the Stage 2 AA3 and Stage 2 AA4, was conducted by Andrew and Daniela (GHD), Adam Speer (Viva Energy), Stephen Mulligan (ERM), Matthew Parkison (JBS&G), Jeffrery Lord (DBL Property), and Dane Magnus (Environ Pacific Services [EPS]).
– The auditor noted that Stage 2 AA4 is relatively flat with a gradual slope to the south towards Duck River. Apart from some shallow, man-made surface water drainage features, the site no longer contains any infrastructure associated with the former activities conducted at the site, apart from a curbed drainage boundary the Stage 2 AA4.
– A curbed drainage around 4 to 5 meters deep was observed running within the western boundary of WARP towards Duck River. Vegetation surrounding this drainage did not show signs of stress (such as leaf discoloration) that could have been caused by historical impacts. No sheen, stains, or odours were observed within the surface water.
– Two groundwater monitoring wells, approximately 1.0 meter above ground, were observed parallel to the curbed drainage.
– The south boundary of Stage 2 AA4 is determined by a fence followed by the "old infrastructure road," a second fence, and then the riparian zone.
– The riparian zone comprises very well-established native vegetation. No visual signs of stress, such as leaf discoloration, stunted growth, or reduced leaf appearance, were observed.
– One groundwater monitoring well was observed between Lot 64 and the riparian zone.
– The AEC-4 floor comprises concrete in poor condition and some exposed soils.
– Several stockpiles were observed around Stage 2 AA4. At least four stockpiles containing asbestos were visually observed. All stockpiles containing asbestos (ACM) were isolated, and signs were visible.

A photolog registering the key site visit observations is presented below.

Photolog 19 February 2024

Photo 1 ***View of the former Stage 1 Area and stockpiles in the vicinity of AEC-4***

Photo 2 ***Southern boundary of Stage 2 AA4***

Photo 3 *Drainage running within western boundary of Stage 2 AA4*

Photo 4 *Western boundary of Stage 2 AA4 with a commercial facility and roads access to AEC-4*

Photo 5 Groundwater monitoring well installed in the vicinity of drainage at the western boundary of Stage 2 AA4

Photo 6 Southern boundary of Stage 2 AA4 and detail of very well established

Site Visit – 21 March 2024

On 21 March 2024, Daniela Balbachevsky (GHD), and Jeffrey Lord (DBL Property) undertaken a site visit to verify the progress of the remediation activities within the AEC-4. The following observations were made by GHD:

- No free surficial asbestos was visually observed during the site visit.
- Stockpiles containing asbestos around the Stage 2 AA4 were isolated, and hazards were identified.
- The stormwater works within the proposed Public road within eastern boundary of Stage 2 AA4 were nearly completed.
- Capping engineering material was observed close to the "offices" / carparking.
- The groundwater monitoring wells within Stage 2 AA4 is still present.
- The bitumen coverage from AEC-4 was removed and stockpiled within the AEC-4.
- Initial earthworks for the preparation of the capping within the proposed Lot 64 has begun.

A photolog registering the key site visit observations is presented below.

Photolog – 21 March 2024

Photo 7 ***Proposed Public Roads surrounding Stage 2 AA4***

Photo 8 ***Removal of hard surface within AEC-4***

Photo 9 Bitumen stockpile from AEC-4

Photo 10 View of carparking close to the "offices" and capping engineering material

Site Visit – 12 April 2024

On 12 April 2024, Andrew Kohlrusch and Daniela Balbachevsky (GHD) conducted a site visit accompanied by Jeffrey Lord (DB Property), Adam Speers (Viva Energy), Stephen Mulligan (ERM) to verify the site progress of the remediation activities. The following observations were made by GHD:

- The audit team noted that the removal of the hard surface within AEC-4 was completed.
- Groundwater monitoring wells surrounding the AEC4-4 up and down gradient were preserved.
- Several stockpiles were observed around Stage 2 AA4. At least four stockpiles containing asbestos were visually observed. All stockpiles containing asbestos (ACM) were isolated, and signs were visible.

A photolog registering the key site visit observations is presented below.

Site Visit 12 April 2024

Photo 11 Overview of AEC-4 and riparian zone to the south

Photo 12 Overview of surface of AEC-4 and Stage 2 AA4 western boundary

Photo 13 *AEC-4 earthworks*

Site Visit 30 April 2024

On 30 April 2024, Andrew Kohlrusch (GHD) conducted a site visit accompanied by Jeffrey Lord (DB Property), Adam Speers (Viva Energy), Stephen Mulligan (ERM) and Matthew Parkinson (JBS&G) to verify the progress of the remediation activities. The following observations were made by GHD:

– General earthworks in western and eastern portions of site.
– The final level of the containment cell in Lot 64 had been constructed – i.e. former bitumen cap had been stripped and exposed surface graded to achieve a one percent fall to the boundaries of the area to be capped. Protective layer had been installed in most of the perimeter anchor trench. No protective layer had been placed as yet across the surface of the containment cell at the time of the site visit. The trench for the retaining wall on the northern boundary has also been excavated.

Photo 14 ***Stage 2 view of trench excavated for construction of northern retaining wall with anchor trench at foot of barrier mesh. Darker material at base of the retaining wall trench may be material buried within the containment cell***

Photo 15 ***Stage 2 anchor trench (which will also allow future installation of services without disturbing the cap) with protection layer installed – southern perimeter. Unsealed soil is the prepared surface to be capped with the protection layer and the LDPE.***

Photo 16 ***Northern boundary of containment cell in Lot 64 showing anchor trench and protection layer. Background is the cul de sac of the north-south road. Installation of service conduits***

Site Visit 27 May 2024

On 27 May 2024, Andrew Kohlrusch and Sam Vaughan (GHD) conducted a site visit accompanied by Jeffrey Lord (DB Property), Adam Speers (Viva Energy), Stephen Mulligan (ERM) and Matthew Parkinson (JBS&G) to verify the progress of the remediation activities. The following observations were made by GHD:

– General earthworks in western and eastern portions of site.
– The final level of the containment cell in Lot 64 had been constructed.
– HDPE lining of Lot 64 cell and pressure testing of liner.
– Water sprayers observed being used to help suppress dusts.

Photo 17 *Detail of AEC-4 LDPE placement.*

Photo 18 *Detail of HDPE lining of Lot 64.*

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The Power of Commitment