Viva Energy Clyde Western Area Remediation Project - Stage 1 Remedial and Validation Works

Devon Street, Rosehill, NSW

Report_RevA

February 2021

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Glossary

Acronym	Description
ACM	Asbestos Containing Material
AECs	Areas of Environmental Concern
AEVR	Air Emissions Verification Report
AF	Asbestos Fines
AHD	Australian Height Datum
ANSTO	Australia Nuclear Science and Technology Organisation
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines.
AOC	Accidentally Oil Contaminated
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plan
AS	Australian Standard
ASC	Assessment of Site Contamination.
ASS	Acid Sulphate Soil
BGL	Below Ground Level
BH	Borehole
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CC	Continually Contaminated
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
CT	Contaminate Threshold
CTCP	Clyde Terminal Conversion Project
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry, and Environment
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives

Acronym	Description
EC	Electrical Conductivity
EIL	Ecologically Based Investigation Level
EIS	Environmental Impact Statement
ENM	Excavated Natural Material
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ERM	Environmental Resources Management
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
eV	Electron Volt
FA	Fibrous Asbestos
GME	Groundwater Monitoring Event
GMP	Groundwater Management Plan
Ha	Hectares
HHERA	Human Health and Ecological Risk Assessment
HIL	Health-Based Investigation Level
HSL	Health Screening Level
IMWs	Intrusive Maintenance Workers
km	Kilometre
LCS	Laboratory Control Samples
LEP	Local Environment Plan
LFG	Landfill Gas
LGA	Local Government Area
LNAPL	Light Non-Aqueous Phase Liquid
LOR	Limit of Reporting
LPG	Liquid Petroleum Gas
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

Acronym	Description
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
MHF	Major Hazard Facility
MJ/Kg	Mega joule per Kilogram
MPa	Mega Pascal
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 Walls
OCP	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PCB	Polychlorinated Biphenyls
PFAS	Per and Polyfluoroalkyl Substances
PFHxS	Perfluorohexanesulfonate
PFOS	Perfluorooctanesulfonic acid
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
REMP	Remediation Environmental Management Plan
RLs	Relative Levels
ROA	Remedial Options Analysis
RPD	Relative Percentage Difference

Acronym	Description
RSI	Remediation Site Investigation
RSW	Restricted Solid Waste
SAQP	Sampling and Analytical Quality Plan
SCC	Specific Contaminate Concentration
SIA	Specific Immobilisation Approval
SPOCAS	Suspension Peroxide Oxidation – Combined Acidity and Sulphate
SSD	State Significant Development.
SSTLs	Site Specific Target Levels
SVE	Soil Vapour Extraction
SVOC	Semi-Volatile Organic Compound
SWL	Standing Water Level
SWMP	Soil and Water Management Plan
TCLP	Toxicity Characteristic Leaching Procedure
TP	Test Pit
TRH	Total Recoverable Hydrocarbons
UCS	Unconfined Compressive Strength
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

1.1 Site audit details

Andrew Kohlrusch of GHD Pty Ltd (the **auditor**) was commissioned by Viva Energy Australia Pty Ltd (the **Viva Energy or VE**) to conduct an environmental site audit of remedial works that have taken place in 2020 of a portion of the Western Area (the **Western Area Remediation Project or WARP**) of the former Clyde refinery.

Viva Energy intends to remediate the Western Area to facilitate future commercial/industrial development under the existing land use zoning (IN3 – Heavy Industrial). Viva Energy is proposing to stage the remediation of the WARP as follows:

- Stage 1 Area – Former Process West (the **Site**)
- Stage 2 Area – Former Utilities and Movements
- Stage 3 Area – Former Process East

This Site Audit Report (SAR) has been prepared for the Stage 1 Area remedial and validation works. The auditor noted the Site Audit Statement (SAS – Section B) number 043-2127799 was issued on 22 June 2020 endorsing the Stage 1 Remedial Action Plan (the Stage 1 RAP), meeting condition B3 of State Significant Development (SSD) Consent 9302 granted by the Department of Planning, Industry and Environment (DPIE).

The auditor noted that ERM prepared a Long-Term Environmental Management Plan (LTEMP) for the Stage 1 Area, dated 17 December 2020 (ERM, 2020i). This was prepared to satisfy the relevant conditions of Development Consent for the Project (see **Section 1.6**). This plan was accepted by the auditor and submitted for review and approval by the DPIE.

A SAR accompanying the Site Audit Statement (SAS) regarding the remedial and validation works completed in Stage 1 were issued by the auditor in December 2020, considering the information presented in the LTEMP (ERM, 2020i). However, as per correspondence received from the DPIE, dated 15 January 2021, the DPIE requested additional information to be incorporated into the LTEMP.

The updated LTEMP (ERM, 2021), dated 29 January 2021, was issued to the DPIE for approval. On 11 February 2021 the DPIE issued a notification accepting the updated LTEMP as follows "*Accordingly, the Planning Secretary has approved the Long Term Environmental Management Plan (dated 29 January 2021).*"

Following advice from the NSW EPA, as the LTEMP was modified, the previous SAR and SAS number 055-2127799 (and accompanying SAR) had to be reviewed to include the additional information presented in the updated LTEMP (ERM, 2021). A copy of the LTEMP (ERM, 2021) is presented in **Appendix F.** The original site audit report has been updated and relabeled with Rev A added as a suffix and a new site audit statement 055-2127799A issued.

The site audit details are presented in **Table 1**.

Table 1 Site audit details

Site auditor	Mr. Andrew Kohlrusch
NSW EPA site auditor accreditation nº.	0403
NSW EPA site audit statement nº.	055-2127799A
Audit category	Statutory
Legal property description	Part Lot 100 in DP 1168951 – as shown in the survey plan presented in Appendix A (referred to as the Stage 1 Area)
Council	City of Parramatta Council

Site area	6,998 hectares
Site owner	Viva Energy
Current land use	Vacant site
Proposed land use	Commercial and/or industrial

A figure showing the location of the WARP as well as the Stage 1 Area is presented in **Appendix A** (Figures F1 and F2 from Stage 1 Validation).

1.2 Purpose of this report

A site audit as defined in Part 1 Section 4 of the CLM Act 1997 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."

The purpose of the audit is to certify that the remedial works associated with the Site (referred to as the Stage 1 Area) were carried out in accordance with the endorsed Stage 1 RAP with the aim to render the Stage 1 Area suitable for future development in accordance with the zoning classification (IN3 heavy industrial) and complied with relevant Consent Conditions required by the DPIE.

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 1 RAP
- risks to human health and the environment have been addressed in accordance with the objectives of the Stage 1 RAP

1.3 Reports audited

Environmental investigations have been conducted at the Site over the past 17 years, culminating in a remedial action plan prepared by Environmental Resources Management Australia Pty Ltd (ERM) – *Clyde Western Area Remediation Project – Stage 1 Detailed "Remediation Action Plan",* Final V3 (June 2020 – the Stage 1 RAP).

The RAP was the subject of a site audit statement (043-2127799) and site audit report (*Viva Energy Clyde Western Area Remediation Project – Stage 1 - Durham Street, Rosehill, NSW – Site Audit Report*) issued by the auditor on 22 June 2020. The site audit statement confirmed that the Stage 1 RAP was appropriate in demonstrating the nature and extent of contamination and presented all procedures and place necessary to reduce risk to human health and the environment.

Remediation took place from September to November 2020. This SAR has been prepared following review of information presented in the following documents associated with the validation of the remedial works:

- ERM (2020f). *Clyde Western Area Remediation Project - Drainage Decommissioning Sampling Analysis & Quality Plan*, 2 November 2020 (**the Drainage SAQP**)
- ERM (2020g). *Clyde Western Area Remediation Project, Stage 1 – Validation Report*, 10 December 2020 (**the Stage 1 Validation**)
- ERM (2020h). *Clyde Western Area Remediation Project, Stage 1 Stage 1 Drainage Decommissioning Validation Report*, 21 December 2020 (**the Drainage Validation**)
- ERM (2020i). *Clyde Western Area Remediation Project, Stage 1 Long Term Environmental Management Plan*, 17 December 2020 (**the LTEMP**)
- ERM (2021). *Clyde Western Area Remediation Project, Stage 1 Long Term Environmental Management Plan*, 29 January 2021 (**the updated LTEMP**)

The key information presented in the following reports were considered by the auditor during review of the aforementioned reports:

- ERM (2020a). *Clyde Western Remediation Project, Remediation Site Investigation,* dated 7 February 2020 (**the RSI**)
- ERM (2020b). *Clyde Western Area Remediation Project, Human Health and Ecological Risk Assessment*, dated 16 February 2020 (**the HHERA**)
- ERM (2020c). *Clyde Western Area "Remediation" Project, Stage 1 - Detailed Remediation Action Plan*, dated 4 June 2020 (**the Stage 1 RAP**)
- ERM (2020d). Clyde Western Area Remediation Project, Stage 1 - Remedial Options Analysis, dated 3 June 2020 (**the ROA**)
- ERM (2020e). *Clyde Western Area Remediation Project, Stage 1 Air Emission Verification Report*, dated 26 May 2020 (**the AEVR**)

Copies of relevant interim audit advice letters (IAAs), as well as the consultant's response (where relevant) are presented in **Appendix B** of this SAR.

1.4 Proposed and permitted land uses

The Stage 1 Area is zoned IN3 – Heavy Industrial under the Parramatta Local Environmental Plan 2011. The uses which are permissible use under the current zoning (with consent) include:

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.

1.5 Site visits

The auditor has conducted a visit to gain an understanding of the site conditions and surrounding area. During the site inspection on **27 April 2020**, the auditor observed the features of the Stage 1 Area and discussed with Viva Energy the work that was being planned for the forthcoming remediation and the drainage decommissioning works.

All above ground structures had recently been demolished. The site surface largely comprised bitumen and concrete sealed surfaces. The site sloped gently towards Duck River to the south. There were some depressions owing to either removal of some infrastructure or associated with the pipe tracks and/or drainage network. No water was noted in any of the depressions.

There was no storage of chemicals. A disturbed area associated with the excavation of soil associated with the remedial trials conducted in late 2019 was visible in the northern portion of Stage 1 Area.

The auditor visited the site on **20 October 2020** during the remedial works. At the time of the visit, excavation was taking place in the southern half of AEC9. Stockpiles had been created in an area to the immediate south of the excavation and had been segregated based on visual and olfactory evidence of hydrocarbon contamination. There was a slight odour near the stockpiles which was not noticeable at a distance of 20 metres. No odour was noted emanating from the excavation.

The base of the excavation at the time (about 1.5 metres below the surrounding area) comprised hard, mottled grey/red clay, deemed to be residual, weathered shale bedrock that underlies the Site. No water had entered the excavation during the remedial works, but there were some puddles from recent rainfall that that fallen on the excavation. There was no evidence that this rainwater was seeping through the clay.

Once contaminated soil had been removed from the area, it was relatively easy to identify the vertical extent of contamination as there was little evidence that the hydrocarbons had seeped into the underlying clay. The were some footings in the excavation that still had some of the historical formwork in place. The formwork appeared to be corrugated asbestos

1.6 Regulatory context

Following the announcement of the closure of the former Clyde Refinery, on 22 June 2012, the NSW EPA issued a Preliminary Investigation Order (Number 20121001) to Viva Energy under the CLM Act requesting reports on environmental contamination.

Following receipt of a number of reports, in June 2016, the NSW EPA declared Lot 398 DP41324, Lot 2 DP224288, Lot 1 DP383675, Lot 101 DP809340 and Lot 100 DP1168951 (which includes the WARP) as contaminated land under the CLM Act (Declaration Number 20131110).

1.6.1 Conditions of Development Consent

The DPIE granted the Development Consent on 7 May 2020 for the remediation of contaminated soils and management of contaminated groundwater to enable future commercial and industrial land uses subject to conditions. The conditions imposed on the Development Consent (from the audit perspective) require the following:

- *A2. The development may only be carried out:*
  - *(a) in compliance with the conditions of this consent;*
  - *(b) in accordance with all written directions of the Planning Secretary;*
  - *(c) in accordance with the EIS and RtS;*
  - *(d) in accordance with the Detailed RAP;*
  - *(e) in accordance with the Development Layout in Appendix 1. and*
  - *(f) in accordance with the management and mitigation measures in Appendix 2.*

Part B of the Conditions of Consent SSD 9302 specified the environmental conditions for the remediation, which included the following:

- *B1. Prior to the commencement of preparation works, the Applicant must prepare a Detailed RAP for the development, in consultation with the EPA and to the satisfaction of the Site Auditor and the Planning Secretary. The Detailed RAP must:*

- *(a) be prepared by a suitably qualified and experienced person in accordance with Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011). The auditor notes that this Guidelines was updated in April 2020 and are currently referenced as EPA (2020) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*
- *(b) be reviewed by the Site Auditor in accordance with the requirements of Condition B3.*
- *(c) be approved by the Site Auditor and Planning Secretary, prior to the commencement of preparation works.*
- *(d) be submitted to the EPA for reference once approved and prior to the commencement of preparation works.*
- *(e) detail all final remediation methods and technologies including layouts and design.*
- *(f) detail the decision protocol for determining which remediation method applies to different materials.*
- (*g) incorporate the recommendations of the Air Emissions Verification Report approved in accordance with condition B15.*
- *(h) include triggers for contingency actions and alternate treatment methods to ensure the remediation objectives are achieved.*
- *(i) detail all procedures and plans to be implemented to reduce risks to an acceptable level for the proposed final land use."*

- *B4. The Applicant must remediate the Western Area in accordance with the Detailed RAP prepared in accordance with condition B1, to the satisfaction of the Site Auditor. If any amendments are required to the Detailed RAP, the amendments must be approved by the Site Auditor.*
- *B6. Within six months of the completion of demobilisation, or as otherwise agreed with the Planning Secretary, the Site Auditor must submit a Validation Report to the EPA, Council and the Planning Secretary. The report must be prepared in accordance with relevant guidelines produced or approved under the CLM Act.*
- *B7. Within 12 months of the completion of demobilisation, or as otherwise agreed with the Planning Secretary, the Site Auditor must submit a Site Audit Report and Section A, Site Audit Statement to the EPA, Council and the Planning Secretary. The reports must be prepared in accordance with relevant guidelines produced or approved under the CLM Act and must confirm:*
  - *(a) the remedial works approved under this consent have been completed in accordance with the remediation objectives listed in the Detailed RAP;*
  - *(b) the risks to human health and the environment have been addressed in accordance with the objectives of the Detailed RAP.*
- *B8. Prior to the finalisation of the Site Audit Statement and Site Audit Report, required by Condition B6, the Applicant must prepare a Long Term Environmental Management Plan (LTEMP) for the development, to the satisfaction of the Site Auditor and the Planning Secretary.*
- *B9. The LTEMP must*:
  - *(a) be prepared in consultation with Council and the EPA;*
  - *(b) identify where the LTEMP applies and who is responsible for implementing the LTEMP;*
  - *(c) detail how the LTEMP will be implemented, including corrective actions and reporting requirements;*

- *(d) recommend any systems/controls to be implemented to minimise the potential for any material harm;*
- *(e) include a groundwater monitoring program to verify natural attenuation is occurring over time, consistent with the requirements of condition B21;*
- *(f) include biodiversity management measures for the Green and Golden Bell Frog, consistent with the Revised Plan of Management: Restoration of Green and Golden Bell Frog Habitat, Clyde Terminal, January 2019, or its latest version;*
- *(g) detail procedures for managing and monitoring any remaining contamination, including triggers that would indicate if further management or remediation is required;*
- *(h) detail procedures for managing and monitoring any remaining contamination that has potential for off-site migration so that it does not present an unacceptable risk to either the on-site or off-site environment;*
- *(i) include measures to be implemented if any parts of the remediated area are required to be physically disturbed;*
- *(j) describe any required planning controls for future development that may interact with any remaining contamination at depth;*
- *(k) incorporate a programme for ongoing monitoring and review to ensure that the LTEMP remains contemporary with relevant environmental standards;*
- *(l) include mechanisms to report results to Council and the EPA;*
- *(m) be written in plain language to be understood by all personnel involved in the maintenance activities on the site.*

- *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."*
  - *(b) Clyde Western Area Remediation Project (SSD-9302) – Remedial Staging*

1.6.2 Clyde Western Area Remediation Project (SSD-9302) – Remedial Staging

Viva Energy has entered an agreement with VE Property Pty Limited (VE Property) to sell the Western Area to VE Property. VE Property has entered into an agreement with Downer EDI Works Pty Ltd (Downer) to sell the Stage 1 Area (the Site) to Downer for the purpose of enabling Downer to construct and operate an asphalt production facility, a construction material recycling facility, a road detritus processing facility and a bitumen products manufacturing facility.

Viva Energy therefore reviewed it's approach to remediating the Western Area and decided to conduct the remediation in three stages (based on geographical portions of the Western Area) and informed DPIE of it's intent (letter of 19 May 2020) as per Condition A9 of the Development Consent. The correspondence to DPIE stated that all relevant documentation required by the Conditions of Consent for the WARP will be submitted for all stages. This audit report for the Stage 1 Area has been prepared to meet this obligation.

1.7 SAR structure

This SAR documents the audit of the relevant environmental works conducted by the consultants presented in the referenced reports shown in **Section 1.3 Error! Reference source not found.**. Where the auditor has provided comments on the work completed by the

consultants these are highlighted in blue shaded dialogue boxes. The remainder of this report is organised as follows:

Section 2 Site conditions and environmental setting

Section 3 Site history

Section 4 Contaminants of potential concern

Section 5 Previous investigations

Section 6 Validation criteria

Section 7 Data quality objectives

Section 8 Stage 1 RAP

Section 9 Remedial and validation works

Section 10 Data quality assessment

Section 11 Conceptual site model

Section 12 Other considerations

Section 13 Compliance with regulatory requirements

Section 14 Long term environmental management plan

Section 15 Auditor's opinions and conclusions

Section 16 Disclaimer

1.8 Limitations of this report

The information and opinions given in this SAR are based on reviewing information presented in the documentation referenced in **Section 1.3.** and other supporting information provided by Viva Energy and the consultant.

The auditor has not carried out any independent investigations in relation to the condition of the site. This audit is subject to the limitations presented in **Section 16** of this report.

The auditor assumes no responsibility or liability for any errors or omissions in the information provided in the reports reviewed or that the consultant did not confer any reliance on the reports to the auditor.

The purpose of the audit is to certify that the remedial works associated with the Stage 1 were carried out in accordance with the endorsed Stage 1 RAP in order to render the Stage 1 area suitable for future development in accordance with the zoning (IN3 heavy industrial) and to comply with relevant Consent Conditions required by the DPIE as previously discussed in **Section 1.6**. No other warranties, expressed or implied, are made.

This SAR relates only to the subsurface to define the nature and extent of contamination at the site, and related identified off-site impacts from surface water, groundwater or soil vapour. It does not comment on the evaluation of geotechnical issues or any other issues associated with the site.

1.9 Guidelines used

This SAR was prepared with reference to the following statutory legislations, guidelines and/or standards which have been endorsed for use by NSW EPA:

- NSW EPA, 2020. *Contaminated sites: Guidelines for Consultants Reporting on Contaminated sites* (**the Consultant Guidelines**)

- NSW EPA, 2020. *Assessment and Management of Hazardous Ground Gases* (**the Ground Gases Guidelines**)
- HEPA, 2020. *PFAS National Environmental Management Plan*, Heads of EPAs Australia and New Zealand (**the HEPA**)
- ANZAST, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
- CRC CARE, 2018. *CRC for Contamination Assessment and Remediation of the Environment, National Remediation Framework, Guideline on Performing Remediation Options Assessment*
- NSW EPA, 2017. *Contaminated Land Management: Guidelines for the New South Wales Site Auditor Scheme (3rd edition)* (**the Auditor Guidelines**)
- NSW EPA, 2016. *Addendum to Waste Classification Guidelines (2014) - Part 1: classifying waste*
- NSW EPA, 2015a. *Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW EPA, 2014. *Waste Classification Guidelines Part 1: Classifying Waste, NSW EPA* (**the Waste Guidelines**)
- 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 ASC NEPM**)
- EnHealth, 2012. *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards*, Department of Health and Ageing and enHealth Council, Commonwealth of Australia
- NSW DEC, 2007. *Guidelines for the Assessment and Management of Groundwater Contamination* (**the Groundwater Guidelines**)
- NSW EPA, 1995. *Sampling Design Guidelines*

2. Site conditions and environmental setting

2.1 Site identification

The following information is derived from the Stage 1 Validation. The Stage 1 Area is located within the former Process West Area and extends from Devon Street in the north to the Duck River at the southern boundary of the WARP.

A site location plan and a site layout are provided in **Appendix A** (Figures F1 and F3 from Stage 1 Validation). The site identification information is summarised in **Table 2**.

Table 2 Site location

Site identification:	Stage 1 Area
Site area:	6.998 hectares
Local Government Authority	City of Parramatta Council
Lot, section and deposit plan (DP):	Part Lot 100 in DP 1168951 a survey drawing is included in Attachment A.
Site occupant:	Viva Energy
Current land use:	Vacant site
Proposed land use:	Commercial/industrial
Land use zoning:	IN3 – Heavy Industrial under the Parramatta Local Environmental Plan 2011

2.2 Former site description

The Stage 1 Validation described that the Stage 1 Area, which comprises the Former Process West Area is currently a vacant site. The following was noted by ERM on 22 January 2020:

- Concrete and bitumen hard standing was present across most of the Site prior to remedial works
- Aboveground pipework remained within the pipe tracks bordering the west and northern extent of the former Process West footprint
- Corrugated Plate Interceptor units remain at the ground surface. The location of these interceptors is shown in **Appendix A** (Figures F2 and F3 from Drainage Validation)
- The Central Control Room building had been demolished, leaving an open void with concrete walls and base within the former basement area of approximately 50 metres x 18 metres which extended approximately three metres below the surrounding surface level
- A large stockpile of building and demolition waste situated in the Western portion of the Site. This stockpile occupied an approximate footprint of 1,100 m^2 with an average height of two metres (approximately 2,200 m^3)

2.3 Topography and drainage

The Stage 1 Validation reported that the surface of the WRAP has been reshaped over time with the use of imported fill material, to provide a relatively flat surface. Surface water and runoff is directed towards the drainage network, which comprises the following:

- Clean water drainage system that discharges direct to the Parramatta and Duck Rivers
- Accidentally Oil Contaminated (AOC) and a Continually Oil Contaminated (CC) drainage network

The RSI described that the Duck River is lined with mangroves adjacent to the Western Area, however, was considered a moderately disturbed catchment. As reported by ERM in it's RSI 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 LGA where stormwater flows within a series of storm water pipes and open concrete drains.

The downstream extent of the Duck River converges with the Parramatta River at the north-east boundary of the Site. Parramatta River is the major tributary of Sydney Harbour located approximately 15 kilometres downstream of the Site which, in turn, discharges into the Pacific Ocean.

2.4 Geology

The RSI reported that based on historical intrusive works, the average thickness of fill material within the Site is 0.6 metre which is underlain by high plasticity clay (alluvial sediments).

Localised areas of backfill sand had been identified surrounding subsurface footings and structures to a depth of two metres below ground level (mbgl).

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 RSI reported that no estuarine sediments had been identified within soils during previous intrusive investigations within the Site. ERM in the Stage 1 RAP concluded that given the absence of such sediments across the Stage 1 area, the probability of encountering ASS or Potential Acid Sulfate Soils (PASS) was considered low.

During the site visit of 20 October 2020, the auditor noted that the soil profile encountered during the excavation in AEC9 comprised a layer of fill at the surface (to a depth of 0.5 metres) composed of clay and stones. The soil beneath the fill layer was a stiff to very stiff clay, mottled red/grey and extended to the base of the excavation (about one metre thick).

A photograph showing the soil profile is presented as follows (the water observed in the photograph was rainwater that had accumulated in the excavation).

2.5 Hydrogeology

A summary of the hydrogeology relevant to the Site presented by ERM in its RSI is summarised in **Table 3**.

Table 3 Hydrogeology – Stage 1 Area

Information	Outcome
Groundwater Depth	The groundwater is represented as a shallow unconfined water bearing zone within the fill material at depths between one to three mbgl. The referential pathways for groundwater flow have been identified by ERM (ERM 2020a) within sandy lenses in the fill including anthropogenic structures, such as the on-site storm water drainage network. No groundwater was encountered during the remedial works apart from inflow at a depth of approximately 1.5 to 2 mbgl.
Groundwater Flow Direction	The inferred groundwater flow direction based upon the numerous gauging activities that have taken place is towards the Duck River to the south and south-east.
Hydraulic Gradient	The average hydraulic gradients calculated ranged 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. ERM concluded that hydraulic gradients were found to increase with proximity to the Duck River.
Hydraulic conductivity	The RSI reported that the hydraulic conductivity has been established to be low across the large majority of the Western Area, with estimated hydraulic conductivity values for wells that were screened across clay, sandy clay and gravelly clay typically ranging from 5x10-5 m / day to 4x10-2 m/day (close to the Duck River). Historical data demonstrates that the laterally continuous higher hydraulic conductivity lithological units are not expected to be encountered within the Site.
Conclusions	It was reported in the RSI that based upon the understanding of geology and hydrogeology at the Stage 1 Area, the lateral migration potential of Chemical of Potential Concern (CoPC) in groundwater was limited by the low permeability of the lithology, relatively flat hydraulic gradient and low average groundwater velocity. This was supported by the limited extent of impacted groundwater, indicating that, where present, areas of impacted groundwater are relatively stable and do not appear to be migrating. ERM stated that this observation is supported by soil analytical results indicating that CoPC in soil samples collected from the clay layer (or at depths greater than two mgbl) as part of the validation program did not exceeded applicable screening criteria.

The auditor considered that the information presented by ERM in the Stage 1 Validation as well as in previous reports outlined in **Section 1.3** provided an appropriate description of the Site as well as the local environment setting. The Stage 1 Validation also outlined a detailed summary and understanding of site geology and hydrogeology that provided a basis for understanding these elements of the conceptual site model (CSM) and influences on impacts of contaminant distribution and mobility.

The Site description as well as the immediate surrounding land uses reported in the Stage 1 Validation as well as in the previously reports was consistent with the auditor's observations made during his site visits (discussed in **Section 1.5**).

The key potential ecological receptor observed within or immediately adjacent to the Site is the Duck River. The auditor noted there is no complete Source - Pathways - Receptor (SPR) Linkages between the Duck River and the Stage 1 Area, as previously discussed in the PFAS Conceptual Site Model and Flux Assessment Report (ERM 2018).

The auditor considered that the information provided by ERM in it's Stage 1 Validation was largely in accordance with the Schedule B2 of the ASC NEPM (NEPC 2013) and the Consultant Guidelines (NSW EPA 2020).

3. Site History

3.1 Land use

AECOM in the Conceptual RAP (AECOM 2019) described that the site was originally included as part of an 850-acre land grant by the Crown to John Macarthur. In 1908, a parcel of 140 acres of land was transferred to the Commonwealth Oil Corporation (COC). The COC struck financial difficulties and went into receivership. In 1913 the land was then acquired from COC by John Fell and Co.

The new owner began purchasing crude oil to refine at Clyde and refining commenced in 1926. In 1928, Shell Refining Pty Ltd took over as owner and operator of the site. Shell purchased an additional seven acres of land and a further 150 acres in June 1930. The duration of the first stage of expansion of the site was from 1929 to 1939 with the purchase and construction of new equipment and buildings, increasing the crude product intake to approximately 250 tonnes/day by 1934.

The former Clyde Refinery operations primarily comprised the receipt and refining of crude oil and finishing product piped from the Gore Bay Terminal until cessation of refining activities in 2012. Since the completion of refining operations, the former Clyde Refinery has been partially utilised as a terminal (herein known as the Clyde Terminal), which primarily involves the receipt, storage and distribution of finished petroleum products.

3.2 The Clyde Terminal

Since the cessation of refining operations in 2012, the Clyde Terminal continues to receive finished petroleum products from the Gore Bay Terminal via an existing product transfer pipeline and distributes the products by separate pipelines from the Clyde Terminal to the adjacent Parramatta Terminal.

A figure showing the Clyde Terminal location is presented in **Appendix A** (Figures F1 and F2 from Stage 1 Validation).

3.3 The Western Area

Following completion of the Clyde Terminal Conversion Project (authorised by development consent SSD 5147), the Western Area was no longer required for operational purposes. The three stages of remedial works proposed for the Western Area in accordance with the Development Consent is aimed at rendering it suitable for future commercial and/or industrial land use.

A figure showing the location of the Western Area is presented in **Appendix A** (Figures F1 and F2 from Stage 1 Validation).

3.4 Stage 1 Area (the Site)

The Site comprises Part Lot 100, DP1168951 at Devon Street, Rosehill, a figure of which is shown in **Appendix A** (Figure F2 from Stage 1 Validation).

The Stage 1 RAP documented that the plant decommissioning, decontamination and above grade demolition activities of the majority of above-ground infrastructure within the Western Area, including the Stage 1 Area, was completed between 2012 and 2016.

Demolition of the final remaining above ground infrastructure (Western Tank farm, Tank farm C and remaining pipe track areas) was completed in early 2020 prior to commencement of the remedial works in the Stage 1 Area.

Within the boundaries of the Stage 1 Area, the following features associated with former refining operations existed and operated since approximately 1960 prior to demolition. These features are shown in **Appendix A** (Figure F3A from Stage 1 Validation):

- Former Process West – Aboveground fuel processing infrastructure including a Distillate splitter unit, crude oil distillate units, Central Control Room
- Tank Farm H – formerly containing Aboveground Storage Tanks (ASTs) 501 – 505, formerly storing various grades of bitumen and wash oil
- Drainage infrastructure and associated oil-water interceptor units.

The auditor considered that the site's primary historical usage which had the potential to result in soil and groundwater contamination was the storage and processing of petroleum hydrocarbons, the substation units and the local drainage and associated oil-water interceptor units.

The auditor noted that most of the former infrastructure within Stage 1 Area was aboveground, including the drainage infrastructure, Tank farm H and Former Process West, which is expected to have mitigated soil and groundwater impacts.

The Distillate splitter unit, which was closely associated with AEC9 had some underground pipework.

4. Contaminants of potential concern

The Stage 1 RAP identified that the primary sources of soil and groundwater contamination were associated with the decommissioned/removed refinery processing infrastructure. The mechanism of release from these former primary sources was at the ground surface due to storage and transfer of petroleum manufacturing product primarily within aboveground infrastructure. The Stage 1 RAP identified the following CoPC:

- Total recoverable hydrocarbons (TRH) C8-C12 aliphatic fractions
- TRH C10-C16 aromatic fractions
- BTEXN and TRH C16-C40 (these chemicals have been selected as a precaution as their presence at levels greater than nominated screening levels has not been detected in Stage 1 Area soils)

During the removal of contaminated soils from AEC9, suspected asbestos formwork was identified around some of the concrete footings. This was treated as an unexpected find and managed accordingly, including the surveying of the locations and recording this information in the updated LTEMP.

Based on the long-term use of the site and considering previous monitoring results, it is the auditor's opinion that the suite of analytes selected to be remediated is appropriate.

A summary of previous works and principal findings is discussed in **Section 5** this SAR and in **Appendix D**.

5. Previous investigations

A summary of relevant background data which has informed preparation of the Stage 1 RAP is summarised in **Appendix D**. A summary of the Remedial Option Analysis (ROA), the Air Emission Verification Report (AEVR) and the Drainage Decommissioning SAQP are summarised below.

5.1 Requirements for remediation

In the SAR prepared for the Stage 1 RAP, the auditor presented the following summary of the remediation drivers:

- *The potential for indoor inhalation of vapours by future on-site commercial workers from hydrocarbon impacted soil and LNAPL within the northern portion of the former Process West plant area (AEC9).*

These exceedances are shown in **Appendix A** (Figures F6A, F6B, F6C and F7 from Stage 1 Validation). **Table 4** presents a summary of the remediation requirements.

Table 4 Requirements of remediation – Stage 1 Area

Matrix	CoPC requiring remediation	Comments
Soil	TRH C8-C12, TRH C8-C12 and TRH C10-C16	Not applicable
Groundwater (LNAPL)	TRH C6-C10 (Less BTEX)	Single exceedance during groundwater sampling of MW12/16 in December 2012. Sample collected is representative of LNAPL, based on the noted presence during sampling.
Soil Vapour	Naphthalene	Naphthalene concentrations considered to be associated with residual LNAPL at the level of groundwater, rather than overlying soils based on soil data.

The auditor recognised that the understanding of the site history led to the selection of the distribution of the sampling locations used to characterise the nature and extent of contamination within Stage 1 Area.

The identification of the key drivers for remediation were based on this characterisation. However, as noted by the auditor in IAA04 issued on 5 May 2020, given the size of the Stage 1 Area and the number of sampling locations that have been used to characterise this area, it would be prudent to include as part of the validation program a series of sampling points in areas where there was a paucity of data.

The results of the additional sampling at 10 locations around the Site was documented in the Stage 1 Validation report.

5.2 Remedial options analysis

In planning the remedial works for the Site, ERM prepared a ROA. This was prepared for the entire Western Area and included the following scope:

- Review of previous investigations/risk assessments undertaken within the site detailing site specific environmental conditions and the nature and extent of contamination within the WARP
- Definition of remedial goals based on the CSM and LNAPL CSM presented in the RSI and SSTLs derived in the HHERA
- Calculation of the required remedial extent and volume of material for each AEC based the risks outlined in the HHERA
- An assessment of potential remedial options using the criteria of effectiveness, timeframes, health and safety, sustainability, cost and in consideration of NSW EPA regulatory guidance relating to remedial hierarchy
- An assessment of the preferred remedial strategy for each AEC based upon information presented within the assessment of options

5.2.1 Estimated remedial volumes

The ROA stated that estimates of the volume of material requiring remediation and/or management were based on the locations of the contaminated soils, the fill thicknesses from available borelogs and field density measurements of the encountered materials.

For the Stage 1 Area, the remedial design would entitle an excavation of contaminated soil in AEC-9 to a depth of approximately 1.5 metres. The total estimated excavation volume was approximately 4,000 m^3.

5.2.2 Preferred remediation approach

In relation to the contaminated soils in Stage 1 Area, ERM stated in the ROA that on-site treatment (biopiling) and the subsequent on-site reuse of soils from AEC9 was the preferred remedial strategy. This option was selected based on the following considerations:

- It was more sustainable approach than off-site disposal or other technologies, such as thermal treatment. Additionally, on-site treatment meets the principles of waste minimisation and sustainable development. Following completion of biopiling, the material would either be re-used on-site or disposed off-site to a suitably licensed receiving facility
- Identified contamination within the WARP does not pose a risk to off-site receptors, as outlined within the HHERA
- LNAPL in groundwater was identified to be degrading, stable and not migrating off-site. Therefore, it was considered by ERM suitable for management via Monitored Natural Attenuation (MNA)

It was the auditor's opinion that the ROA was developed in a manner consistent with guidance provided in the CRC CARE (2018) *Guideline on Performing Remediation Options Assessments*, considering relevant Australian and international guidance. Additionally, the hierarchy for site clean-up and/or management outlined in the ASC NEPM (NEPC 2013) was considered by ERM during its analysis.

5.3 Air emissions verification report

The AEVR provided an assessment of air emission control requirements for the Stage 1 Area remediation. This was a requirement of Conditions of Consent B15 and B16 of the SSD 9302 issued by the DPIE on 7 May 2020. The AEVR noted that with implementation of a staged remediation approach, a separate AEVR (or multiple AEVRs) will be prepared for each remedial stage. The AEVR prepared by ERM included the following information:

- The AEVR process, with direct reference to the relevant conditions of consent;
- Description of the Stage 1 Area remediation, including remediation processes and final selected remediation approach
- Characterisation of potential air emissions, including Volatile Organic Compound (VOC), odour and principal toxic pollutants
- Benchmarking of relevant emission controls including a detailed description of controls and management measures relevant to each remedial method and associated activities
- Evaluation of consistency between the proposed Stage 1 remediation and the air quality studies prepared for the EIS and Response to Submissions (RtS) for the WARP
- Conclusions regarding the necessary emissions controls for the Stage 1 Area remedial works

5.4 Remedial trials

Based on the recommendations in the ROA, a series of remedial trials on the contaminated soil identified on the Site were conducted between October 2019 and January 2020. The remedial trials comprised:

- Generation of four separate 100 m^3 soil stockpiles (SP1 to SP4 designed to monitor treatment of C6-C15 hydrocarbon fractions) and three 10 m^3 stockpiles (SP5 to SP7 designed to monitor treatment of C15-C40 hydrocarbon fractions) using material excavated from the eastern portion of AEC-9. ERM stated that this material was selected as it was the most contaminated material within AEC-9 and was suitable for the evaluation of the ability of biopiling to break down hydrocarbon contamination.
- The stockpiles comprised:
  - Two 100 m^3 biopiles. SP1 had no additives, while nitrogen fertiliser was added to SP2
  - Two 100 m^3 stockpiles for ex-situ land farming: Nitrogen fertiliser was added to SP3 while nitrogen and mulch was added to SP4. SP5 to SP7 were used to evaluate treatment of C15-C40 hydrocarbon fractions. Combinations of nitrogen fertiliser or nitrogen fertiliser/mulch were added to SP5 to SP7

5.4.1 Remediation trial results

ERM reported in the AEVR the following findings from the remediation trials:

- A reduction of TRH F1 concentrations to less than SSTLs following soil handling, homogenisation and stockpiling activities. The SSTLs (ERM, 2020b) are presented in **Appendix C**.
- Volatile TRH fractions (C6-C16) decreased throughout the eight-week trial, as shown in Figure 1

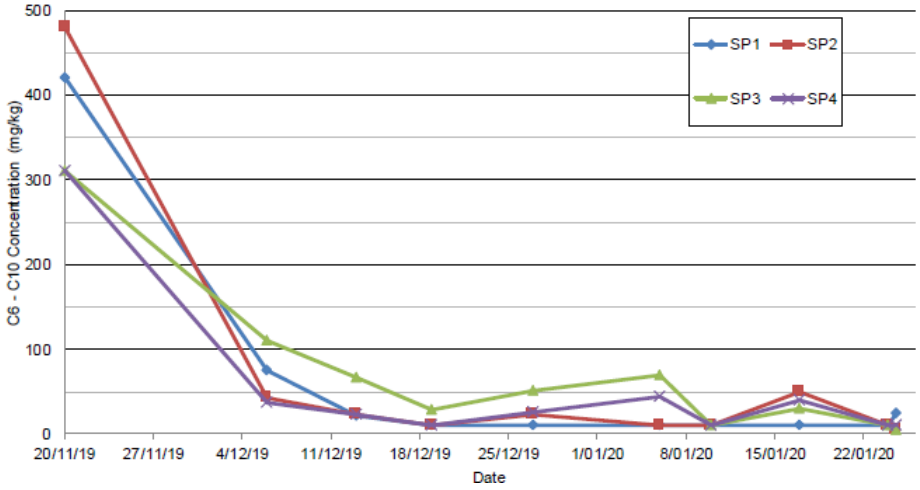

Figure 1 C6-C10 TRH concentrations measured during biopiling remediation trials

- Longer TRH fraction concentrations were variable following an initial decrease. With silica gel clean-up TRH analysis, decreasing trends of heavier chain hydrocarbon concentrations were measured in the final four weeks of the remediation trial period
- Indigenous populations of hydrocarbon utilising bacteria were identified in site soils;
- No distinct differences in hydrocarbon degradation rates were identified between stockpiles with nutrient amendments over the eight-week period of the trial
- Reductions of longer TRH fractions increased bacterial populations and an increase in ratio of polar biodegradation metabolites over the course of the trail suggest that the process of biodegradation was occurring
- Excavated soil from AEC-9 could be treated to be less than the unrestricted on-site reuse criteria (i.e. ASC NEPM management limits for TRH)

5.5 Remediation trial ambient air quality monitoring

The AEVR documented the outcome of monitoring of VOCs in ambient air during excavation and biopiling of material from AEC-9 as part of the remediation trials. These data were considered by ERM the most relevant in defining potential air emissions from for the larger scale remediation of Stage 1 Area due to the following:

- *The monitoring was conducted during handling and treatment of material from within AEC 9.*
- *The monitoring was conducted during excavation, stockpiling and biopiling activities that are consistent with the type and scale of processes and methods proposed as part of the Stage 1 remediation.*
- *Samples were collected in evacuated canisters and analysed using the US EPA TO-15 methodology, with analysis for a broad range of petroleum hydrocarbons. These included those identified in soil, groundwater, and soil vapour as well as those considered in the AQIA and the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (the Approved Methods), EPA (2017).*
- *Real time monitoring was also undertaken using Photo-Ionisation Detectors (PIDs), to provide an understanding of temporal variations during the monitoring period.*

5.5.1 Ambient air quality monitoring results

Ambient air monitoring of excavation activities was conducted over a three-hour period during the excavation of approximately 600 m^3 of soil at AEC-9 on 7 November 2019. The material was excavated from the eastern portion of AEC-9 and stockpiled to the west of the excavation area. Ambient monitoring was carried out at five locations (AS_00A, AS_01A, AS_02S, AS_03A and AS_04A) including an upwind sample (AS_00A) to provide information on potential interference from upwind sources.

Four downwind samples were collected (AS_01A - AS_04A) which were located at increasing distances from the excavation activities. Figure 2 shows these monitoring locations relative to the excavation area (orange square).

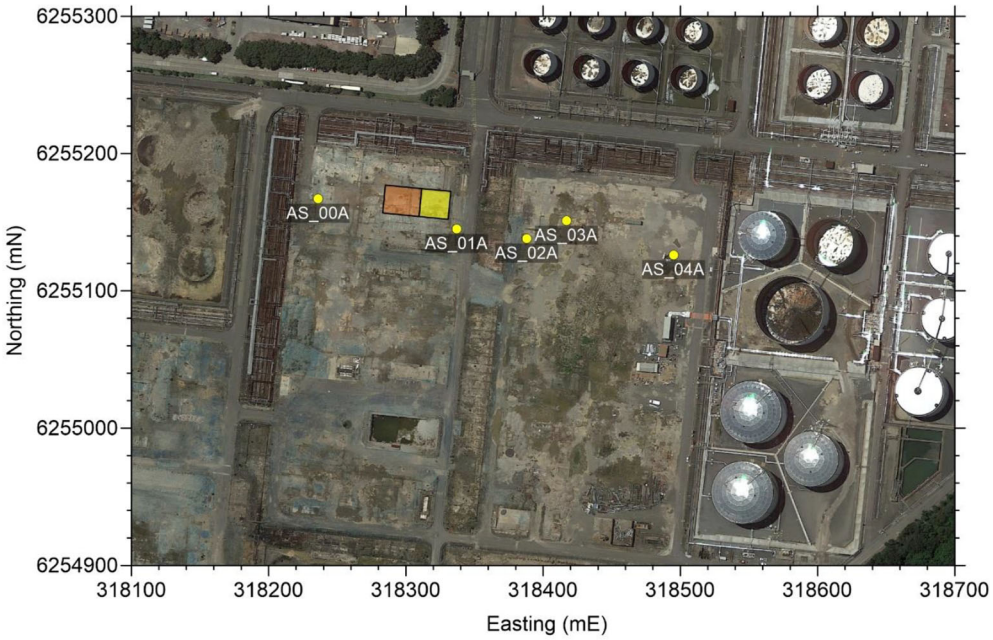

Figure 2 Remediation trial excavation area

Air quality was measured with a Photo-Ionisation Detector (PID) as well as samples collected using Summa canisters. ERM reported that ambient VOCs concentrations decreased significantly with distance from the remediation trial excavation area, with all compounds below the LOR 165 metres from the excavation area.

Hydrocarbon odours representative of diesel oil were observed during the excavation process. However, no odours were observed beyond 165 metres from the excavation. **Table 5** provides a summary of monitoring results for both canister sampling and PID measurement methods.

Table 5 Summary of BTEXN and TRH concentrations

Compounds	Monitoring location				
	AS_00A (upwind)	AS_01A (excavation)	AS_02A (60 m downwind)	AS_03A (85 m downwind)	AS_04A (165 m downwind)
Evacuated Canister (TO-15) (µg/m³)					
Benzene	<1	<1	<1	<1	<1
Toluene	<2	4	2	3	<2

Compounds	Monitoring location				
	AS_00A (upwind)	AS_01A (excavation)	AS_02A (60 m downwind)	AS_03A (85 m downwind)	AS_04A (165 m downwind)
Ethylbenzene	<2	11	3	3	<2
Xylenes	<5	34	7	6	<5
1,2,4-Trimethylbenzene	<2	108	26	16	<2
1,3,5-Trimethylbenzene	<2	29	7	<2	<2
n-Hexane	<1	8	6	<1	<1
Naphthalene	<41	2,096	335	110	18
PID (ppm isobutylene equivalent)					
TVOC	NA	3.1	0.11	0.06	NA

5.5.2 Biopile ambient air sampling

The AEVR reported that monitoring of ambient air quality during the biopile turning was conducted over a one-hour period on the 19 December 2019. During this period, westerly winds were observed, and both biopiles SP3 and SP4 were turned using an excavator. Figure 3 shows the location of the biopiles and air sampling locations.

Ambient monitoring was undertaken at three locations including an upwind sample (AS_00C) to provide information on potential interference from upwind sources. Two downwind samples (AS_01C, AS_02C) were collected at increasing distances from the excavation activities.

ERM reported that only xylenes and trimethylbenzenes were recorded above the LOR in the air quality samples, with no reportable levels of benzene, toluene, ethylbenzene, hexane or naphthalene.

ERM concluded that the results were consistent with soil monitoring data, which did not record the presence of BTEXN above LOR after commissioning of the biopile. There was also a significant decrease in C6-C10 concentrations after commissioning. **Table 6** shows the summary of ambient monitoring results during biopile turning.

Table 6 Summary of ambient monitoring results during biopile turning

Compounds	Monitoring location		
	AS_00C (upwind)	AS_01C (7 m from SP4)	AS_02A (15 m from SP4)
Benzene	< 4	< 5	< 5
Toluene	< 7.5	< 7.5	< 7.5
Ethylbenzene	< 6	< 7	< 6
Xylenes	< 18	29	< 19
1,2,4-Trimethylbenzene	< 7	64	< 7

[1] Naphthalene samples should be treated qualitatively. Due to the high molecular weight, laboratory noted significant difficulty with retention of naphthalene in the sample train. Reported results represent the highest values observed across three analytical runs. TVOC – Total Volatile Organic Compounds

Compounds	Monitoring location		
	AS_00C (upwind)	AS_01C (7 m from SP4)	AS_02A (15 m from SP4)
1,3,5-Trimethylbenzene	< 7	33	< 7
n-Hexane	< 5	< 5	< 5
Naphthalene	< 29	< 33	< 31

Figure 3 Location of biopiles (SP1 to SP4) and air sampling locations

5.5.3 Toxic pollutants assessment

ERM concluded that whilst benzene and toluene were detected in groundwater and soil vapour, they were only detected in trace quantities, i.e. close to the Limit of Reporting (LOR). These chemicals were not detected in excavated soil, or in ambient air in the immediate vicinity of the excavation of and surrounding soil, or during turning of the biopiles.

ERM noted that despite the dry conditions during the trial, the shallow depth to groundwater and the moist nature of soils both within the excavation and biopiling operations led to no observable generation of dust.

Hydrocarbon odours representative of diesel were noted during the excavation process; however, these odours were not observed beyond 165 metres from the excavation.

5.6 Qualitative risk – Stage 1 Area

The following aspects were noted by ERM in it's RSI based on the qualitative risk assessment:

- Significant buffer distances exist between all areas and adjacent non-industrial receptors

- The lowest unmitigated emission potential exists for the surplus material storage area, due to the small intermittent scale of operations, and handling of validated/clean material
- The highest unmitigated emission potential exists for the excavation area. However, the duration and scale of these operations is low, and the effectiveness of mitigation is high, which is considered indicative of a minimal risk of adverse air quality impacts with appropriate emissions management
- Management measures include those which are practical both for the management of emissions and progression of works and consider the concentrations of CoPC measured in air during the remedial trial

It is the auditor's opinion that the AEVR prepared by ERM provided an appropriate assessment of the releases of volatile chemicals generated during the biopiling trials conducted in the Stage 1 Area and what factors needed to be considered in relation to air emission management during full scale remediation.

The ambient air monitoring conducted during remediation trial excavations demonstrated that concentrations of VOCs (include BTEX and TRH compounds) decreased significantly with distance from the excavation area, with all VOCs below the LOR at 165 metres from the excavation area.

Although benzene was identified in excavation water samples collected from the trial pit, neither benzene nor any other principal toxic air pollutants were detected in ambient air in the immediate vicinity of the excavation, stockpiles or the biopiling area.

A range of emission controls were considered based on those identified in best practice references, and the risks associated with each remediation operation, as a function of the proximity, duration and intensity of the proposed activity, as well the practicality with which contingency measures can be implemented. On the basis of the air quality monitoring conducted during the treatment trial and the size and nature of the works that will be required to excavate the contaminated soil and form and operate biopiles, ERM did not identify the need to establish an emissions control enclosure.

The auditor stated in IAA09, that the AEVR provided sufficient lines of evidence to support that an emissions control enclosure within Stage 1 Area is not required, as measured ambient VOCs or any other principal toxic air pollutants were below LOR or not considered to pose an unacceptable risk to site workers and/or neighbouring receptors.

5.7 Drainage decommissioning plan

A Drainage SAQP was prepared that presented the strategy for the validation of the decontamination and decommissioning of the sub-grade COC and AOC drainage infrastructure in the Western Area that included the Site.

The decommissioning of redundant pipework was to demonstrate that sludge and/or oily water has been removed from this infrastructure. The approach to validating the decommissioning included the following:

- Reviewing the scope of drainage decontamination works completed by Ventia in 2018 and identifying data gaps to be addressed as part of the proposed decommissioning works

- Preparation of a planned approach to decontaminating and decommissioning the remaining Western Area sub-grade drainage infrastructure as well as defining the means by which validation and verification data will be collected for drains previously cleaned as well as the current drain cleaning/decommissioning program
- Development of a drainage validation SAQP program based on Ventia's proposed scope that details the data to be collected to validate that the decommissioning objectives are met

The auditor noted appropriate CoPC were selected to validate the presence/absence of chemicals that would have been present in the drainage network.

The scope of Ventia works for the planned in-situ decontamination and decommissioning of the sub-grade drainage infrastructure was presented in *Proposed Pipe Decontamination and Decommissioning Scope of Works* report, included in Appendix A of the Drainage SAQP. The data gaps identified by ERM following review of Ventia's report, as well as the proposed validation program is summarised below:

- Sub-grade Pipework decontamination: One gas test from each end of the pipe before and after cleaning. In-situ measurement of VOCs, Hydrogen Sulphide (H_2S) and Lower Explosive Limit (LEL)
- Pits and/or sumps and other in-ground infrastructure decommissioning: Visual inspection to confirm pit has been filled with sand and/or cement mix
- Pipework decontamination (above ground drainage): Visual inspection of surface drains to confirm removal of sludge
- Disconnection of Western Area drainage from wider Clyde Terminal and wastewater treatment plant: Visual inspection to confirm that all drainage exiting the Western Area and/ or contributing to the discharge to the Clyde Terminal wastewater treatment plant has been separated from the Clyde Terminal drainage network outside the Western Area
- Validating previously completed decontamination and decommissioning works: One gas test from each end of the pipe before and after cleaning. In-situ measurement of VOCs, H_2S and LEL
- Corrugated Plate Interceptors (CPIs): As per the requirements of the Stage 1 RAP (Walls – one sample per 10 linear metres and, Base - 10x10 metres offset grid pattern)
- CPIs where demolition is not possible: At least one test pit and soil sample per 10 metres length of CPI perimeter
- Compromised pipework: At least one test pit and soil sample per length of compromised pipework. One test pit and soil sample will be collected per 10 linear metres of compromised pipework
- Solid Waste (sludge): One sample per 50 m^3 of material. Laboratory analysis for CoPC, heavy metals, phenols and TCLP analysis (if required)
- The proposed data quality indicators and assessment criteria are to include the following:
  - Intra-laboratory and inter-laboratory samples: one sample for every 20 primary samples, with a minimum of one sample for each matrix type. Criteria: RPDs to be less than 30% for inorganic and organic analyses where the results of one or both values are greater than 10 times the limit of reporting. Where both values are less than 10 times the LOR, RPDs of less than 100% will be considered acceptable

– Rinsate blank samples (from an item of sampling equipment): one per day. Criteria: Concentrations of analytes to be less than the laboratory limits of reporting
– Trip spikes: one sample per batch for the soil investigation for BTEXN analysis. Criteria: Recovery of analytes in trip spikes to be within the range of 70% to 130%
– Trip blanks: one sample per batch for the soil investigation for BTEXN and volatile TRH analysis. Criteria: Concentrations of analytes to be less than the laboratory limits of reporting

6. Validation criteria

The HHERA discussed in **Appendix D** of this SAR, evaluated potential risks to off-site adjacent receptors as unlikely. The risk assessment derived SSTLs for vapour inhalation and direct contact were developed for the following receptors:

- Future commercial/industrial workers
- Future construction workers conducting intrusive works
- Future intrusive maintenance workers (IMW) conducting intrusive works

ERM reported that the SSTLs were developed for target CoPC which exceeded relevant Tier 1 assessment criteria for remediation and, management considerations along with the ASC NEPM HSLs for asbestos management and management limits for LNAPL. The TRH SSTLs were derived for specific aliphatic and aromatic hydrocarbons fractions.

ERM stated in the Stage 1 RAP that as certain remediation methods result in the breakdown of petroleum hydrocarbons that alters the fraction specific make-up (e.g. natural attenuation, bio-piling) the fraction specific SSTLs may be used in post-remediation validation. The risk assessment conclusions for residual potential risks that warrant consideration for remediation or management are summarised in this section.

Appendix C presents a table summarising the SSTLs for the site.

6.1 Remediation criteria

Applicable risk-based remediation criteria derived by ERM (2020b) for soils in the excavation bases and walls were as follows. ERM also adopted the same criteria for assessing reuse of bioremediated soils.

- Soil SSTLs (Direct Contact) for commercial workers, construction workers and intrusive maintenance workers
- Soil SSTLs (Vapour Intrusion) for commercial workers, construction workers and intrusive maintenance workers

In addition to these risk-based criteria, the following were to be used to assess the potential risks associated with the presence of LNAPL or residual TRH concentrations that may require management under a LTEMP.

- The visible presence of LNAPL or sheen in the walls or base of the excavation
- NEPM Management Limits for TRH, which may indicate the potential formation of LNAPL or potential for acute hazards if encountered

Given that the presence of contaminated groundwater was to be noted and managed under an LTEMP, no groundwater remediation criteria were nominated. The generation of soil vapours from groundwater with CoPC concentrations in excess of NEPM HSLs was evaluated further through direct soil vapour measurement or was assessed as part of the HHRA.

The remediation criteria nominated in the Stage 1 RAP were based on a robust CSM, the likely receptors for a commercial/industrial land use and the risk assessment methods presented in Schedule B7 of the ASC NEPM (NEPC 2013).

6.2 Waste disposal criteria

The Stage 1 RAP stated that off-site disposal of excavated materials was not required, but if it was, waste classification would be undertaken in accordance with the Waste Guidelines (NSW EPA 2014).

The nomination of NSW EPA criteria for waste classification should material need to be disposed off-site was appropriate.

7. Data quality objectives

ERM reported in the Validation that the Data Quality Objectives (DQOs) for the validation program have been developed in accordance with the ASC NEPM (NEPC 2013) and the Australian Standard AS4482.1 Guide to the Sampling and Investigation of Potentially Contaminated Soil. A summary of the DQOs presented by ERM in it's Stage 1 Validation is presented in **Table 7.**

Table 7 Data quality objectives

Step	Description	Outcomes
1	State the problem	ERM stated that the remediation objectives for the Stage 1 Area are: • *"Remediate the soil and manage groundwater within Stage 1 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; and* • *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. Particular focus is to be placed on ensuring the drainage system is designed to adequately support both the remediation period and post-remediation period."* ERM stated that the following will require validation to demonstrate the successful implementation of remediation works: • *"Soils from the walls and floors of excavation areas stockpiled soil materials originating from remediation excavations to confirm suitability for on-site re-use (before or following bio-remediation);* • *The footprint of temporary stockpiles, where applicable based on the validation strategy;* • *Imported fill materials (excluding construction and landscaping materials); and* • *Soil materials requiring off-site disposal."*
2	Identify the decisions	ERM stated that based on the remediation objectives, the following decisions must be made: • *Has the sub-grade drainage network been satisfactorily decommissioned and isolated from the wider drainage network?* • *Have remediation excavations removed contaminated soil and LNAPL to the extent practicable?*

Step	Description	Outcomes
		• *Is excavated soil material suitable for on-site re-use, or does it require further treatment (via biopiling) or off-site disposal?* • *Is imported fill material suitable for its intended purpose?*
3	Identify the information inputs	ERM stated that the inputs to make the above decisions included: • *Results from previous soil, groundwater and soil vapour sampling during previous investigations the HHERA.* • *Field observations and analytical data collected during of remedial trials.* • *Field observations made during remediation works for odours, NAPL, sheens, discolouration, asbestos and other indicators of potential contamination.* • *Field screening of soil material during excavation works for volatile organic compounds within the AEC-9 excavation.* • *Characterisation of contaminant conditions via visual screening and sampling of soil from excavations and stockpiled material and subsequent laboratory analysis of selected samples.* • *Assessment criteria presented in the HHERA (SSTLs) for Stage 1 Area.* • *Confirmation of acceptable data quality by assessment of QA/QC by comparison against DQIs.* • *Sampling and analysis methods: Field procedures and data collection will be consistent with all relevant guidelines made or approved by the NSW EPA.*
4	Defining the study boundaries	ERM stated that the Stage 1 Area is approximately seven hectares and is situated within the former Process West area of the WARP. The extent of the Stage 1 Area is shown in Appendix A (Figure F2 from Stage 1 Validation). The lateral extent of required remediation excavation is shown in Appendix A (Figure F6B from Stage 1 Validation). The vertical extent of remediation will be to an anticipated maximum depth of 1.5 mbgl. Temporal limits: The study comprises validation activities to be completed as part of the Stage 1 RAP scope of works. Constraints within the study boundaries are considered limited to the location and extent of sub-grade footings and associated concrete and footings, which will not be removed as part of excavation works.
5	Develop a decision rule	ERM developed the following analytical decision rules:

Step	Description	Outcomes
		• *Have remediation excavations been completed successfully and to the extent practicable?* • *Soil and soil vapour analytical data compared against adopted assessment criteria?* • *If concentrations of COPC in soil are reported equal to or below the adopted assessment criteria in samples collected from the base and walls of the AEC-9 excavation, the answer is "Yes".* • *If concentrations of CoPC are reported above the adopted assessment criteria in soil samples collected from the base and walls of the AEC-9. Excavation, the answer is 'No'. Further excavation to remove impacted soils and validation sampling would be required.* • *If LNAPL is present at the base of the excavation, Further excavation (to the extent practicable to remove impacted soils and validation sampling would be required.* Statistical analysis of data sets of chemical CoPC concentrations will be used as inputs, consistent with guidance in the ASC NEPM (NEPC 2013). The analysis shall include: • *95% upper confidence limit (UCL) of the arithmetic mean concentration of each analyte shall be less than or equal to the criterion.* • *The maximum concentration of each analyte shall be less than or equal to 250% of the criterion.* • *The standard deviation of each analyte shall be less than 50% of the criterion.* • *If any of these are exceeded, then the answer to the decision is "No".* Has the subgrade drainage network been decommissioned successfully and isolated from the wider drainage network? • *An appropriate lines of evidence approach to validation of drainage line decommissioning works will be prepared following a review and documentation of the previously completed drainage cleaning program undertaken by Ventia in 2018.* A detailed decommissioning scope would be developed by the contractor, after which a validation methodology could be prepared by the Validation Consultant for consideration by the auditor in the context of the Stage 1 Area Remediation Project. In addition to the validation of actions taken to address the presence of contamination that presence an unacceptable risk to human health, ERM also nominated the following decision rules for material to be brought onto site for the purpose of backfilling excavations:

Step	Description	Outcomes
		• *Is imported fill material suitable for its intended purpose?* • *Imported material will need to be assessed against criteria for VENM or ENM in accordance with the Waste Guidelines (NSW EPA 2014).*
6	Specify limits on decision errors	ERM stated that the acceptable limits on decision errors applied during the review of the results will be based on the DQIs of precision, accuracy, representativeness, comparability and completeness (PARCC) in accordance with the ASC NEPM (NEPC 2013). 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.* • *Ensuring that the criteria set was appropriate for continuing use consistent with current and proposed usage under the sites zoning (IN3 – Heavy Industrial).*
7	Optimisation of the design for obtaining data	ERM stated that the DQOs were developed based on a review of existing data and discussions with relevant project stakeholders, including Viva Energy and the auditor. If data gathered during the assessment indicates that the objectives of the assessment programme are not being met, the sampling design will be adjusted accordingly using feedback (where necessary) from project stakeholders. If the findings of the investigation identify issues which require delineation or further investigation these will be delineated to the extent practicable, the scope of which is subject to approval from Viva Energy.

The auditor considered that the DQOs presented by ERM in the Stage 1 Validation were appropriate for the purposes of collecting data of acceptable quality to validate the efficacy of the remedial works.

8. Stage 1 RAP

8.1 Objectives

ERM (2020d) stated that the remedial objectives for the project, as defined within the Conceptual RAP (AECOM 2019) 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; and*
- *Ensure any approved remediation process that is implemented adheres to all applicable regulatory requirements to limit or eliminate where possible adverse effects to human health or ecological receptors. Focus was placed on ensuring the drainage system is designed to adequately support both the remediation period and post-remediation period*.

ERM stated that the remedial strategy for the Stage 1 Area was consistent with the Conceptual RAP (AECOM 2019) which stated that where remediation is required, the focus of the works was:

- *Addressing petroleum hydrocarbon impacts on shallow soil horizons;*
- *Addressing soil/sludge impacts in the drainage network and surrounds;*
- *Removing shallow LNAPL to the extent practicable; and*
- *Ensuring short or long-term contamination risks to the environment are removed or mitigated.*

8.2 Remediation strategy

The Stage 1 RAP nominated the following remedial methods.

1. Excavation and on-site bioremediation (bio piling); and
2. Excavation and off-site disposal of soils (as a contingency measure).

ERM noted that these methods are consistent with the shortlisted remediation methods outlined within the EIS (AECOM 2018) and Conceptual RAP (AECOM 2019). The Stage 1 RAP reported that this approach involves the selective excavation of hydrocarbon impacted soil and placement within managed biopiles.

ERM (2020d) stated that given the current assessment that hydrocarbon concentrations in groundwater are stable to decreasing, it is expected that the remediation works proposed will enhance the current natural attenuation processes to reduce residual groundwater impacts over time.

8.3 Remediation extent

The estimated extent of contaminated soil requiring remediation is depicted in Figure F6 from Stage 1 RAP as shown in Appendix A.

Details of the vertical and lateral extent of remediation required are provided in **Table 8**.

Table 8 Extent of remediation – Stage 1 Area

AEC	Estimated area (m^2)	Estimated remediation depth (mbgl)	Estimated in-situ soil remediation volume (m^3)
AEC-9 (Process West)	2,781	1.5	4,172
Remediation Trials Excavation	840	1.5	1,260
Total Remaining	1,941	1.5	2,911.5

8.4 Remediation processes

8.4.1 Excavation and screening

ERM reported that excavation is to take place to a depth of approximately 1.5 metres. Excavated material will be stockpiled adjacent to the excavation, prior to screening and loading into trucks, at which point the material will be transported to the biopile treatment area for classification and treatment (as required). Oversize material will be crushed and mixed with validated soils for re-use on the project as backfill.

Following validation, excavations were to be progressively backfilled with Virgin Excavated Natural Material (VENM) or other suitable material (as per the SSD Conditions of Consent), with restoration of the surface to the local grade.

8.4.2 Biopile construction

Biopiling was to take place in a designated biopile treatment area, formerly known as Tank Farm A2, as shown in Appendix A (Figure F8 from the Stage 1 RAP). The decommissioned tank farm covers an area of approximately 180 metres x 70 metres. Whilst internal tank infrastructure and pipework has been removed, the perimeter bunding has been retained, apart from a small segment on the southern side that has been removed to allow vehicular access. Figure 4 (ERM 2020d) below illustrates the proposed biopiling construction. The design of the biopiling is presented in **Appendix A** (Figure F9 from Stage 1 RAP).

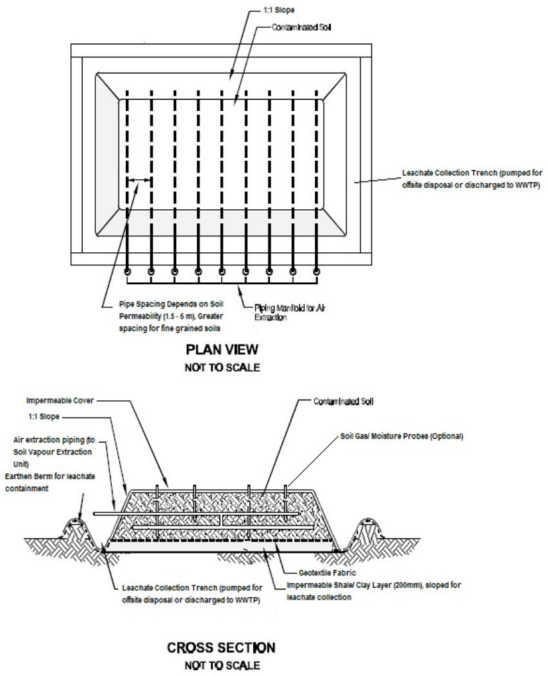

Figure 4 Biopile Construction Schematic – Adapted from USEPA (2017)

8.4.3 Biopile operation and monitoring

The aeration system was to be operated on a continuous basis to promote biological degradation of hydrocarbon contamination. The aeration system was fitted with a granular activated carbon (GAC) based exhaust emission control system to minimise the release of VOCs to atmosphere.

ERM stated that monitoring of contaminant concentrations in soils will be performed on a fortnightly basis within the first four weeks to assess the progress of biological treatment. Subsequent progress monitoring will be undertaken on a monthly basis (as required) until remediation criteria are met. Progress monitoring will assess TRH C6-C40 and BTEXN concentrations and, if necessary, nutrient ratios, bacterial populations, pH and moisture content.

Once treatment is complete and the material validated, the biopile is to either remain in the biopile treatment area, or alternatively moved to the surplus material storage area, prior to evaluating reuse options

8.4.4 Stockpiling of surplus materials

The surplus material stockpile area was planned to be situated within the former Tank Farm A1 as shown in **Appendix A** (Figure 8 from Stage 1 RAP). ERM reported that this area would be used to store treated and validated soils that have been characterised as suitable for reuse on-site. The area may also store uncontaminated surplus materials such as VENM, as well as supplementary uncontaminated materials (e.g. sand, gravel, organic matter) that may be used in remediation and/or biopiling processes.

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8.5 Contingency measures

8.5.1 Remediation contingency

The remedial contingencies included an action or a combination of the following actions:

- Conduct additional excavation to remove residual impacts and collect validation samples;
- Conduct additional soil vapour investigation following backfill of the excavation and monitoring to demonstrate residual soil impacts would not generate soil vapour concentrations greater than the relevant SSTLs
- Conduct additional risk assessments, based on a revised understanding of future site layout. It would be noted that the LTEMP may need to incorporate restrictions on future building design or incorporating vapour barriers beneath building slabs
- Consideration of short-term active LNAPL remedial solutions (such as mobile MPVE) if changes to groundwater conditions were identified that may present an unacceptable risk to human health or the environment

8.5.2 Soil treatment contingencies

The Stage 1 RAP presented the following contingency measures if unforeseen conditions were encountered during soil treatment works.

- Extended treatment duration: Although a 10-week timeframe is anticipated for the project, the remediation program was designed to accommodate a longer treatment timeframe if required
- Dust and odour impacts: The dust and odour management measures described within the Air Quality Management Plan (AQMP) included contingency actions to mitigate unacceptable dust/odours. PID screening to assess volatile air quality impacts were to be supplemented by alternative field measurements or collection of ambient air samples for laboratory analysis if necessary, to more accurately assess the speciation (and therefore exposure potential) of elevated PID readings or odours
- Bioremediation area construction/ maintenance deficiencies: Should the bioremediation area construction/maintenance deficiencies be observed during the fortnightly inspections, repairs were to be implemented as soon as reasonably practicable. In addition, a root cause analysis would be performed to determine the cause of the deficiency and measures that can be taken to prevent recurrence
- Releases from bioremediation area: Measures were outlined to stop the release of soil/stormwater from any of the working areas and perform necessary

8.6 Groundwater monitoring

8.6.1 Monitoring well placement

The Stage 1 RAP stated that monitoring wells will be lost during the soil remediation. As the hydrogeological and contaminant characterisation data from these wells had been incorporated into the CSM and are well understood, replacement of monitoring wells lost as a consequence of remedial works will not be considered necessary.

ERM reported that the focus for post-remediation monitoring will be the monitoring of groundwater quality in down gradient areas to assess groundwater flux and boundary

conditions. The existing boundary monitoring well network is not expected to be affected by the Stage 1 Area remedial works.

8.6.2 Post remediation groundwater monitoring

ERM (2020d) reported that previous groundwater monitoring indicated stable to decreasing concentrations of TRH and BTEX in groundwater over time within monitoring wells in the Western Area. No risks to human health and ecological receptors from dissolved phase hydrocarbon groundwater concentrations have been identified in the Stage 1 Area.

ERM stated that the assessment of groundwater conditions post-remediation would involve a risk-based evaluation, including fate and transport considerations and groundwater flux (as required). This approach would be aimed at demonstration of stable groundwater conditions post remediation and that residual groundwater impacts do not present a risk to the ecological values of the Duck River.

Ongoing monitoring will be the responsibility of Viva Energy, with specific details provided within the GMP and associated groundwater monitoring program. The requirement to provide access for ongoing monitoring following completion of remediation would be outlined within the updated LTEMP.

As required by the DPIE, the updated LTEMP included the reporting mechanisms to be submitted to the Council and the EPA, as follows:

The ongoing groundwater monitoring and the annual summary report (as required in the GWMP) will be made available within three months of the completion of monitoring to the NSW EPA and Council. ERM (2021) also noted that this requirement was included within the GWMP, which forms an appendix to the updated LTEMP for Stage 1.

8.7 Validation program

8.7.1 Validation method

ERM (2020d) reported that the general methodology for collection of soil samples was to be as follows:

- Samples will be collected from stockpiles at a minimum rate of one sample per 50 m^3 of material
- A minimum of two samples per stockpile will be collected. Discrete sampling locations within the stockpile will be selected such that the samples collected will be representative of the stockpile. Composite samples are not expected to be collected due to the potential for loss of volatile contaminants during sample splitting and homogenising
- An excavator bucket will be used preferentially to remove portions of soil from the stockpile. Representative soil samples will be collected directly from the centre of the excavator bucket
- Samples of stockpiled material may be collected by hand or via a clean sampling trowel/shovel where logistical or safety constraints prevent the use of an excavator for sample collection. Where samples are not collected using an excavator, samples are to be collected from a minimum depth of 0.3 metres below the surface of the stockpile

- Soil will be logged by an appropriately trained and experienced scientist/engineer to record the following information: soil/rock type, colour, grain size, sorting, angularity, inclusions, moisture condition, structure, visual signs of contamination
- Duplicates of each soil sample will be placed in a sealed snap-lock bag and will be screened using a PID fitted with a 10.6 eV lamp, calibrated at the beginning of each working day. Where the presence of volatile contaminants or other impact is suspected, additional laboratory analysis may be undertaken
- Representative soil samples will be collected in accordance with techniques described in Australian Standard AS4482 (Part 2 – Volatile Substances) to maintain the representativeness and integrity of the samples. The samples will be placed in pre-treated, laboratory-supplied sample containers
- Field QA/QC samples will include intra-laboratory duplicates, inter-laboratory duplicates, trip spikes and trip blanks and rinsate blanks
- Sample containers will be sealed and immediately placed in a cooler on ice to minimise potential degradation of organic compounds
- Any non-disposable sampling equipment required to be utilised for sampling will be decontaminated between sampling locations by initially removing any residual soil with a stiff brush, followed by washing the equipment with a 2% Decon 90/potable water solution to reduce the potential for cross contamination between sampling locations

8.7.2 Excavation validation sampling

ERM (2020d) stated that validation samples will be collected from the walls and floors of all excavation areas using the following sampling pattern:

- 1/100 m^2 from floors of excavations
- 1/10 linear metres of excavation walls

8.7.3 Stockpile validation sampling

ERM (2020d) reported that where stockpiles of contaminated soil material are temporarily stored on unsealed ground within the Stage 1 Area, baseline monitoring and post-decommissioning monitoring of soils beneath the bioremediation area will be performed to assess whether bioremediation works have impacted the treatment site.

Should a stockpile be placed on the footprint of an area planned for remediation, separate validation for residual stockpile impacts prior to removal of underlying soils was not considered warranted. ERM noted that biopile and surplus stockpile treatment areas shown in **Appendix A** (Figure 8 from Stage 1 RAP) have been selected in consideration of this aspect.

8.7.4 Soil stockpile re-use validation

ERM (2020d) reported that biopiling will be undertaken to treat soil materials for on-site beneficial re-use. Initial sampling is to be undertaken to determine the requirement for biopiling for less impacted materials. The assessment of stockpile suitability for re-use will be based on the following:

- Visual assessment of soil for the presence of LNAPL

- Laboratory analytical results of stockpiled soil to determine suitability for beneficial re-use or if further treatment is required

8.7.5 Validation reporting

ERM stated that upon the completion of works, a validation report will be prepared documenting the scope, methods, results and conclusions of the remedial works. The report is to include conclusions regarding the suitability, from a contamination perspective, of the Site for the proposed land use.

8.8 Drainage structure decommissioning

ERM stated that the following aspects were to be considered regarding contamination risks associated with the drainage network, namely that it:

- Is not considered an ongoing primary source of soil and groundwater impact or a preferential pathway for migration of contaminants
- Does not present an unacceptable future safety risk via accumulation of gases in sub grade void space
- Is isolated from the wider Clyde network, such that future site operations will not contribute discharge to the site's WWTP
- Cannot be recommissioned for use in future.

ERM developed an approach to validating the decommissioning of the drainage structure via the following process:

- Preparation of a drainage decontamination summary report which documents the scope of drainage decontamination works completed to date, and any gaps to be addressed via a future decommissioning scope (to be prepared by ERM)
- Preparation of a scope of works to address identified items within the drainage decontamination summary report (to be prepared by Ventia)
- Development of a lines of evidence validation and verification approach based on the decommissioning scope to validate that the decommissioning objectives have been met

It is the auditor's opinion that the Stage 1 RAP included the key elements for a RAP as stipulated in the Consultant Guidelines. Following remedial and validation activities discussed in the Stage 1 RAP will be suitable for the proposed future use (commercial and/or industrial) in accordance with the permissible land use IN3 – Heavy Industrial under the Parramatta Local Environmental Plan 2011.

The Stage 1 RAP outlined a clear rationale for the selection and implementation of on-site biopiling as the preferred remedial option to address the presence of the contaminated soils on-site and to remove the potential human health risk so that the Site is suitable for the future commercial / industrial use.

The validation plan proposed was sufficient to meet the remediation objectives in the Stage 1 RAP.

The auditor was satisfied that the Stage 1 RAP adequately demonstrates in detail all procedures and plans to be implemented to reduce risks to human health or environment,

and establishes the environmental safeguards required to complete the remediation in an environmentally acceptable manner.

The auditor noted that an SAS endorsing the Stage 1 RAP was issued on 22 June 2020.

9. Remedial and validation works

The remedial and validation works discussed by ERM in the Stage 1 Validation are summarised below.

9.1 Additional investigation

The auditor noted that the scope of works presented in the Stage 1 RAP was based on a thorough understanding of the site history, including the operation of the Distillate Splitter. The auditor did comment in the review of the Stage 1 RAP that:

Given the size of the Stage 1 Area (seven hectares and the number of sampling locations that have been used to characterise this area, it would be prudent to include as part of the validation program a series of sampling points in areas where there is a paucity of data

To address this data gap, ERM conducted the following scope of additional characterisation:

- Advancing 10 test pits (TP20/09 to TP20/18) to a maximum depth of two metres
- Collecting 19 soil samples for TRH and BTEX analysis
- Comparison of data to the established SSTLs

A figure showing the location of these test pits is presented in **Appendix A** (Figure F6A extracted from Stage 1 Validation). A summary of analytical results is presented in **Appendix C**.

The additional characterisation demonstrated that fill extended to a depth of approximately 1.1 metres bgl. The fill was underlain by natural mottle clays. Soils with TRH concentrations in excess of the nominated validation criteria were identified at two locations, TP20/09 (SSTLs and NEPM management limits) and TP20/17 (NEPM management limits). TP20/09 was deemed to be associated with AEC-9 and provisions were made to extend if necessary, the nominated excavation extent in this area. TP20/17 was incorporated into areas of the Site that were to be managed under the LTEMP.

9.2 Scope of remedial works

The Stage 1 Validation documented that remedial works were conducted between 14 October and 16 November 2020. The final surveyed extent of the AEC9 excavation is presented in Figure F6B of the Stage 1 Validation (**Appendix A**). All remediation works were supervised full-time by a qualified and experienced environmental scientist from ERM.

Once the concrete surface slab was removed, remedial excavations advanced through a 1 to 1.2 metre layer of medium grained sand fill. Hydrocarbon staining was occasionally observed in the fill. Underlying the fill was a red/grey mottled, stiff clay. The vertical limit of the excavation averaged 1.5 metres, with the exception of the area around grids C5 and C6 (Figure F5 from Stage 1 Validation), where LNAPL was noted to be seeping out of the walls and floor of the excavation. The walls of the exaction in this area were extended to remove a pipe and the base extended to a depth of 5.5 metres bgl to remove what appeared to be an aggregate sump.

The base of the excavation terminated in the natural clay with the exception of large concrete footings, some of which were left in situ and/or had suspected asbestos cement formwork attached (grids E11, B2 and E9 – Figure F5 from Stage 1 Validation). The walls generally comprised clay with the exception of intersecting service trenches. Only a small amount of groundwater was observed entering the excavation during the remedial works.

The volume of material excavated from AEC9 was 4,673 m^3.

9.3 Unexpected finds

Unexpected finds uncovered during the remedial works included the asbestos cement formwork attached to some of the concrete footings, the LNAPL that was identified at grids C5 and C6 and hydrocarbon contaminated soil in the wall at sample location AEC9_W-V22. The asbestos formwork was left in situ and will be managed under the LTEMP while the LNAPL and hydrocarbon was excavated until validation samples reported hydrocarbon concentrations less than the nominated validation criteria.

The locations of these unexpected finds are shown in Figure 6B of the Stage 1 Validation (**Appendix A**).

9.4 Validation works

Sixty-eight primary soil samples were collected as part of the validation program. These comprised:

- Walls: 30 samples collected at different levels in the soil profile
- Floors: 38 samples collected using a grid-based sampling pattern across the floor of the excavation

All primary samples were sent to a NATA accredited laboratory Eurofins for analytical testing for the presence of the CoPCs while duplicate samples were sent to ALS. Almost all samples recorded concentrations of the CoPC below the validation criteria with the exception of:

- AEC9_W_22 (1.0)
- AEC9_W_24

The location of those validation samples is presented in **Appendix A** (Figure 6B from the Stage 1 Validation). Tabulated summaries of the validation results are presented in Appendix C.

Both Management Limits (for TRH C10-C16 and C16-C34) and SSTLs (TRH C12-C16) were exceeded in sample AEC9_W_22. The contaminated soil was associated with backfill soil surrounding a decommissioned drainage pipe. Additional soil was removed from this area and the subsequent validation sample (AEC_W_25_1.0) recorded all CoPC at concentrations less than both the Management Limits and the SSTLs.

Only the Management Limits for TRH C10-C16 and C16-C34 were exceeded in AEC9_W_24. An unexpected find of asbestos was also identified in the area which limited excavation of the soils. Consistent with the approach outlined in the RAP, the Management Limit exceedance was to be highlighted in the updated LTEMP.

ERM concluded that based on comparison of the data to the validation criteria, the remediation achieved its goal. ERM did acknowledge the presence of soils with hydrocarbon concentrations in excess of the Management Limits and the asbestos associated with the formwork attached to the concrete footings and stated that these materials could be managed as part of the updated LTEMP.

The auditor considered that the number and locations of the samples collected during the validation sampling program was adequate in demonstrating the effectiveness of the remedial works. The samples from the walls and bases of excavations e were collected in a manner consistent with standard industry practice and the approach listed in the Stage 1 RAP.

The selection of the soil analytical suite was suitable given that contamination was clearly linked to the historical use of the site and previous investigations.

9.5 Drainage validation

A summary of the objectives of the drainage decontamination and decommissioning (in blue), as well discussion on whether they were achieved are presented below.

Ensure the sub-grade drainage infrastructure within the Stage 1 Area do not act as an ongoing primary source of contamination or a preferential pathway for migration of contaminants

- Pipework and drainage were cleaned and validated as containing no residual hydrocarbons or sludge as per the endorsed SAQP
- Some more extensive diameter trunk lines (600 to 1370 millimetres) were unable to be totally cleaned. The location of those lines is shown in figure F6 of the Drainage Validation (Appendix A). ERM undertook characterisation of residual impacts within these pipes and potential risks of the release of these residual sludges were deemed to do not exist under regular site conditions. Management measures to prevent the inadvertent release during future construction or intrusive works were included in the updated LTEMP
- Four corrugated Plate Interceptor (CPI) units present within the Stage 1 Area were drained and cleaned of oily water and residual sludge. The integrity of the walls and base of these pits were considered by ERM to be in good condition and no longer represent a potential source of impact to soil and/or groundwater
- Compromised pipes identified within the Stage 1 Area were situated mainly within the footprint of the AEC-9 remediation area, which was remediated and validated as per the Stage 1 RAP. For other pipework outside of the AEC-9 footprint, test pits were excavated to characterise backfill materials at these locations to assess for the potential release of contaminants from the infrastructure. Field observations and analytical results found no evidence of contamination requiring additional remediation in the surrounding sub-grade material
- Upon completion of cleaning, drainage pit junctions were backfilled with aggregate or stabilised sand to prevent lateral migration of residual sludges (where present) within the drainage network

Sub-grade drainage infrastructure does not present an unacceptable future risk via accumulation of gases in sub grade void spaces

Gas testing undertaken by ERM during drain cleaning process indicated residual concentrations of gases associated with petroleum hydrocarbons were below the adopted limits. Therefore, ERM considered that future safety risks related to gas accumulation in sub-grade void spaces are negligible.

Sub-grade drainage network is isolated from the Clyde Terminal network, such that future site operations will not contribute discharge to the WWTP

The isolation of drainage flows from the Stage 1 Area has been achieved from the surrounding network in Stage 2 (to the west), and Stage 3 (downstream to the east) as all pits have been backfilled.

Pits servicing trunk mains within the Stage 1 area have been backfilled with stabilized sand to plug flows to the WWTP. As an additional measure, ERM stated that permanent isolation of the Western Area drainage (in Stages 1 and 2) from the Clyde Terminal WWTP is planned to be completed throughout December 2020 via air gapping and plugging of removed sections of the 1,370 millimetres trunk lines within the Stage 3 Area.

Sub Grade drainage cannot be recommissioned for use in future

The Stage 1 drainage network was considered by ERM as unserviceable and unable to be recommissioned for use following completion of backfilling activities and removal of drainage infrastructure undertaken in the northern section of Area 1 as part of the Stage 1 Area remediation works.

The scope of works was undertaken in general as per the endorsed Drainage SAQP apart from the unexpected findings.

Based on the data collected, it is considered that the objectives of the Stage 1 drainage validation works have been met. However, as residual contamination remains within the Stage 1 Area in specific localized areas, and ongoing management to mitigate these impacts is required.

The following residual risks specific to the drainage decommissioning works include:

- Potential acute exposure risks to intrusive maintenance workers/construction workers during future intrusive works via excavation of residual hydrocarbon impacted soils (in the vicinity of TP20/20)
- Release of residual sludge and/or LNAPL to soil and/or groundwater during the excavation of pipework or drainage infrastructure
- Safety controls for workers undertaking removal of pipework or sludges to mitigate against hydrocarbon exposure via dermal contact/ ingestion and/or inhalation of vapours

The location of residual conditions and associated management controls have been incorporated into the updated LTEMP for the Stage 1 Area, which will be legally enforceable as per the Development Consent for the Western Area Remediation Project (SSD 9302).

A figure showing the location of residual impacts related to the drainage network is presented in **Appendix A** (Figure F3 from ERM 2021).

9.6 Waste management

In confirming that the material was VENM, ERM checked documentation provided by the VENM supplier and conducted daily inspections to establish that there were no foreign materials and the VENM was consistent with the information provided by the suppliers.

All material that was removed from AEC9 was segregated and screened for reuse on site or subsequent placement in biopiles. Material that failed either screening or laboratory testing was segregated from the material that was assessed to be suitable for on-site reuse.

Thirty-nine soil samples were collected from SP44, SP65 to SP68 and SP73. The subsequent laboratory results for the CoPC that were tested were all less than the validation criteria. ERM stated that these stockpiles could remain on site. Figures F3B, F3C and F4 from the Stage 1 Validation shows the locations of these stockpiles (**Appendix A**). Summaries of the laboratory data are presented in **Appendix C**.

Temporary stockpiles SP69 to SP71 and SP74 were segregated into stockpiles SP 72 (<50mm diameter) and SP73 (>50mm diameter). Subsequent laboratory testing of the material in SP73 resulted in ERM deciding that this stockpile could be reused on site. The soils that comprised SP72 were moved to the biopile area that was outside the boundaries of Stage 1.

No material that was excavated from AEC9 was disposed off-site. ERM provided a stockpile tracking register demonstrating how material from AEC9 tracked.

The auditor considered that the drainage decommissioning works were mainly undertaken as per the endorsed SAQP. Residual hydrocarbon sludge in drainage lines does not pose potential human health risks to future commercial workers under ordinary activities. Management controls during any excavation or demolition work in these areas must to undertaken as per the updated LTEMP.

The segregation of material that was removed from AEC9 was based on physical observations, field screening with a PID and laboratory testing. The auditor considered that approach was appropriate. Using these lines of evidence and comparing analytical data to the validation criteria, ERM was able to demonstrate that a number of stockpiles could be reused on-site. The materials that comprised SP72 will be biopiled in a designated area with appropriate environmental controls and health and safety monitoring.

9.7 Air Quality

Air quality was monitored during the remedial works as per the requirements of the AEVR and EPL570. The AEVR formed Condition of Consent B15 of SSD9302 and was reviewed by the auditor (IAA09 presented in **Appendix B**). Key requirements of the AEVR were:

- To limit the exposed are of contaminated soil to 900 m^2. This was achieved through a combination of the following:
  - Progressive validation (via field headspace screening using a calibrated {PID) of exposed surfaces (i.e. excavation, stockpiles) as 'contaminated soils' requiring treatment (>100 ppmv) or not requiring treatment (100 ppmv); and
  - Covering of contaminated exposed surface areas in excess of 900 m^2 with a liquid polymer solution (Vital Bon-Matt™ Solution) to bind surface soils and limit VOC/odour flux.

Daily ambient air, dust and odour monitoring was completed during remediation, the results of which were reported weekly to the NSW EPA under condition R.1 of EPL 570. No exceedances of action limits for VOCs, or performance criteria for dust or odours were noted.

The auditor noted that the air quality was measured as per the requirements of the AEVR. The results of the monitoring confirmed that the excavation and stockpiling of contaminated soils did not generate volatile chemicals that warranted management other than the procedures implemented.

The air quality data was supported by the historical data in that the highest benzene concentration recorded in soil was 1.2 mg/kg, well below the validation criteria.

9.8 Groundwater management

ERM stated that groundwater monitoring was undertaken prior to (sampling and gauging), during (gauging) and post remediation (sampling and gauging) as per the GMP. No significant changes to groundwater levels or LNAPL presence was observed. Post remediation groundwater sampling is to be conducted as per the GMP for the WARP.

10. 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 Section 4.1.3 of the Guidelines for the NSW Site Auditor Scheme (3rd edition).

The field and laboratory QA/QC measures presented by ERM in its Validation report have been reviewed in accordance with the NSW EPA guidelines to gauge the integrity of the data set used to validate the site.

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

The auditor considered that an adequate level of QA/QC has been adopted by ERM in the validation program.

Sample locations were appropriate to validate the effectiveness of the remedial excavations as well as characterise the remainder of the site that could not be accessed when the site was operational. A suitable number and type of samples were selected to characterise the unexpected finds.

The analyses of all soil samples (both as part of the validation of remedial excavations and the validation characterisation program) have been conducted by laboratories certified by the NATA, and the contaminants of concern has been previously identified at the Site.

The auditor considered that the data presented in the validation report was sufficiently precise, accurate, representative, complete and comparable for the audit.

The auditor considers that the overall quality of data and their presentation are of an adequate standard to support the conclusions that ERM met regarding the suitability of the Site.

11. Conceptual site model – Post remediation

A summary of the updated CSM relevant to the Stage 1 Area following completion of remedial and validation works is discussed as follows.

11.1 Sources

The Stage 1 Validation stated that following completion of remedial works, the following potential ongoing sources of contamination exist within the Stage 1 Area:

- Residual Soil Impacts limited to hydrocarbon impacts exceeding management limits
- Asbestos associated with sub-grade footings and infrastructure
- Residual hydrocarbon sludge remaining within the decommissioned drainage pipes/pits

11.2 Exposure pathways

The following exposure pathways for on-site receptors were presented in the Stage 1 Validation:

- Inhalation of dusts or potential asbestos fibres from asbestos formwork that was attached to subgrade structures within AEC9
- Release of residual sludge/ LNAPL to soil and/or groundwater during excavation of pipework or drainage infrastructure

11.3 Receptors

The receptors that may be impacted by the identified residual sources of contamination included:

- On-site construction, subsequent commercial workers and occasional intrusive workers

11.4 SPR linkages

The Stage 1 Validation report identified the following complete SPR linkages relevant to the Stage 1 Area following completion of remedial and validation works.

- Inhalation of potential asbestos fibres from asbestos formwork identified attached to sub-grade structures during excavation works
- Release of residual sludge or LNAPL to soil and/or groundwater during excavation of pipework or drainage. Potential exposure risks to workers where areas of residual hydrocarbon impact in soils are present are to be managed via administrative controls outlined in the updated LTEMP

A surveyed plan and co-ordinates showing the ACM locations as well as the residual hydrocarbons impacts is provided in Appendix A (Figures F1 and F2 from LTEMP).

On the basis that the above are addressed through future administrative controls in the updated LTEMP, the above potential SPR linkages are considered incomplete.

The following notes were presented in the CSM section of the Stage 1 Validation report:

- Groundwater users (potable or non-potable) were not considered a potential receptor given the absence of registered extraction bores down gradient of the Stage 1 Area, poor background quality of groundwater and likely low yields
- No on-site ecological receptors have been identified
- Any development of the Site is likely to comprise slab on grade commercial / industrial land use, resulting in the removal of any areas where ecological communities could establish

The auditor noted that the CSM developed by ERM for the Stage 1 Area provided the framework for identifying the potential sources of contamination and how potential future receptors may be exposed. The auditor considered that the CSM developed by ERM was prepared as per the ASC NEPM (NEPC 2013) method.

The key exposure routes to residual contamination would only occur if the areas in which residual contamination are disturbed. The management of these areas is outlined in the updated LTEMP that is discussed further in **Section 14**

12. Other considerations

12.1 Ecological considerations

ERM stated in the HHERA that off-site migration of LNAPL or dissolved phase petroleum hydrocarbons was not occurring at levels that could potentially cause risk to the identified environmental/ecological receptors, principally Duck River. Testing for PFAS and metals from soil leachate and groundwater in the WARP were not considered to represent a risk to off-site receptors.

Previous groundwater monitoring events data (discussed in **Appendix D)** also presented information demonstrating that CoPC did not exceed relevant investigation levels in groundwater samples collected down gradient of the Site.

12.2 Aesthetic impacts

The Stage 1 Validation presented discussion on the ASC NEPM TRH management limits (NEPC 2013) as trigger levels for future site management considerations. The management/mitigation actions for residual impacts for future intrusive workers are detailed in the updated LTEMP discussed in **Section 14.**

A copy of the updated LTEMP is included in **Appendix F**. The materials that have TRH concentrations in excess of the management limits are not at the surface and would only create a nuisance odour if disturbed.

12.3 Chemical mixtures

The Stage 1 Validation did not specifically examine potential additive or synergistic effects of chemical mixtures.

The auditor noted that the site was a petroleum refinery process area mostly covered in hardstand. Additionally, the primary sources of contamination within the Stage 1 Area that could present a human health risk were removed as part of the remedial works. Furthermore, future land use of the Stage 1 will be commercial/industrial which would require the Site to be covered in hardstand.

ERM reported in the RSI that groundwater concentrations of CoPC were largely less than adopted trigger levels for ecological receptors at delineation wells down gradient of the Stage 1 Area. As such, the auditor agrees there is no complete pathway between identified groundwater impacts on-site and off-site ecological receptors.

The auditor noted that following completion of remedial works, LNAPL in soils or groundwater is unlikely to be encountered during routine use of the Site. On-site intrusive maintenance works would need to be managed under the updated LTEMP (discussed in **Section 14**) and relevant workplace health and safety procedures. Odours may be encountered in some areas of the site if excavations are undertaken, but air quality monitoring conducted during the remedial works has shown there is little or any volatiles generated when disturbing the hydrocarbon affected materials.

Although not specifically discussed in the Stage 1 Validation, potential chemical mixtures are not relevant in relation to human health risks as these were assessed as part of the HHERA used to inform the scope of the remedial works.

13. Compliance with regulatory requirements

The national and NSW regulatory guidelines relevant to the scope detailed in the Stage 1 Validation report are presented as follows.

13.1 National guidelines

- ANZAST (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (the Groundwater Guidelines)
- CRC CARE (2011) *Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater*. CRC CARE, Technical Report Series 10. Friebel, E. and Nadebaum, P
- NEPC (2013*) National Environmental Protection Council (Assessment of Site Contamination) Measure 1999* (the NEPM Guidelines)

13.2 NSW guidelines

- NSW EPA (2017*) Guidelines for NSW Site Auditor Scheme (3rd Edition)*
- NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW EPA (2014) *Technical Note: Investigation of Service Station Sites*
- NSW EPA (2007) *Guidelines for the assessment and management of contaminated groundwater*
- NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites*
- NSW EPA (2010) *UPSS Technical Note: Site Validation Reporting*

In addition to the guidelines listed above, the auditor confirms that Conditions of Consent of SSD9302 that are relevant to auditor involvement have been fulfilled, including consultation with NSW EPA and Parramatta Council on the updated LTEMP. The endorsement of the updated LTEMP was outlined in the DPIE's letter of the 11 February 2021, as follows:

- "*I refer to the Long Term Environmental Management Plan which was submitted in accordance with Condition B8 of Schedule 2 of the consent for the Viva Energy Clyde Western Area Remediation (SSD 9302)*
- *The Department has carefully reviewed the document and is satisfied that it meets the relevant requirements of the conditions of consent*
- *Accordingly, the Planning Secretary has approved the Long Term Environmental Management Plan (dated 29 January 2021). Please ensure that the approved plan is placed on the project website at the earliest convenience*."

A review of the Stage 1 Validation demonstrated adequate compliance with the requirements of these guidelines.

The auditor did not consider that any identified deviations from these guidelines affected the outcome of the audit.

14. Long term environmental management plan

Following completion of remedial and validation works, ERM prepared an LTEMP (ERM, 2020i). However, as discussed in **Section 1.1 of this SAR,** DPIE correspondence issued on 15 January 2021, requested additional information. A revised LTEMP (ERM, 2021) was prepared to address the matters raised within the DPIE letter. A copy of the updated LTEMP is included in **Appendix F**.

14.1 Purpose of updated LTEMP

The purposes of the updated LTEMP are as follows:

- Summarise background environmental information conditions at the site, and provide a mechanism 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 that will avoid and / or mitigate adverse effects on human health and / or the environment
- Outline the mechanisms of reporting the groundwater monitoring events to the EPA and Council
- Provide a methodology for the appropriate environmental management of excavation works that may encounter residual contaminated soil and / or groundwater
- Provide environmental requirements for the sourcing and placement of backfill material;
- Discuss safety measures / considerations for dealing with potentially contaminated soil / groundwater
- Outline restrictions to potential future land uses

14.2 Nature of the residual contamination:

Following completion of remedial works within the Stage 1 Area, the following residual contamination may be present:

- Oily water / sludge associated with former underground drainage infrastructure;
- Asbestos associated with former underground building structures
- Hydrocarbon impacted soils
- Residual hydrocarbon impacted groundwater

A detailed description of residual contamination and the associated potential human health risks where intrusive excavation works are undertaken is presented within Section 5 and Section 6 of the updated LTEMP.

The location and extent of residual contamination within the Stage 1 Area is illustrated on **Appendix A** (Figures F2 and F3 from ERM, 2021).

14.3 LTEMP enforceability

All requirements are legally enforceable via condition B10(a) and (b) of the Development Consent (State Significant Development 9302), as issued under Section 4.38 of the Environmental Planning and Assessment Act 1979 (the 'EP&A Act'), 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 will be requested to add a notation to the planning certificate for the Stage 1 Area under section 10.7(5) of the EP&A Act that the property is subject to the updated LTEMP.

14.4 LTEMP public notification

Notification of the updated LTEMP will be placed on the Section 10.7(5) planning certificate.

14.5 Actions required under LTEMP

Based on the nature and extent of residual contamination identified within the Stage 1 Area the following management controls are required:

- Non-Intrusive works – No management controls are required
- Intrusive Excavation Works – Implementation of environmental management controls as detailed in **Appendix C**

The auditor considered that the updated LTEMP had been prepared in a manner consistent with relevant NSW EPA made or approved guidelines.

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

The auditor concurred that management and mitigation measures associated with residual impacted soils are passive and can be easily managed based on the proposed future proposed land use scenario.

The auditor notes that the GMP requires groundwater sampling before, during and three months after completion of the remedial works. A groundwater report discussing these data will be presented as per the GMP. The auditor, however, notes that given the findings of the validation sampling program, in particular the clay layer that acts as an aquitard, groundwater monitoring over such a short period probably would not identify any changes to groundwater quality.

The auditor noted that the updated LTEMP is enforceable through condition B10(a) of the Development Consent (State Significant Development 9302). Additionally, the updated LTEMP will be noted on the planning certificate under section 10.7(5) of the EP&A Act as required by condition B10(b) of the Development Consent.

15. Auditor's opinion and conclusions

15.1 Consultant conclusions

The objective of the Stage 1 Area remedial and validation works was to remediate the soil and manage groundwater in the Stage 1 Area, thereby reducing the vapour intrusion risk presented by hydrocarbon contaminated soil in AEC9 and enabling the land to be used for commercial/ industrial purposes.

ERM presented a comprehensive data set that demonstrated soils that could present a potential vapour intrusion had been successfully removed from AEC9. ERM concluded that:

Based on the outcomes of validation activities undertaken and detailed within this report, the Stage 1 Area is considered suitable for commercial/industrial land use, subject to implementation of a legally enforceable Long-Term Environmental Management Plan.

Residual soil/LNAPL contamination that exceeded ASC NEPM management limits along with asbestos cement formwork attached to concrete footings left on site and sludge within the decommissioned drainage network will be managed as per the updated LTEMP.

15.2 Auditor's conclusion

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 9** presents this assessment.

Table 9 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 1 Validation report prepared by ERM contained the key elements required by the Consultant Guidelines for such reports.
Any aesthetic issues relating to soils have been adequately addressed.	The auditor noted that residual contaminated soils if encountered could have a hydrocarbon odour. Exposure to odorous groundwater or soils would only occur if there was excavation. This situation is not likely to be encountered under general activities at the site and will otherwise be managed under 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 SSTLs in relation to health risks or ASC NEPM (NEPC 2013) 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.	Groundwater monitoring was not conducted as part of the validation process. Previous data had demonstrated that there were no unacceptable health risks posed by the recorded concentrations of the CoPC.
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.

EPA's requirements	Auditor 's comments
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, the CoPCs were assessed as part of the HHERA (used to identify site specific risks of exposure) which would have taken into account cumulative risks of exposure to all identified chemicals.
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 Site.
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 acceptable. Short term exposure risks to identified areas of residual contamination would occur only during intrusive works. Appropriate steps to manage exposure to the chemicals in these areas are presented in the LTEMP.
The site management strategy (where relevant) is appropriate including post-remediation environmental plans.	Site management protocols were presented and discussed in **Section 14** of this SAR. The auditor considered that the updated LTEMP is suitable for the proposed industrial/commercial land uses and that there is appropriate public notification and legal enforceability.

It is the auditor's opinion that based on the remedial and validation works results discussed in this SAR, the Stage 1 Area is suitable (subject to implementation of the updated LTEMP) for the commercial/industrial land uses.

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 1 RAP; and
- risks to human health and the environment have been addressed in accordance with the objectives of the Stage 1 RAP.

16. Disclaimer

This Site Audit Report (SAR) and accompanying site Audit Statement (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 1.2** 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 connection 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 the Stage 1 Area.
- 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:

1. Arising from, or in connection with, any change to the site conditions.
2. 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

Stage 1 RAP

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 less BTEX	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
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			

TP19/73	Depth (m)	TRH >C8-C10 Aliphatic
	0.4	780

TP19/47	Depth (m)	TRH >C10-C12 Aliphatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic
	0.3	2300	1900	1700

Legend
- Stage 1 Remediation Extent (AEC-9)
- Western Area Boundary
- Clyde Refinery
- Stage 1 Area Boundary
- Historical Test Pit
- Historical Soil Bore/Hand Auger
- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well

Latest Sampling (July/August 2019)
- New Test Pit
- New Hand Auger/Surface Sample
- LNAPL present in Soil (0-1m Depths)

Notes:
LNAPL was identified in soil profile at 1m bgl.

Soil Exceedances

F6a

Drawing No:	0515132s_RAP_G006_R1.mxd		Clyde WARP - Detailed Remediation Action Plan (Stage 1), Clyde Terminal - Durham Street, Rosehill
Date:	12/05/2020	Drawing Size: A3	
Drawn By:	GC / GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM

Analytes	TRH C6-C10 less BTEX
Units	µg/L
Clyde WARP SSTL - GW VI - Commercial	6200
Clyde WARP SSTL - GW VI - Construction	NL
Clyde WARP SSTL - GW VI - IMW	NL

MW12/16	TRH C6-C10 less BTEX
	17000
(Dup)	18000
(Trip)	90400

MW11/01 MW11/22 MW94/2 MW11/02 MW11/03 MW11/04 MW11/05 MW11/24 MW12/16 MW12/17 MW11/23 MW11/27 MW12/18 MW11/26 MW12/19 MW18/07 MW11/28 MW11/29 MW11/30 MW18/06 MW11/31 MW11/32 MW18/10 MW11/37 MW11/36 MW11/35 MW98/6 MW11/34 MW11/38 MW11/39 MW11/40 MW11/43 MW11/45 MW12/24 MW94/9 MW98/8 MW12/23 MW11/44 MW11/41 MW11/42 MW94/6X MW11/33 MW11/12 MW11/10 MW11/13 MW11/11 MW11/15 MW11/14 MW11/16 MW98/5 MW11/17 MW11/18 MW11/21 MW11/20 MW18/24 MW11/07 MW94/4 MW11/08 MW98/9

TANKFARM A1 62 28 29 18 30 17 31 23 22 4 63
88.697 MS
EASEMENT 11 26 1 9 85 66 67 CPI
MANIFOLD PIT
NO.1 PUMPHOUSE
ROAD 5 383.743 ME
SUB 4
183.185 MS
WATER TREATMENT PLANT 77 73
BOILERS NO7 NO9 FG COM
SUB 23 B 29 88 71 89 97 70 72 74 75 76
CONTROL ROOM
UTILITIES GEN HOUSE TA 1 TA 2 TA 3
SUB 18
TRANSFORMERS T8 T4 T5
FIELD OFFICE
SUB 26
ROAD 10 280.924 MS
SUB 7 94 95 10
PLATFORMER 3
12
TANKFARM J
ROAD 12A 271.780 MS
SAMPLE STORE 24
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
ROAD 3C
ABSTORE
LABORATORY
ROAD 5 384.378 ME
ROAD 14
ROAD 7 493.776 ME
ROAD 9 530.352 ME
ROAD 2 6.096 MS
SUB 3 1601 ?
CPI
BLOCK ROAD 113.080MS
ROAD 11 652.272 ME
GAS TAIL UNIT
CDU 2
SUB 16
CCR
HVU
TANKFARM H 502 505 504 501 503
CAR PARK
CCU & GS PLANT
DRY GAS TREATER
POLY PLANT
ALKYLATION PLANT
ROAD 13 686.714 ME
ROAD 15 686.008 ME
TRANSF YARD
PLANT WORKSHOP
CAUSTIC SODA REGENERATION
WASTE DISPOSAL PLANT
SULPHER RECOVERY UNIT 1
SULPHER RECOVERY UNIT 2
CAUSTIC SODA TREATER CC GAS
TRANSFORMERS
SUB 24
HYDRO BLASTING AREA
ROAD 12 312.420 MS
SUB 22
COOLING TOWER
SLUDGE
2102
FILTER UNITS
2103
BASIN
COOLING TOWER & BIOTREATMENT FACILITIES
CLARIFIER
ACTIVATED SLUDGE BASIN
FEED NO2
BASINS NO1
2101
MAIN INTERCEPTOR
ANALYSER BLDG
GAS BLENDING PLANT
TANKFARM B
53 50
51
SUB
TANKFARM B1
42 34 35
105 103 106 104
OIL INTERCEPTOR INLET BOX CPI

Legend
- Stage 1 Area Boundary
- Stage 1 Remediation Extent (AEC-9)
- Western Area Boundary
- Clyde Terminal Boundary
- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well
- LNAPL in Groundwater

Groundwater SSTL Exceedances

F6b

Drawing No:	0515132s_RAP_G007_R1.mxd		Clyde WARP - Detailed Remediation Action Plan (Stage 1), Clyde Terminal - Durham Street, Rosehill
Date:	12/05/2020	Drawing Size: A3	
Drawn By:	GR	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 20 40 60m

N

ERM

Analytes	TRH >C8-C10 Aliphatic	Benzene	Naphthalene
Units	mg/m³	ppmv	ppmv
Clyde WARP SSTL - SV VI - Commercial 0.15m	4200	18	14

SV19/07 | Naphthalene | 20.5

MW11/01 MW11/22 MW94/2 MW11/25 MW11/24 MW12/16 MW12/17 SV19/07 MW11/23 MW11/27 MW11/05 MW11/02 MW11/03 SV19/06 MW11/04 MW11/07 MW94/4 MW11/08 MW18/06 MW98/9 MW11/31 MW11/28 MW12/18 MW11/26 SV19/08 MW12/19 MW18/07 MW11/29 MW11/30 MW11/32 MW18/10 MW11/37 MW11/36 MW11/35 MW98/6 MW11/34 MW11/38 MW11/39 MW11/40 MW12/24 MW11/45 MW94/9 MW98/8 MW12/23 MW11/44 MW11/43 MW11/41 MW11/42 MW94/6X MW11/33 MW11/12 MW11/13 MW11/10 MW11/11 MW11/15 MW11/16 MW98/5 MW11/14 SV19/09 MW11/17 MW11/18 SV19/05 MW18/24 MW11/20 MW11/21

ROAD 2 ℄ 6.096 MS · SUB 3 · 1601 · CPI · ROAD 11 ℄ 652.272 ME · BLOCK ROAD ℄ 113.080MS · GAS TAIL UNIT · CDU 2 · SUB 16 · ROAD 13 ℄ 686.714 ME · ROAD 15 ℄ 859.008 ME · ROAD 7 ℄ 493.776 ME · ROAD 9 ℄ 530.352 ME · CCR · HVU · ROAD 12 ℄ 312.420 MS · CAR PARK · ROAD 14

TANKFARM A1 · TANKFARM A3 · TANKFARM A2 · TANKFARM B · TANKFARM B1 · TANKFARM J · TANKFARM H

SUB 1 · SUB 4 · SUB 5 · SUB 6 · SUB 7 · SUB 18 · SUB 22 · SUB 23 · SUB 24 · SUB 26

ANALYSER BLDG · GAS BLENDING PLANT · CCU & GS PLANT · DRY GAS TREATER · POLY PLANT · ALKYLATION PLANT · PLANT WORKSHOP · TRANSF. YARD · CAUSTIC SODA REGENERATION · WASTE DISPOSAL PLANT · SULPHER RECOVERY UNIT 2 · CAUSTIC SODA TREATER CC GAS · HYDRO BLASTING AREA · OIL INTERCEPTOR INLET BOX · MAIN INTERCEPTOR · COOLING TOWER · COOLING TOWER & BIOTREATMENT FACILITIES · CLARIFIER · ACTIVATED SLUDGE BASIN · FEED NO2 · BASINS NO1 · SLUDGE FILTER UNITS · BASIN

BOILERS NO7 NO9 · FG COM · WATER TREATMENT PLANT · CONTROL ROOM · UTILITIES GEN HOUSE 1 2 · TA TA · TA 3 · TRANSFORMERS T8 T4 T5 · FIELD OFFICE · TRANSFORMERS T8 T7 · PLATFORMER 3 · BRU · SAMPLE STORE · GND LEVEL FLARES STAGE 1 · RADIO MAST · MAST · HIGH LEVEL FLARES STAGE 2 · FLARES STAGE 3 · LABORATORY · ABSTORE · ROAD 3C · ROAD 5 ℄ 364.378 ME · ROAD 10 ℄ 280.924 MS · ROAD 12A ℄ 271.780 MS · 88.697 MS · 183.185 MS · EASEMENT · MANIFOLD PIT · NO.1 PUMPHOUSE · ROAD 5 ℄ 383.743 ME

Legend
- Stage 1 Area Boundary
- Stage 1 Remediation Extent (AEC-9)
- Western Area Boundary
- Clyde Terminal Boundary
- Soil Vapour Well
- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well

Soil Vapour SSTL Exceedances

F6c

Drawing No:	0515132s_RAP_G010_R1.mxd		Clyde WARP - Detailed Remediation Action Plan (Stage 1), Clyde Terminal - Durham Street, Rosehill
Date:	12/05/2020	Drawing Size: A3	
Drawn By:	GC / GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM

Point	GDA94 MGA56 Easting	GDA94 MGA56 Northing
Pt 1	318340	6255167
Pt 2	318335	6255132
Pt 3	318258	6255140
Pt 4	318261	6255174

Legend

- Soil Vapour Well
- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well
- Test Pit
- Hand Auger/Surface Sample
- Clean Drain Line (Above ground)
- Clean Drain Line (Underground)
- Contaminated Drain Line (Above ground)
- Contaminated Drain Line (Underground)
- Drainage Lines (Cleaned 2018)
- Sewer
- Interceptor
- WARP Remediation Trials Excavation Extent
- Stage 1 Remediation Extent (AEC-9)
- Stage 1 Area Boundary
- Western Area Boundary
- Clyde Terminal Boundary

Data Source:
Nearmap imagery April 2019

Remediation Extent F7

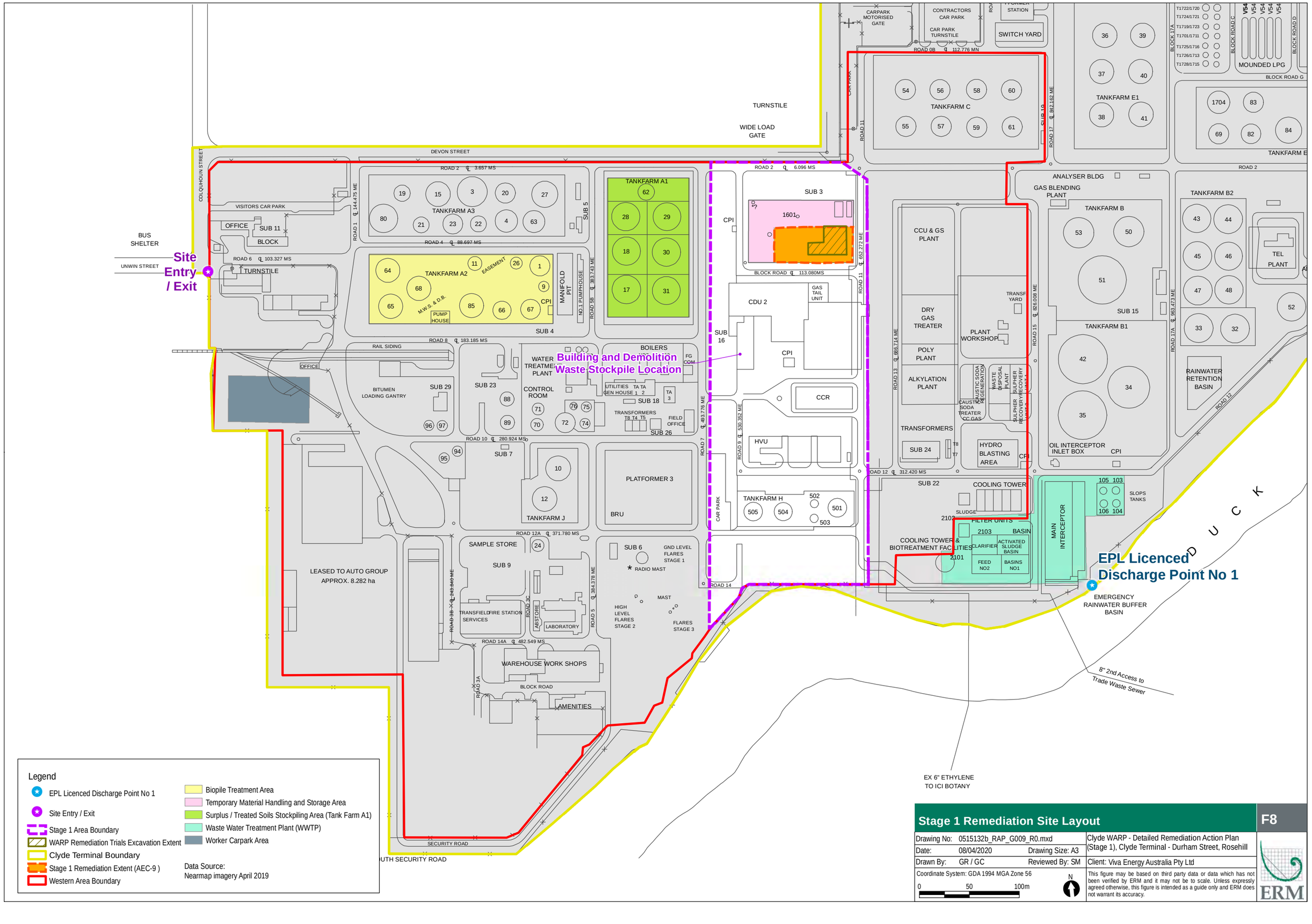
Drawing No:	0515132b_RAP_G008_R0.mxd		Clyde WARP - Detailed Remediation Action Plan (Stage 1), Clyde Terminal - Durham Street, Rosehill
Date:	06/04/2020	Drawing Size: A3	
Drawn By:	GR / GC	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

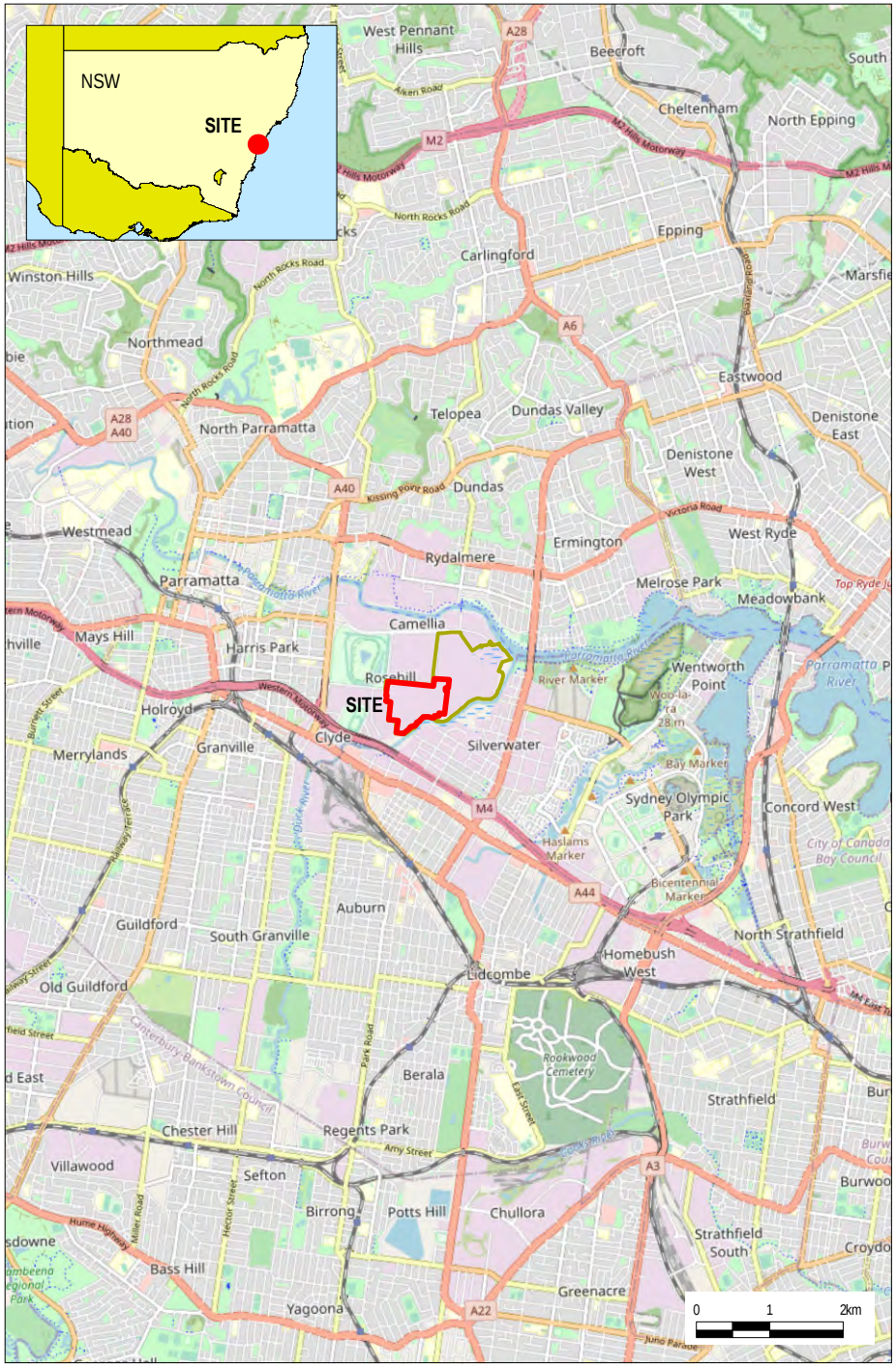
0 20 40 60m

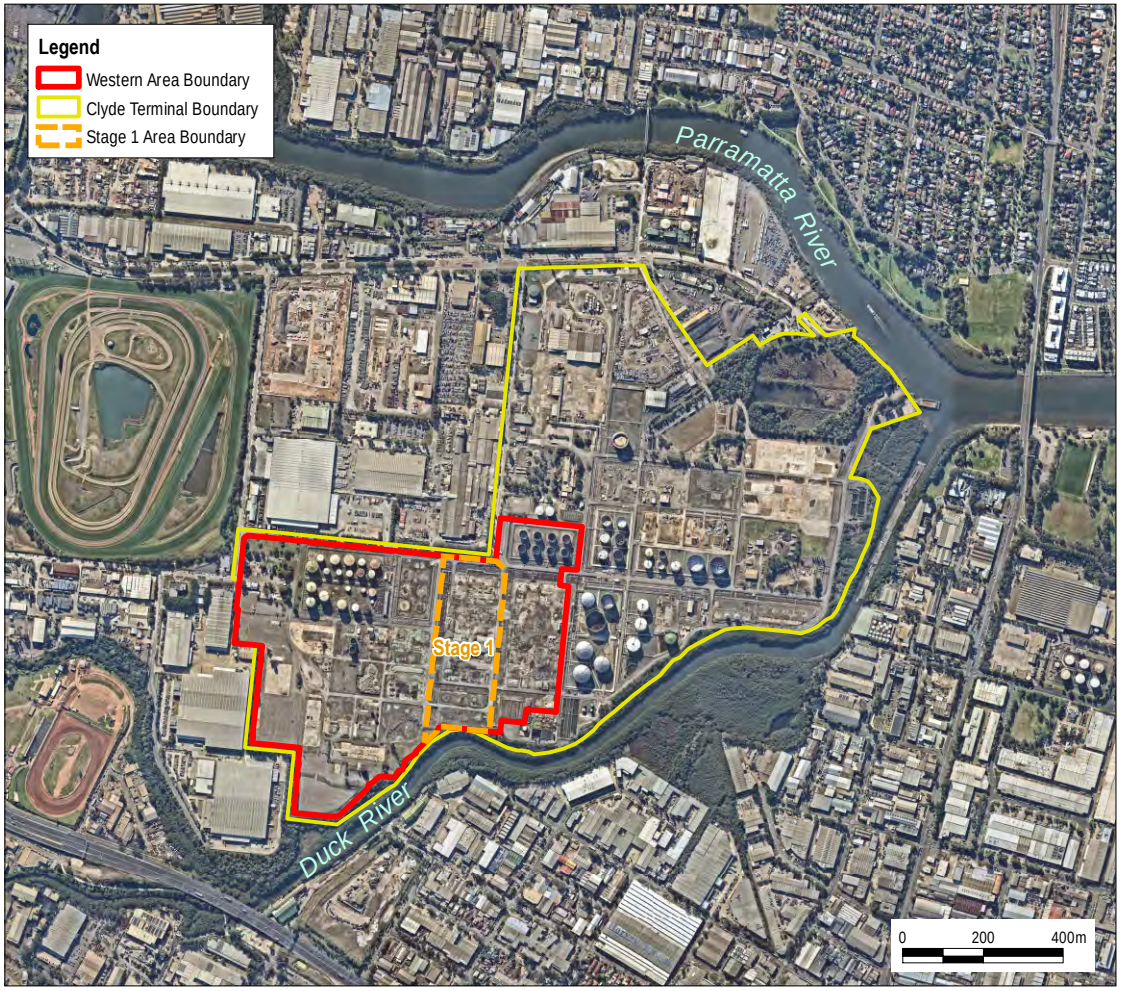
N

ERM


Site Entry / Exit
BUS SHELTER
UNWIN STREET
COLQUHOUN STREET
DEVON STREET
TURNSTILE
WIDE LOAD GATE
CARPARK MOTORISED GATE
CONTRACTORS CAR PARK
CAR PARK TURNSTILE
SWITCH YARD
ROAD 0B
112.776 MN
TANKFARM C
TANKFARM E1
MOUNDED LPG
BLOCK ROAD G
TANKFARM E
ROAD 2
3.657 MS
6.096 MS
VISITORS CAR PARK
OFFICE
SUB 11
BLOCK
ROAD 1
144.475 ME
ROAD 4
88.697 MS
TANKFARM A3
TANKFARM A1
TANKFARM A2
SUB 5
SUB 4
ROAD 6
103.327 MS
TURNSTILE
EASEMENT
M.W.S. & D.B.
PUMP HOUSE
MANIFOLD PIT
NO.1 PUMPHOUSE
ROAD 5B
383.743 ME
CPI
ROAD 8
183.185 MS
RAIL SISTING
OFFICE
BITUMEN LOADING GANTRY
SUB 29
SUB 23
WATER TREATMENT PLANT
BOILERS
FG COM
Building and Demolition Waste Stockpile Location
CONTROL ROOM
UTILITIES
GEN HOUSE 1
TA TA 1 2
TA 3
SUB 18
TRANSFORMERS T8 T4 T5
FIELD OFFICE
SUB 26
ROAD 10
280.924 MS
SUB 7
PLATFORMER 3
BRU
TANKFARM J
ROAD 12A
371.780 MS
SAMPLE STORE
SUB 9
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
TRANSFIELD SERVICES
FIRE STATION
ABSTORE
LABORATORY
ROAD 3C
ROAD 5
384.378 ME
ROAD 3B
249.840 ME
ROAD 14A
482.549 MS
WAREHOUSE WORK SHOPS
BLOCK ROAD
AMENITIES
ROAD 3A
LEASED TO AUTO GROUP
APPROX. 8.282 ha
SECURITY ROAD
SOUTH SECURITY ROAD
SUB 3
1601
BLOCK ROAD
113.080MS
CDU 2
GAS TAIL UNIT
SUB 16
CCR
HVU
ROAD 9
530.392 ME
ROAD 7
483.776 ME
ROAD 11
652.272 ME
CAR PARK
TANKFARM H
502
501
503
505
504
ROAD 14
CCU & GS PLANT
DRY GAS TREATER
POLY PLANT
ALKYLATION PLANT
TRANSFORMERS
SUB 24
ROAD 13
866.714 ME
TRANSF YARD
PLANT WORKSHOP
CAUSTIC SODA REGENERATION
CAUSTIC SODA TREATER
WASTE DISPOSAL PLANT
SULPHER RECOVERY UNIT 1
SULPHER RECOVERY UNIT 2
CC GAS
HYDRO BLASTING AREA
ROAD 15
826.008 ME
ROAD 12
312.420 MS
SUB 22
COOLING TOWER
SLUDGE
FILTER UNITS
2102
2103
BASIN
CLARIFIER
ACTIVATED SLUDGE BASIN
FEED NO2
BASINS NO1
2101
COOLING TOWER & BIOTREATMENT FACILITIES
MAIN INTERCEPTOR
SLOPS TANKS
ANALYSER BLDG
GAS BLENDING PLANT
TANKFARM B
TANKFARM B2
TANKFARM B1
SUB 15
TEL PLANT
RAINWATER RETENTION BASIN
ROAD 17A
963.473 ME
ROAD 12
OIL INTERCEPTOR INLET BOX
CPI
EMERGENCY RAINWATER BUFFER BASIN
EPL Licenced Discharge Point No 1
DUCK
8" 2nd Access to Trade Waste Sewer
EX 6" ETHYLENE TO ICI BOTANY
Legend
EPL Licenced Discharge Point No 1
Site Entry / Exit
Stage 1 Area Boundary
WARP Remediation Trials Excavation Extent
Clyde Terminal Boundary
Stage 1 Remediation Extent (AEC-9)
Western Area Boundary
Biopile Treatment Area
Temporary Material Handling and Storage Area
Surplus / Treated Soils Stockpiling Area (Tank Farm A1)
Waste Water Treatment Plant (WWTP)
Worker Carpark Area
Data Source:
Nearmap imagery April 2019
Stage 1 Remediation Site Layout
F8
Drawing No: 0515132b_RAP_G009_R0.mxd
Date: 08/04/2020
Drawing Size: A3
Drawn By: GR / GC
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0
50
100m
N
Clyde WARP - Detailed Remediation Action Plan (Stage 1), Clyde Terminal - Durham Street, Rosehill
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

Stage 1 Validation





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)

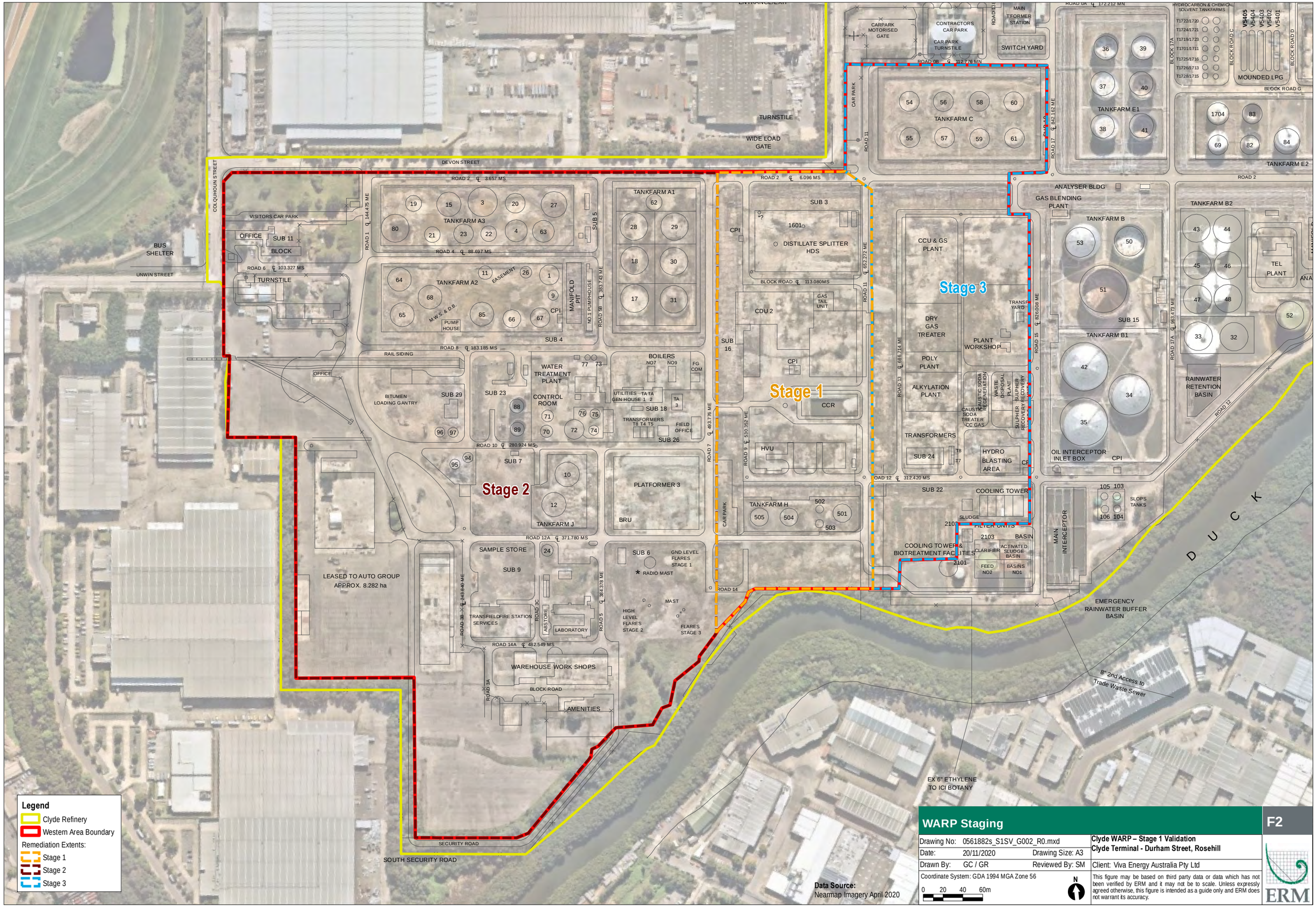
Source:
Nearmap Imagery July 2019
Locality: Esri, OpenStreetMap 2019

Site Location

F1

Drawing No:	0561882s_S1SV_G001_R0.mxd		**Clyde WARP – Stage 1 Validation** **Clyde Terminal - Durham Street, Rosehill**
Date:	20/11/2020	Drawing Size: A4	
Drawn By:	GC / GR	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

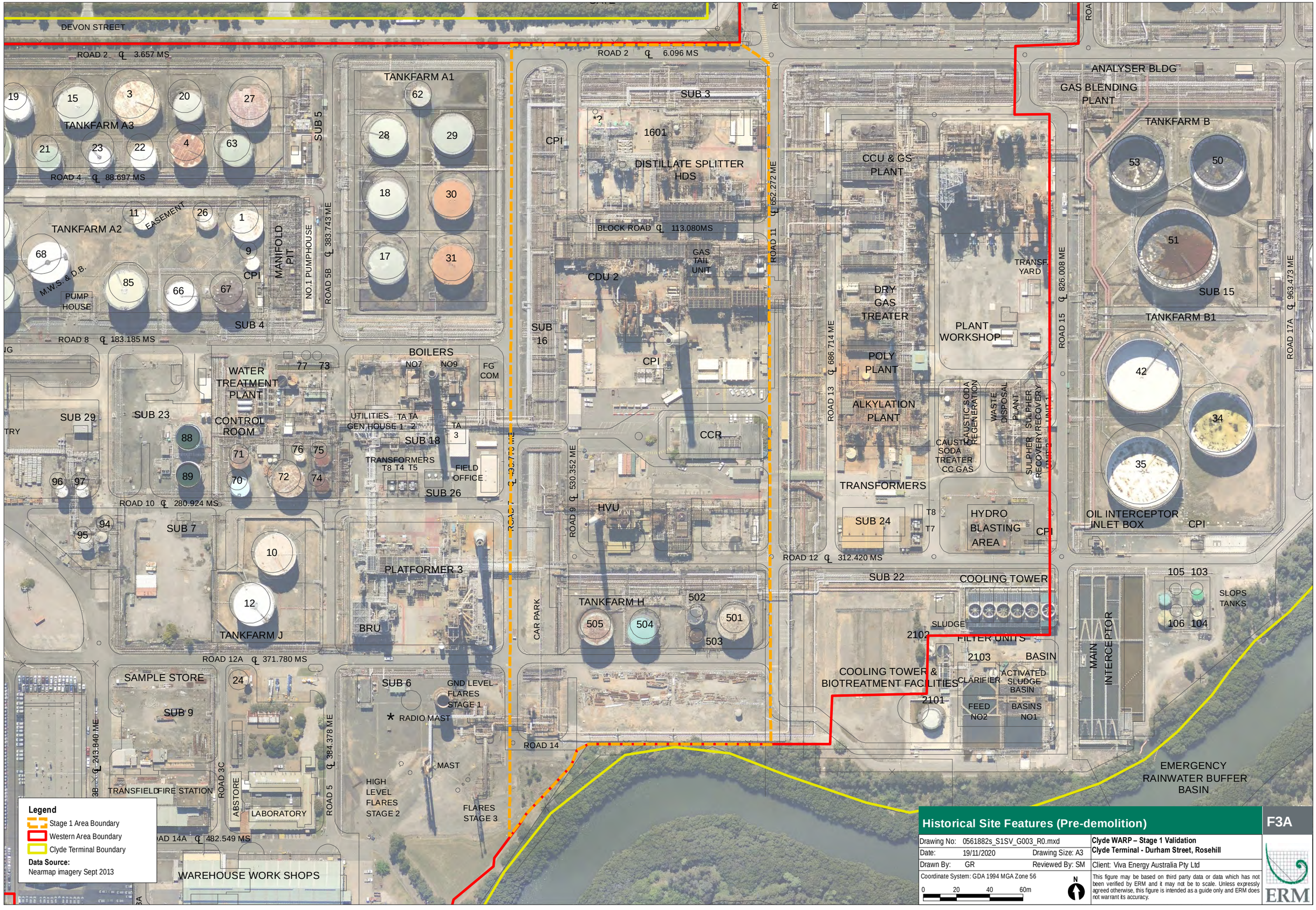


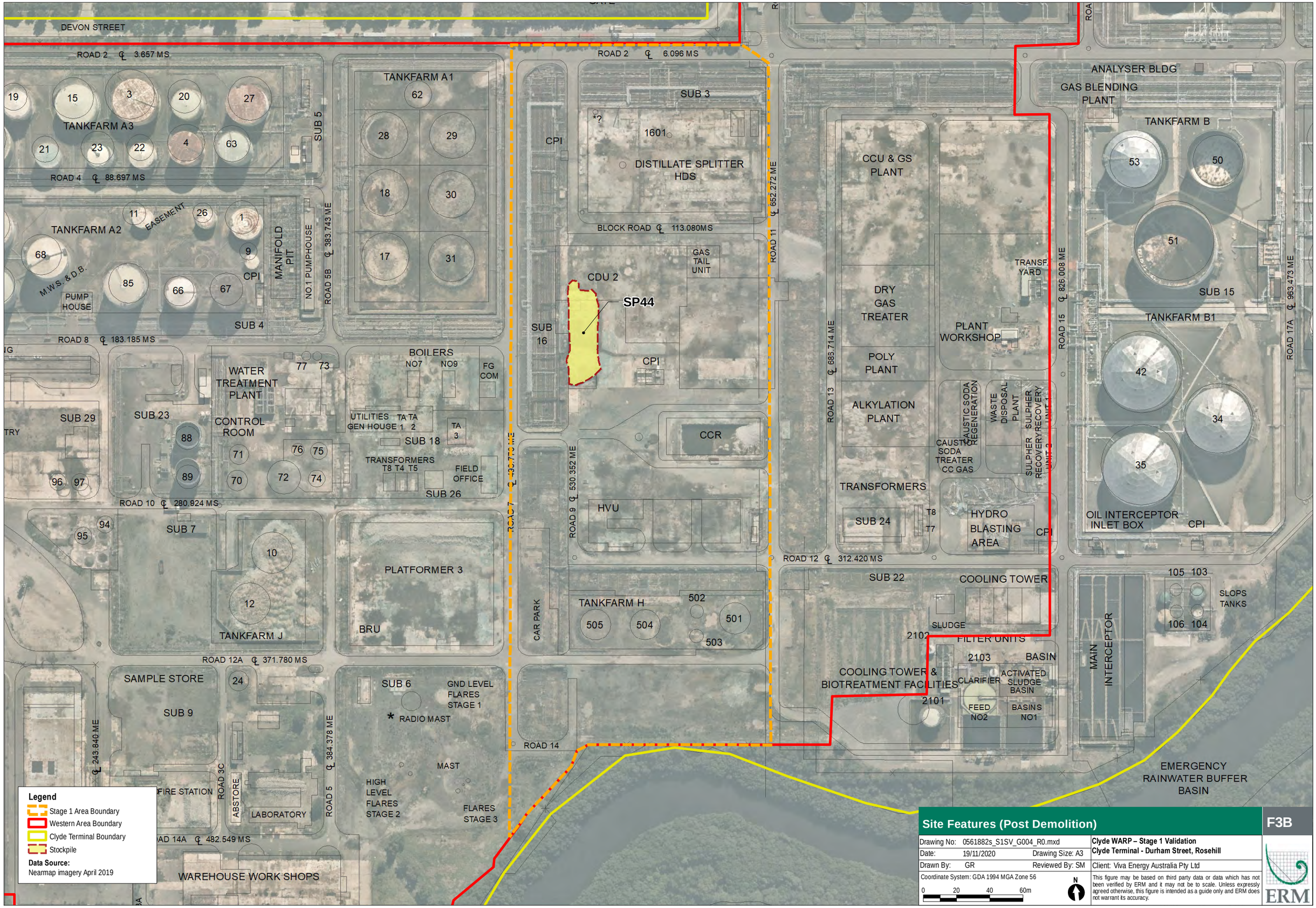
WARP Staging

F2

Drawing No:	0561882s_S1SV_G002_R0.mxd		Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	20/11/2020	Drawing Size: A3	
Drawn By:	GC / GR	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


DEVON STREET
ROAD 2 ℄ 3.657 MS
ROAD 2 ℄ 6.096 MS
TANKFARM A3
TANKFARM A1
TANKFARM A2
SUB 5
SUB 4
SUB 3
1601
DISTILLATE SPLITTER HDS
CPI
BLOCK ROAD ℄ 113.080MS
ROAD 4 ℄ 88.697 MS
ROAD 5B ℄ 383.743 ME
ROAD 11 ℄ 652.272 ME
MANIFOLD PIT
NO.1 PUMPHOUSE
EASEMENT
M.W.S. & D.B.
PUMP HOUSE
GAS TAIL UNIT
CDU 2
SUB 16
ROAD 8 ℄ 183.185 MS
BOILERS
NO7
NO9
FG COM
WATER TREATMENT PLANT
CONTROL ROOM
SUB 29
SUB 23
SUB 18
SUB 26
UTILITIES GEN HOUSE 1
TA TA 1 2
TA 3
TRANSFORMERS T8 T4 T5
FIELD OFFICE
ROAD 7 ℄ 35.770 ME
ROAD 9 ℄ 530.352 ME
ROAD 10 ℄ 280.924 MS
SUB 7
HVU
PLATFORMER 3
BRU
TANKFARM J
TANKFARM H
CAR PARK
CCR
ROAD 12 ℄ 312.420 MS
ROAD 12A ℄ 371.780 MS
SAMPLE STORE
SUB 9
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
ROAD 14
ROAD 3B ℄ 243.840 ME
ROAD 3C
ROAD 5 ℄ 384.378 ME
ABSTORE
LABORATORY
TRANSFIELD FIRE STATION
ROAD 14A ℄ 482.549 MS
WAREHOUSE WORK SHOPS
CCU & GS PLANT
TRANSF. YARD
DRY GAS TREATER
PLANT WORKSHOP
POLY PLANT
ALKYLATION PLANT
CAUSTIC SODA REGENERATION
CAUSTIC SODA TREATER CC GAS
WASTE DISPOSAL PLANT
SULPHER RECOVERY UNIT 1
SULPHER RECOVERY UNIT 2
TRANSFORMERS
SUB 24
HYDRO BLASTING AREA
ROAD 13 ℄ 686.714 ME
ROAD 15 ℄ 826.008 ME
ANALYSER BLDG
GAS BLENDING PLANT
TANKFARM B
TANKFARM B1
SUB 15
OIL INTERCEPTOR INLET BOX
ROAD 17A ℄ 963.473 ME
SUB 22
COOLING TOWER
SLUDGE
FILTER UNITS
2102
2103
BASIN
COOLING TOWER & BIOTREATMENT FACILITIES
CLARIFIER
ACTIVATED SLUDGE BASIN
2101
FEED NO2
BASINS NO1
MAIN INTERCEPTOR
SLOPS TANKS
EMERGENCY RAINWATER BUFFER BASIN
Legend
Stage 1 Area Boundary
Western Area Boundary
Clyde Terminal Boundary
Data Source:
Nearmap imagery Sept 2013
Historical Site Features (Pre-demolition)
F3A
Drawing No: 0561882s_S1SV_G003_R0.mxd
Date: 19/11/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
N
Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill
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


DEVON STREET
ROAD 2 ℄ 3.657 MS
ROAD 2 ℄ 6.096 MS
TANKFARM A3
TANKFARM A2
TANKFARM A1
SUB 5
SUB 4
ROAD 4 ℄ 88.697 MS
ROAD 5B ℄ 383.743 ME
MANIFOLD PIT
NO.1 PUMPHOUSE
EASEMENT
M.W.S. & D.B.
PUMP HOUSE
CPI
ROAD 8 ℄ 183.185 MS
SUB 3
1601
DISTILLATE SPLITTER HDS
BLOCK ROAD ℄ 113.080MS
ROAD 11 ℄ 662.272 ME
GAS TAIL UNIT
CDU 2
SP44
SUB 16
CPI
CCR
HVU
ROAD 9 ℄ 530.352 ME
ROAD 7 ℄ 536.770 ME
ROAD 10 ℄ 280.924 MS
WATER TREATMENT PLANT
CONTROL ROOM
SUB 23
SUB 29
BOILERS
NO7
NO9
FG COM
UTILITIES GEN HOUSE 1
TA TA 2
TA 3
SUB 18
TRANSFORMERS T8 T4 T5
FIELD OFFICE
SUB 26
SUB 7
PLATFORMER 3
BRU
TANKFARM J
TANKFARM H
CAR PARK
ROAD 12A ℄ 371.780 MS
SAMPLE STORE
SUB 9
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
ROAD 14
ROAD 3C
ABSTORE
LABORATORY
ROAD 5 ℄ 384.378 ME
℄ 243.840 ME
FIRE STATION
AD 14A ℄ 482.549 MS
WAREHOUSE WORK SHOPS
CCU & GS PLANT
DRY GAS TREATER
POLY PLANT
ALKYLATION PLANT
TRANSFORMERS
SUB 24
T8
T7
ROAD 13 ℄ 685.714 ME
TRANSF. YARD
PLANT WORKSHOP
CAUSTIC SODA REGENERATION
CAUSTIC SODA TREATER CC GAS
WASTE DISPOSAL PLANT
SULPHER RECOVERY UNIT 1
SULPHER RECOVERY UNIT 2
HYDRO BLASTING AREA
CPI
ROAD 12 ℄ 312.420 MS
ROAD 15 ℄ 826.008 ME
ANALYSER BLDG
GAS BLENDING PLANT
TANKFARM B
TANKFARM B1
SUB 15
OIL INTERCEPTOR INLET BOX
CPI
ROAD 17A ℄ 963.473 ME
SUB 22
COOLING TOWER
SLUDGE
2102
FILTER UNITS
2103
BASIN
COOLING TOWER & BIOTREATMENT FACILITIES
CLARIFIER
ACTIVATED SLUDGE BASIN
2101
FEED NO2
BASINS NO1
MAIN INTERCEPTOR
SLOPS TANKS
EMERGENCY RAINWATER BUFFER BASIN
Legend
Stage 1 Area Boundary
Western Area Boundary
Clyde Terminal Boundary
Stockpile
Data Source:
Nearmap imagery April 2019
Site Features (Post Demolition)
F3B
Drawing No: 0561882s_S1SV_G004_R0.mxd
Date: 19/11/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
N
Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill
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

MW11/01
MW11/02
MW11/03
MW11/04
MW11/05
MW11/06
MW11/07
MW11/08
MW11/09
MW11/10
MW11/11
MW11/12
MW11/13
MW11/14
MW11/15
MW11/16
MW11/17
MW11/18
MW11/19
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MW11/22
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MW11/34
MW11/35
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MW11/37
MW11/38
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MW11/41
MW11/42
MW11/43
MW11/44
MW11/45
MW11/46
MW12/03
MW12/16
MW12/17
MW12/18
MW12/19
MW12/21
MW12/22
MW12/23
MW12/24
MW94/2
MW94/4
MW94/6X
MW94/8
MW94/9
MW95/7
MW96/7
MW98/4
MW98/5
MW98/6
MW98/7
MW98/8
MW98/9
MW18/06
MW18/07
MW18/10
MW18/23
SP44
SP64
SP65
SP66
SP67
SP68
SP73
Biopiling Area(SP72)
CCR

Legend

- Stage 1 Area Boundary
- Western Area Boundary
- Clyde Terminal Boundary
- Stockpile
- Biopiling Area - containing SP72
- Central Control Room (CCR)
- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well
- Pits
- Pits - Removed (AEC9)
- Drainage Line
- Drainage Line - Removed (AEC9)
- AEC9_W_22 Chase Out Area
- AEC-9 Excavation (Backfilled)

Data Source:
Nearmap imagery Sept 2020

Note:
Details on the status of the drainage network are provided separately within the Drainage Decommissioning

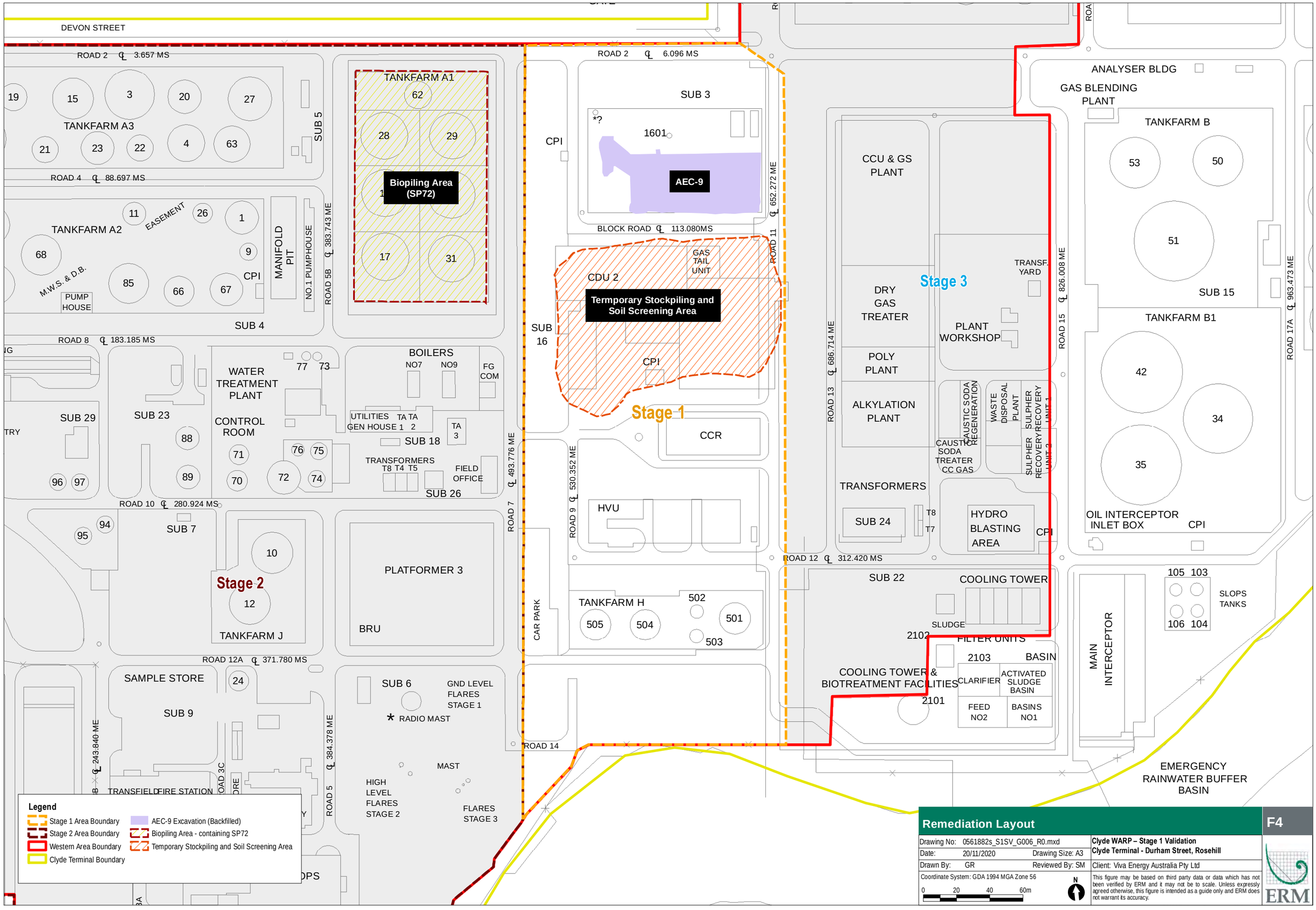
Site Features (Post Soil Remediation)

F3C

Drawing No: 0561882s_S1SV_G005_R0.mxd		**Clyde WARP – Stage 1 Validation** **Clyde Terminal - Durham Street, Rosehill**
Date: 20/11/2020	Drawing Size: A3	
Drawn By: GR	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.

0 20 40 60m

ERM


DEVON STREET
ROAD 2 3.657 MS
TANKFARM A3
19
15
3
20
27
21
23
22
4
63
SUB 5
ROAD 4 88.697 MS
TANKFARM A2
11
EASEMENT
26
1
68
9
CPI
M.W.S. & D.B.
85
66
67
PUMP HOUSE
MANIFOLD PIT
NO.1 PUMPHOUSE
ROAD 5B 383.743 ME
SUB 4
ROAD 8 183.185 MS
TANKFARM A1
62
28
29
Biopiling Area (SP72)
17
31
ROAD 2 6.096 MS
SUB 3
*?
1601
CPI
AEC-9
652.272 ME
BLOCK ROAD 113.080MS
ROAD 11
GAS TAIL UNIT
CDU 2
Termporary Stockpiling and Soil Screening Area
SUB 16
CPI
Stage 1
CCR
ROAD 13 686.714 ME
CCU & GS PLANT
DRY GAS TREATER
POLY PLANT
ALKYLATION PLANT
Stage 3
TRANSF. YARD
PLANT WORKSHOP
CAUSTIC SODA REGENERATION
WASTE DISPOSAL PLANT
SULPHER RECOVERY UNIT 1
SULPHER RECOVERY UNIT 2
CAUSTIC SODA TREATER CC GAS
ROAD 15 826.008 ME
ANALYSER BLDG
GAS BLENDING PLANT
TANKFARM B
53
50
51
SUB 15
TANKFARM B1
42
34
35
ROAD 17A 963.473 ME
OIL INTERCEPTOR INLET BOX
CPI
SUB 29
SUB 23
88
89
96
97
WATER TREATMENT PLANT
77
73
CONTROL ROOM
71
70
76
75
72
74
BOILERS
NO7
NO9
FG COM
UTILITIES GEN HOUSE 1
TA 1
TA 2
TA 3
SUB 18
TRANSFORMERS T8 T4 T5
FIELD OFFICE
SUB 26
493.776 ME
530.352 ME
ROAD 7
ROAD 9
HVU
TRANSFORMERS
SUB 24
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T7
HYDRO BLASTING AREA
CPI
ROAD 12 312.420 MS
SUB 22
COOLING TOWER
SLUDGE
FILTER UNITS
2102
2103
BASIN
CLARIFIER
ACTIVATED SLUDGE BASIN
FEED NO2
BASINS NO1
COOLING TOWER & BIOTREATMENT FACILITIES
2101
MAIN INTERCEPTOR
105
103
106
104
SLOPS TANKS
ROAD 10 280.924 MS
94
95
SUB 7
10
Stage 2
12
TANKFARM J
PLATFORMER 3
BRU
CAR PARK
TANKFARM H
505
504
502
501
503
ROAD 12A 371.780 MS
SAMPLE STORE
24
SUB 9
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
ROAD 14
243.840 ME
384.378 ME
ROAD 5
TRANSFIELD FIRE STATION
EMERGENCY RAINWATER BUFFER BASIN
Legend
Stage 1 Area Boundary
Stage 2 Area Boundary
Western Area Boundary
Clyde Terminal Boundary
AEC-9 Excavation (Backfilled)
Biopiling Area - containing SP72
Temporary Stockpiling and Soil Screening Area
Remediation Layout
F4
Drawing No: 0561882s_S1SV_G006_R0.mxd
Date: 20/11/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
N
Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill
Client: Viva Energy Australia Pty Ltd
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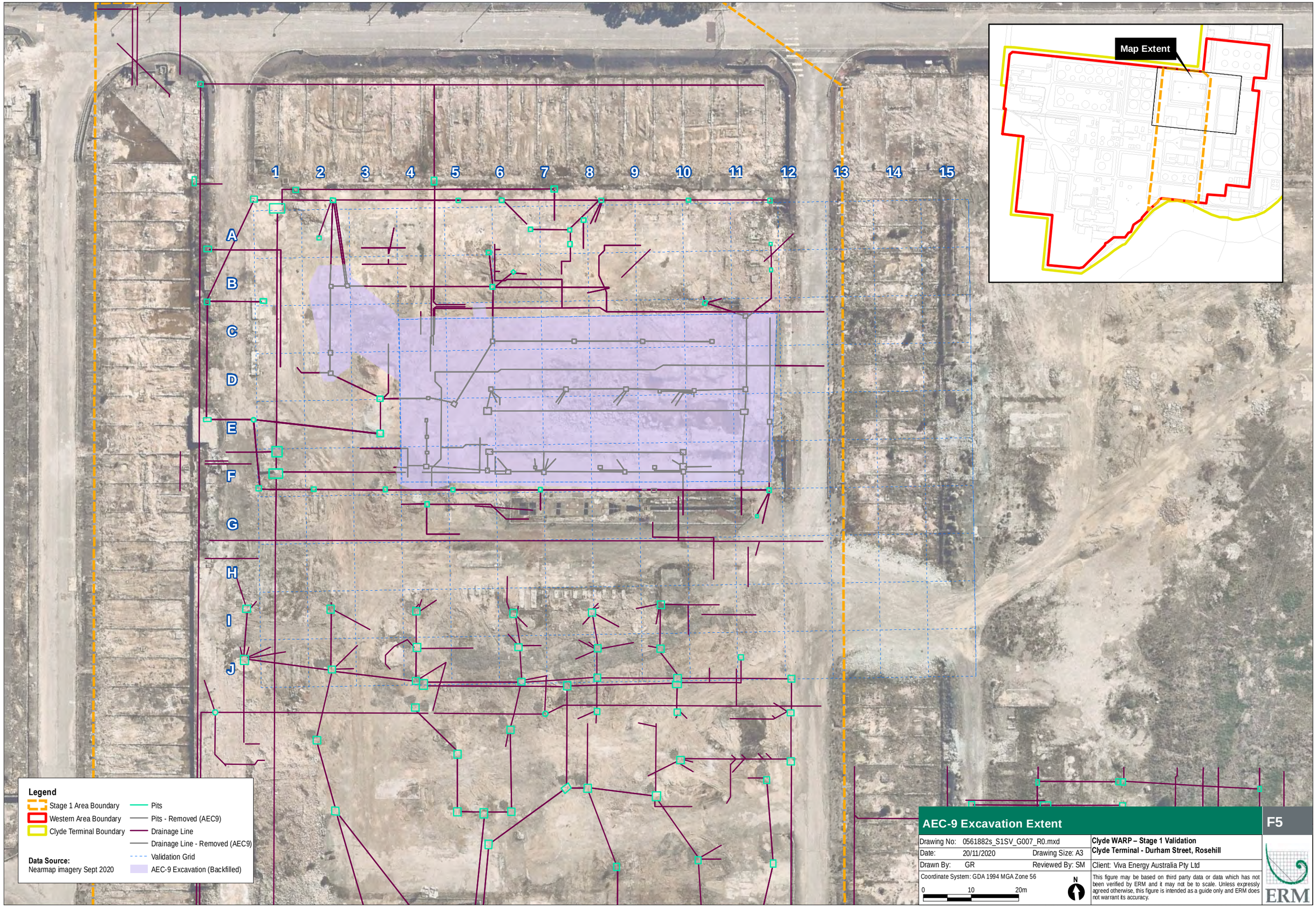
ERM


1
2
3
4
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6
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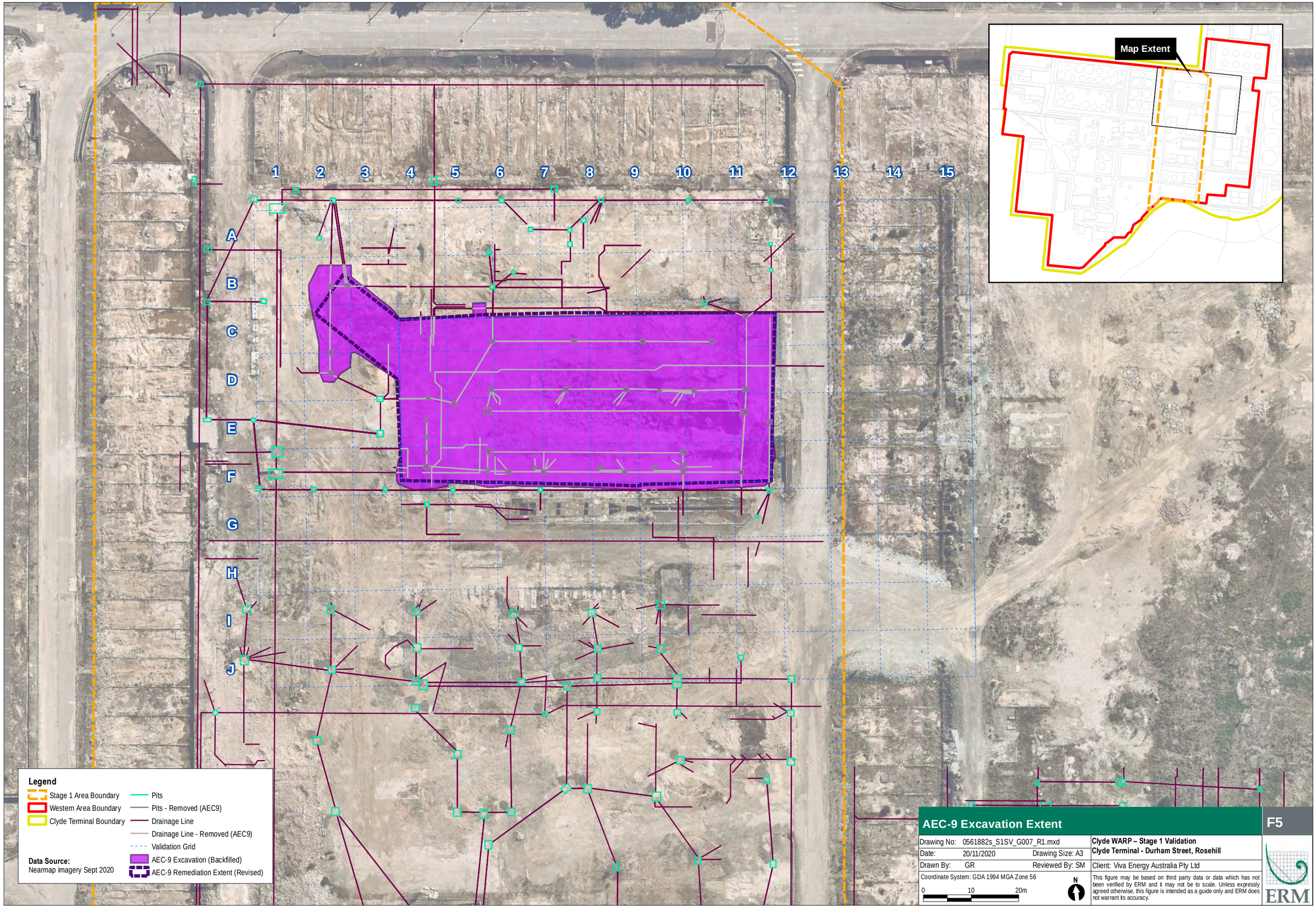
8
9
10
11
12
13
14
15
A
B
C
D
E
F
G
H
I
J
Map Extent
Legend
Stage 1 Area Boundary
Western Area Boundary
Clyde Terminal Boundary
Pits
Pits - Removed (AEC9)
Drainage Line
Drainage Line - Removed (AEC9)
Validation Grid
AEC-9 Excavation (Backfilled)
Data Source:
Nearmap imagery Sept 2020
AEC-9 Excavation Extent
F5
Drawing No: 0561882s_S1SV_G007_R0.mxd
Date: 20/11/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill
Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
0
10
20m
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


Map Extent
1
2
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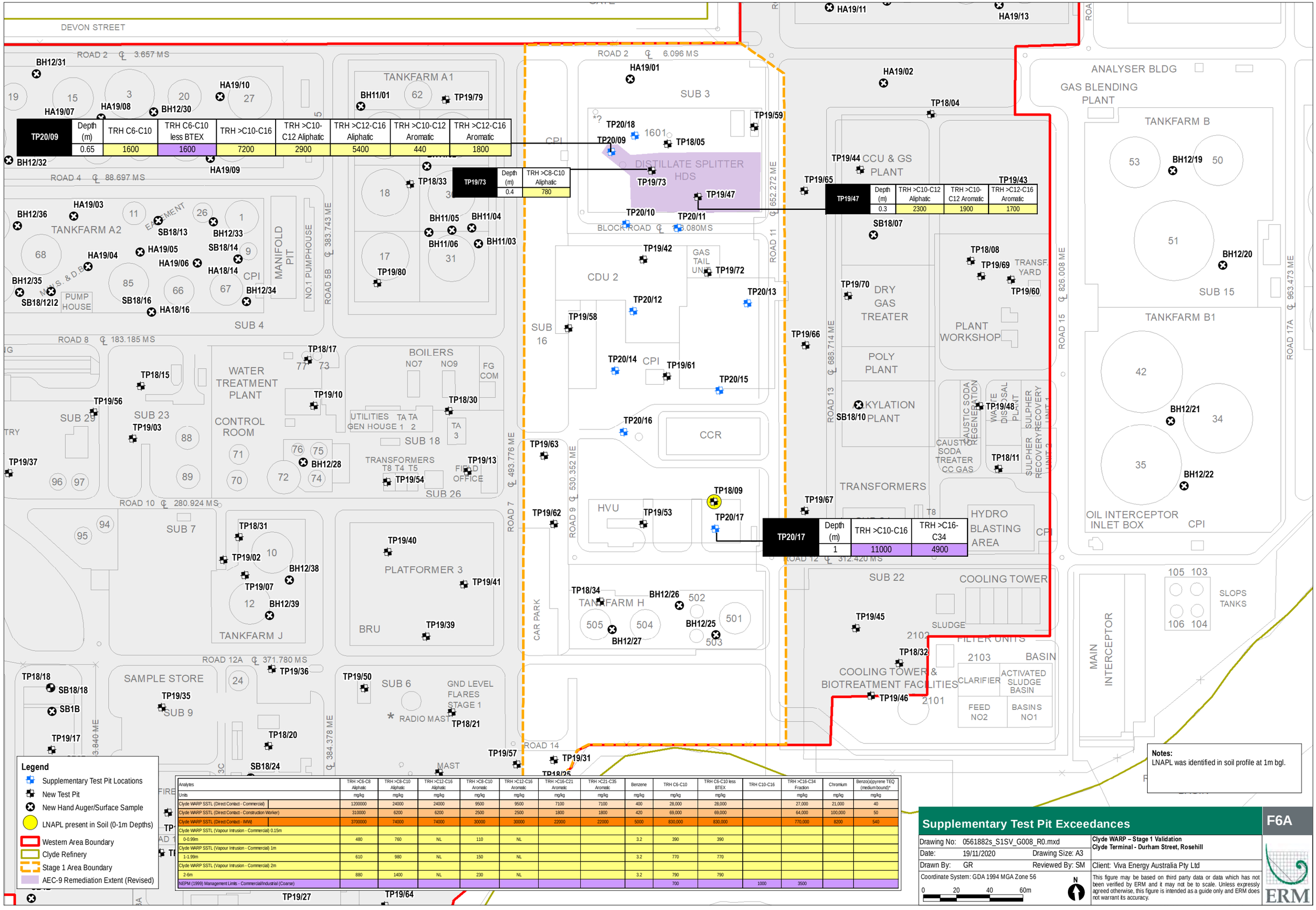
J
Legend
Stage 1 Area Boundary
Western Area Boundary
Clyde Terminal Boundary
Pits
Pits - Removed (AEC9)
Drainage Line
Drainage Line - Removed (AEC9)
Validation Grid
AEC-9 Excavation (Backfilled)
AEC-9 Remediation Extent (Revised)
Data Source:
Nearmap imagery Sept 2020
AEC-9 Excavation Extent
F5
Drawing No: 0561882s_S1SV_G007_R1.mxd
Date: 20/11/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0
10
20m
N
Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill
Client: Viva Energia 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



TP20/09	Depth (m)	TRH C6-C10	TRH C6-C10 less BTEX	TRH >C10-C16	TRH >C10-C12 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic
	0.65	1600	1600	7200	2900	5400	440	1800

TP19/73	Depth (m)	TRH >C8-C10 Aliphatic
	0.4	780

TP19/47	Depth (m)	TRH >C10-C12 Aliphatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic
	0.3	2300	1900	1700

TP20/17	Depth (m)	TRH >C10-C16	TRH >C16-C34
	1	11000	4900

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	TRH C6-C10 less BTEX	TRH C10-C16	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
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	9500	9500	7100	7100	400	28,000	28,000		27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420	69,000	69,000		64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000	830,000	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	390				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m														
1-1.99m	610	980	NL	150	NL			3.2	770	770				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m														
2-6m	880	1400	NL	230	NL			3.2	790	790				
NEPM (1999) Management Limits - Commercial/Industrial (Coarse)									700		1000	3500		

Legend

- Supplementary Test Pit Locations
- New Test Pit
- New Hand Auger/Surface Sample
- LNAPL present in Soil (0-1m Depths)
- Western Area Boundary
- Clyde Refinery
- Stage 1 Area Boundary
- AEC-9 Remediation Extent (Revised)

Notes:
LNAPL was identified in soil profile at 1m bgl.

Supplementary Test Pit Exceedances

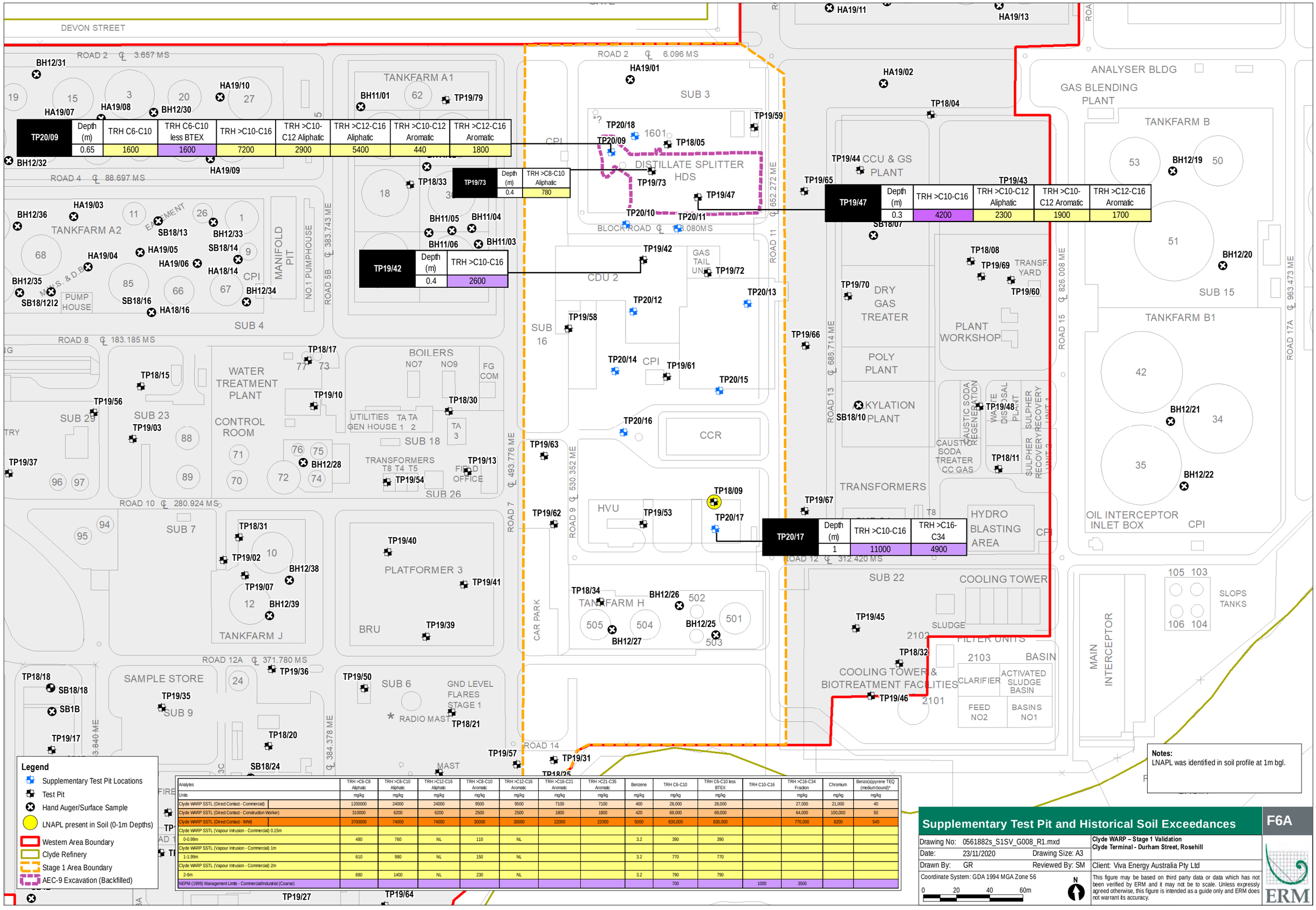
F6A

Drawing No: 0561882s_S1SV_G008_R0.mxd
Date: 19/11/2020 Drawing Size: A3
Drawn By: GR Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m

Clyde WARP – Stage 1 Validation
Clyde Terminal - Durham Street, Rosehill

Client: Viva Energy Australia Pty Ltd

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	TRH C6-C10 less BTEX	TRH C10-C16	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
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	9500	9500	7100	7100	400	28,000	28,000		27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420	69,000	69,000		64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000	830,000	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	390				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m														
1-1.99m	610	980	NL	150	NL			3.2	770	770				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m														
2-6m	880	1400	NL	230	NL			3.2	790	790				
NEPM (1999) Management Limits - Commercial/Industrial (Coarse)									700		1000	3500		

Supplementary Test Pit and Historical Soil Exceedances

F6A

Drawing No:	0561882s_S1SV_G008_R1.mxd	Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	23/11/2020	Drawing Size: A3
Drawn By:	GR	Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56		Client: Viva Energy Australia Pty Ltd

0 20 40 60m

N

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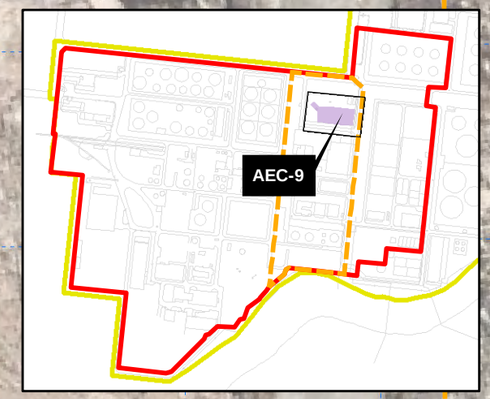
ERM

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	TRH C6-C10 less BTEX	TRH C10-C16	TRH C6-C10 less BTEX	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	28,000		28,000	27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420	69,000	69,000		69,000	64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000	830,000	830,000		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	390		390			
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m															
1-1.99m	610	980	NL	150	NL			3.2	770	770		770			
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m															
2-6m	880	1400	NL	230	NL			3.2	790	790		790			
NEPM (1999) Management Limits - Commercial/Industrial (Coarse)									700		1000		3500		



AEC9_W_V24	Depth (m)	TRH >C10-C16	TRH >C16-C34
	1.5	6400	11000

AEC9_W_V22	Depth (m)	TRH >C10-C16	TRH >C16-C34	TRH >C12-C16 Aromatic
	1	5100	6400	3500

Location	Easting	Northing
AEC9_ACM_1	318318	6255152
AEC9_ACM_2	318329	6255150
AEC9_ACM_3	318246	6255187

Legend

- Validation Sample locations below remediation criteria
- Validation Sample locations above remediation criteria
- Asbestos Containing Material (Unexpected Find)
- AEC-9 Excavation (Backfilled)
- Validation Grid
- AEC-9 Actual Extent
- Clyde Terminal Boundary
- Western Area Boundary
- Stage 1 Area Boundary

Data Source:
Nearmap imagery Sept 2020

AEC-9 Excavation Validation

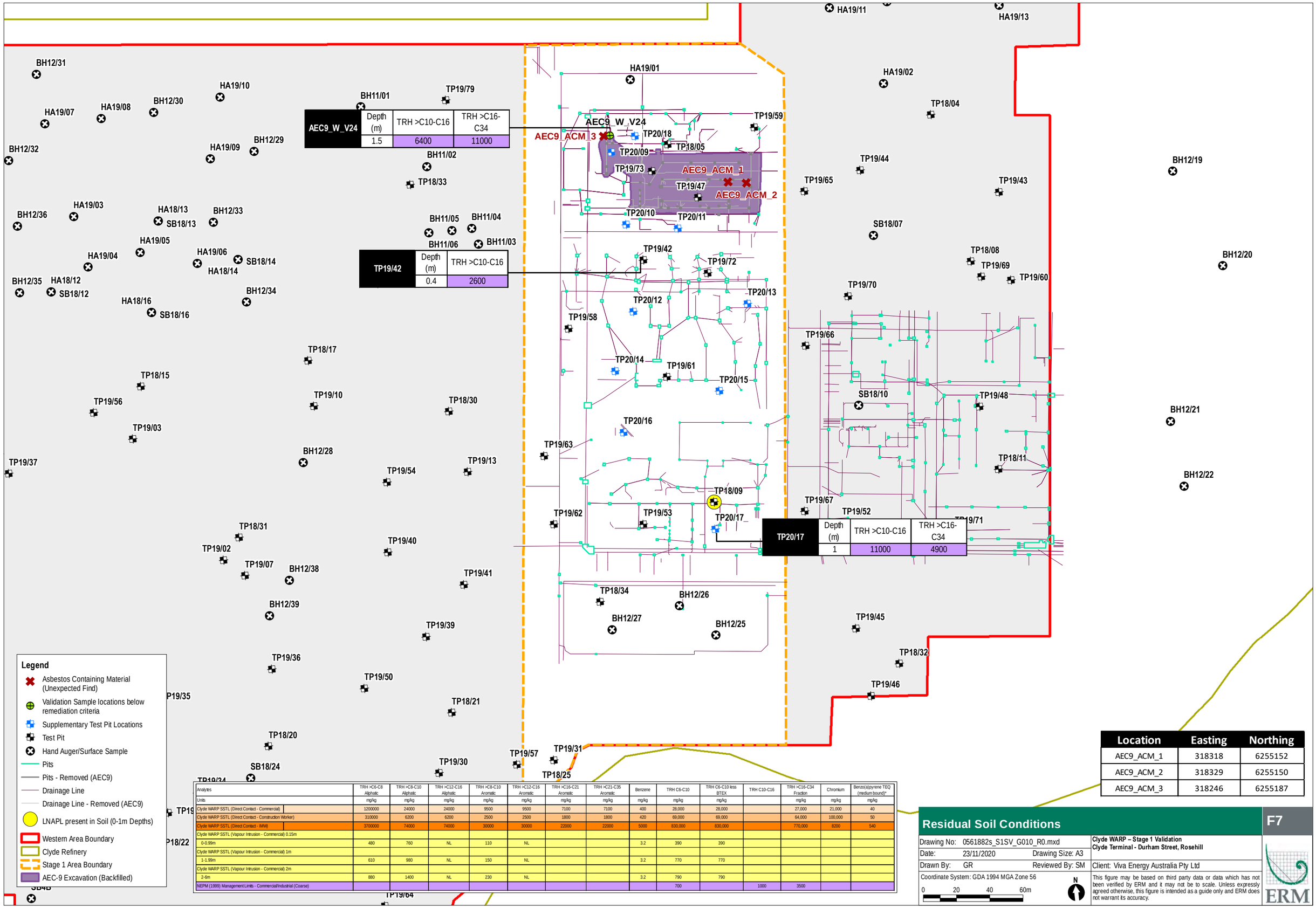
F6B

Drawing No:	0561882s_S1SV_G009_R1.mxd	Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	23/11/2020	Drawing Size: A3
Drawn By:	GR	Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56		Client: Viva Energy Australia Pty Ltd

0 10m

N

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	TRH C6-C10 less BTEX	TRH C10-C16	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
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	9500	9500	7100	7100	400	28,000	28,000		27,000	21,000	40
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	2500	2500	1800	1800	420	69,000	69,000		64,000	100,000	50
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	30000	30000	22000	22000	5000	830,000	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	390				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 1m														
1-1.99m	610	980	NL	150	NL			3.2	770	770				
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m														
2-6m	880	1400	NL	230	NL			3.2	790	790				
NEPM (1999) Management Limits - Commercial/Industrial (Coarse)									700		1000	3500		

Location	Easting	Northing
AEC9_ACM_1	318318	6255152
AEC9_ACM_2	318329	6255150
AEC9_ACM_3	318246	6255187

Residual Soil Conditions

F7

Drawing No:	0561882s_S1SV_G010_R0.mxd		Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	23/11/2020	Drawing Size: A3	
Drawn By:	GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

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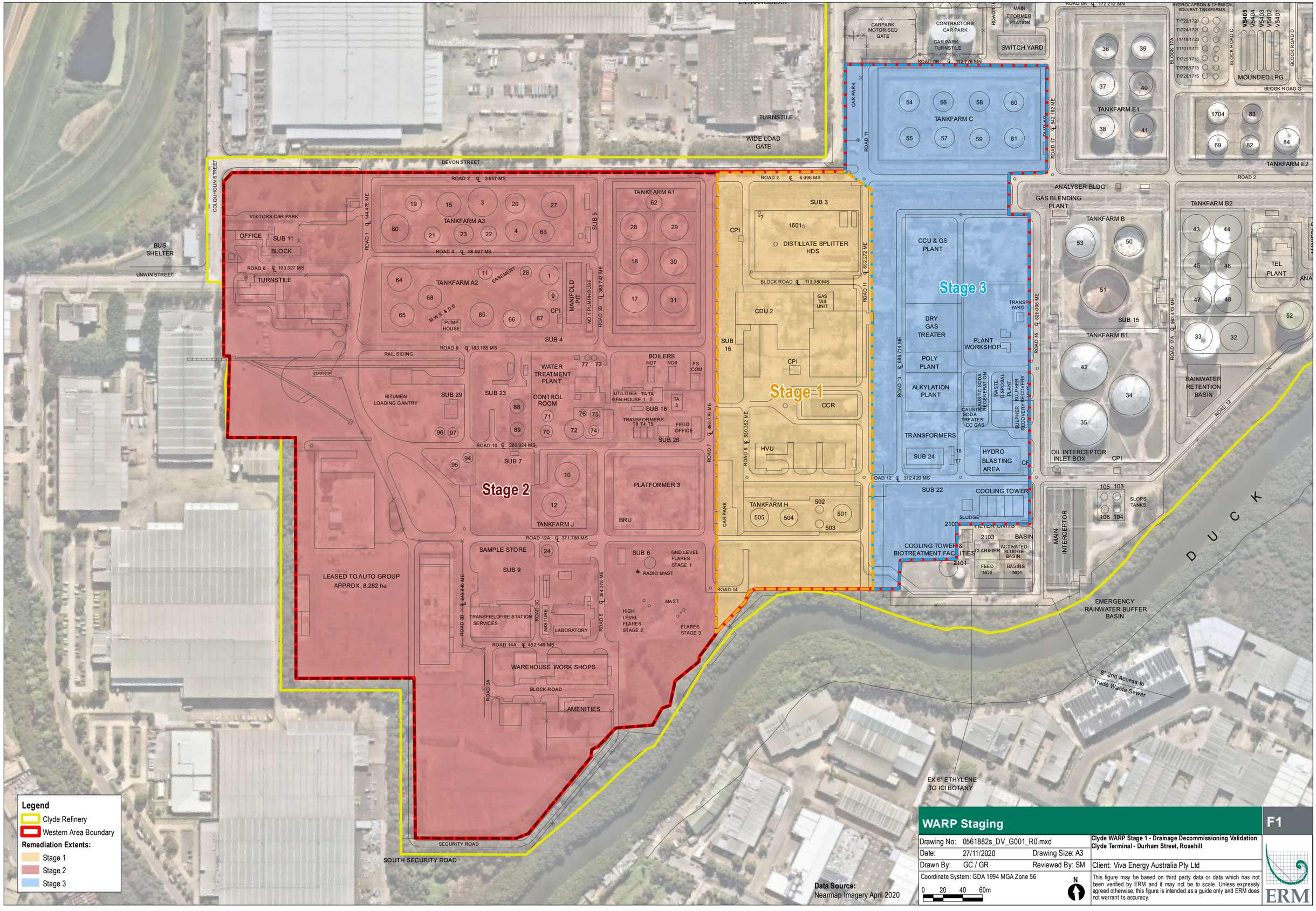
ERM

Drainage Validation


Stage 1
Stage 2
Stage 3
DEVON STREET
COLQUHOUN STREET
UNWIN STREET
BUS SHELTER
TURNSTILE
WIDE LOAD GATE
CARPARK MOTORISED GATE
CONTRACTORS CAR PARK
CAR PARK TURNSTILE
MAIN TFORMER STATION
SWITCH YARD
HYDROCARBON & CHEMICAL SOLVENT TANKFARMS
MOUNDED LPG
TANKFARM C
TANKFARM E1
TANKFARM E2
TANKFARM A1
TANKFARM A2
TANKFARM A3
TANKFARM B
TANKFARM B1
TANKFARM B2
TANKFARM H
TANKFARM J
VISITORS CAR PARK
OFFICE
SUB 11 BLOCK
TURNSTILE
MANIFOLD PIT
NO.1 PUMPHOUSE
PUMP HOUSE
M.W.S & D.B.
EASEMENT
SUB 4
SUB 5
RAIL SIDING
BITUMEN LOADING GANTRY
SUB 29
SUB 23
WATER TREATMENT PLANT
CONTROL ROOM
UTILITIES TA TA GEN HOUSE 1 2
BOILERS
NO7
NO9
FG COM
SUB 18
TRANSFORMERS T8 T4 T5
FIELD OFFICE
SUB 26
SUB 7
PLATFORMER 3
BRU
SUB 3
DISTILLATE SPLITTER HDS
CPI
CDU 2
GAS TAIL UNIT
SUB 16
CCR
HVU
CCU & GS PLANT
DRY GAS TREATER
POLY PLANT
ALKYLATION PLANT
PLANT WORKSHOP
TRANSFORMERS
SUB 24
HYDRO BLASTING AREA
CAUSTIC SODA REGENERATION
CAUSTIC SODA TREATER CC GAS
WASTE DISPOSAL PLANT
SULPHER RECOVERY
SULPHER RECOVERY
TRANSF YARD
ANALYSER BLDG
GAS BLENDING PLANT
SUB 15
TEL PLANT
RAINWATER RETENTION BASIN
OIL INTERCEPTOR INLET BOX
SUB 22
COOLING TOWER
SLOPS TANKS
SLUDGE
FILTER UNITS
COOLING TOWER & BIOTREATMENT FACILITIES
CLARIFIER
ACTIVATED SLUDGE BASIN
FEED NO2
BASINS NO1
MAIN INTERCEPTOR
EMERGENCY RAINWATER BUFFER BASIN
8" 2nd Access to Trade Waste Sewer
EX 6" ETHYLENE TO ICI BOTANY
SAMPLE STORE
SUB 9
SUB 6
GND LEVEL FLARES STAGE 1
RADIO MAST
MAST
HIGH LEVEL FLARES STAGE 2
FLARES STAGE 3
TRANSFIELDFIRE STATION SERVICES
ABSTORE
LABORATORY
WAREHOUSE WORK SHOPS
BLOCK ROAD
AMENITIES
LEASED TO AUTO GROUP APPROX. 8.282 ha
SECURITY ROAD
SOUTH SECURITY ROAD
CAR PARK
ROAD 1
ROAD 2
ROAD 3
ROAD 4
ROAD 5
ROAD 6
ROAD 7
ROAD 8
ROAD 9
ROAD 10
ROAD 11
ROAD 12
ROAD 12A
ROAD 13
ROAD 14
ROAD 14A
ROAD 15
ROAD 17
ROAD 17A
ROAD 3B
ROAD 3C
ROAD 9A
BLOCK ROAD C
BLOCK ROAD D
BLOCK ROAD G
Legend
Clyde Refinery
Western Area Boundary
Remediation Extents:
Stage 1
Stage 2
Stage 3
Data Source:
Nearmap Imagery April 2020
WARP Staging
F1
Drawing No: 0561882s_DV_G001_R0.mxd
Date: 27/11/2020
Drawing Size: A3
Drawn By: GC / GR
Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
Clyde WARP Stage 1 - Drainage Decommissioning Validation
Clyde Terminal - Durham Street, Rosehill
Client: Viva Energy Australia Pty Ltd
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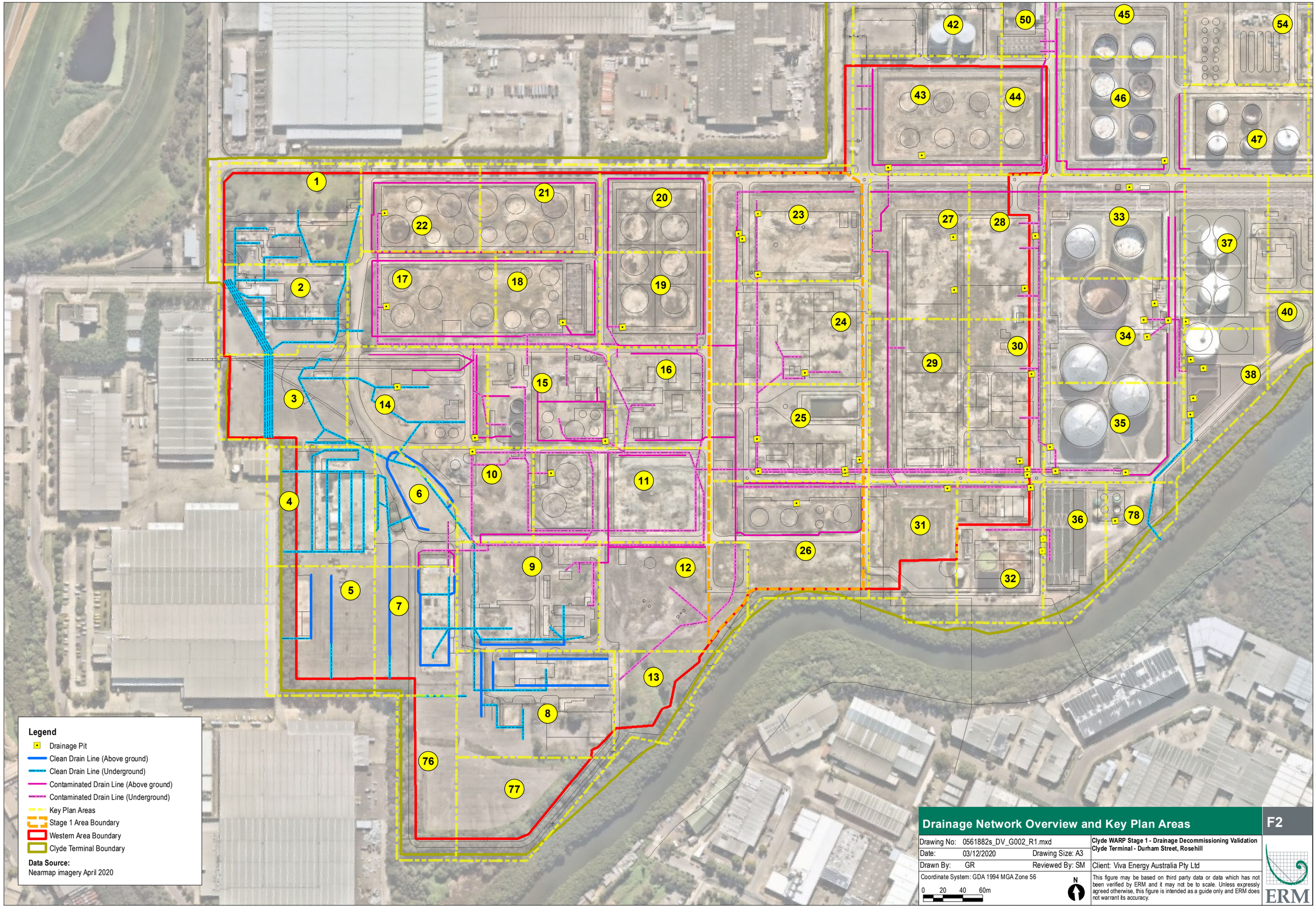
ERM



Drainage Network Overview and Key Plan Areas

F2

Drawing No:	0561882s_DV_G002_R1.mxd		Clyde WARP Stage 1 - Drainage Decommissioning Validation Clyde Terminal - Durham Street, Rosehill
Date:	03/12/2020	Drawing Size: A3	
Drawn By:	GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM

'HVU Pit' (P190)

1370mm Trunk Mains

Header Box

Waste Water Treatment Plant (WWTP)

Legend

- Key Plan Areas
- Sumps / Drainage Pits
- Drainage Pipelines
- Stage 1 Area Boundary
- Western Area Boundary
- Clyde Terminal Boundary

Data Source:
Nearmap imagery April 2020

Stage 1 Drainage Features

F3

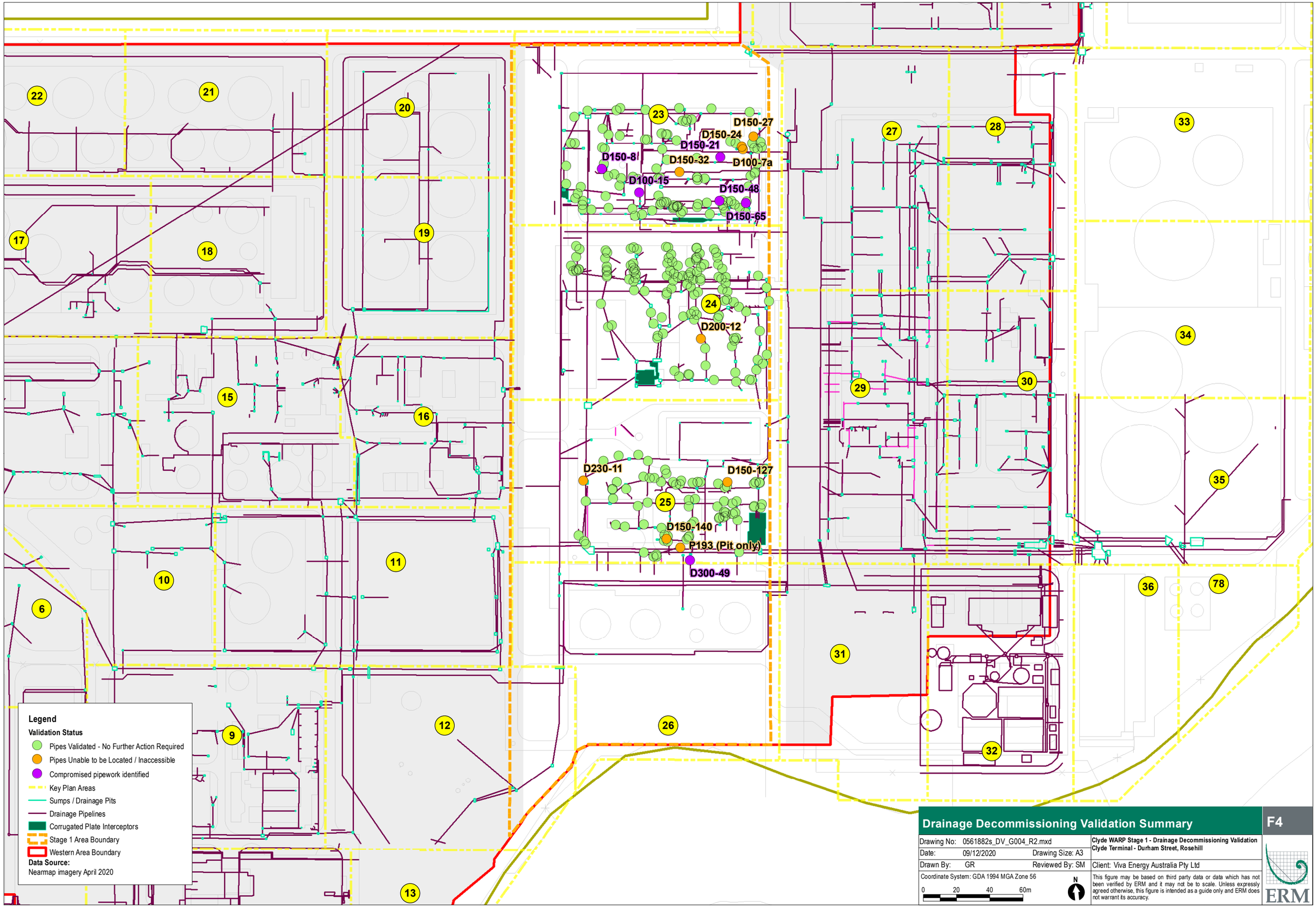
Drawing No:	0561882s_DV_G003_R1.mxd		Clyde WARP Stage 1 - Drainage Decommissioning Validation Clyde Terminal - Durham Street, Rosehill
Date:	18/12/2020	Drawing Size: A3	
Drawn By:	GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM


22
21
20
23
D150-27
D150-24
D150-21
D150-8
D150-32
D100-7a
D100-15
D150-48
D150-65
27
28
33
17
18
19
24
D200-12
34
15
16
29
30
D230-11
D150-127
25
35
D150-140
P193 (Pit only)
D300-49
11
10
36
78
6
31
12
26
9
32
13
Legend
Validation Status
Pipes Validated - No Further Action Required
Pipes Unable to be Located / Inaccessible
Compromised pipework identified
Key Plan Areas
Sumps / Drainage Pits
Drainage Pipelines
Corrugated Plate Interceptors
Stage 1 Area Boundary
Western Area Boundary
Data Source:
Nearmap imagery April 2020
Drainage Decommissioning Validation Summary
F4
Drawing No: 0561882s_DV_G004_R2.mxd
Clyde WARP Stage 1 - Drainage Decommissioning Validation
Clyde Terminal - Durham Street, Rosehill
Date: 09/12/2020
Drawing Size: A3
Drawn By: GR
Reviewed By: SM
Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
N
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ERM

D150-21
D150-8
TP20/19
D150-65
D150-48
D100-15
TP20/20
D300-49

TP20/20	Depth (m)	TRH >C10-C16
	0.5	5400

Legend

- Compromised Drainage Test Pits - Stage 1
- Compromised Drainage Pipelines
- Sumps / Drainage Pits
- Drainage Pipelines
- Key Plan Areas
- Stage 1 Area Boundary
- AEC-9 Excavation (Backfilled)
- Western Area Boundary

Data Source:
Nearmap imagery April 2020

Compromised Pipe Test Pitting Exceedances

F5

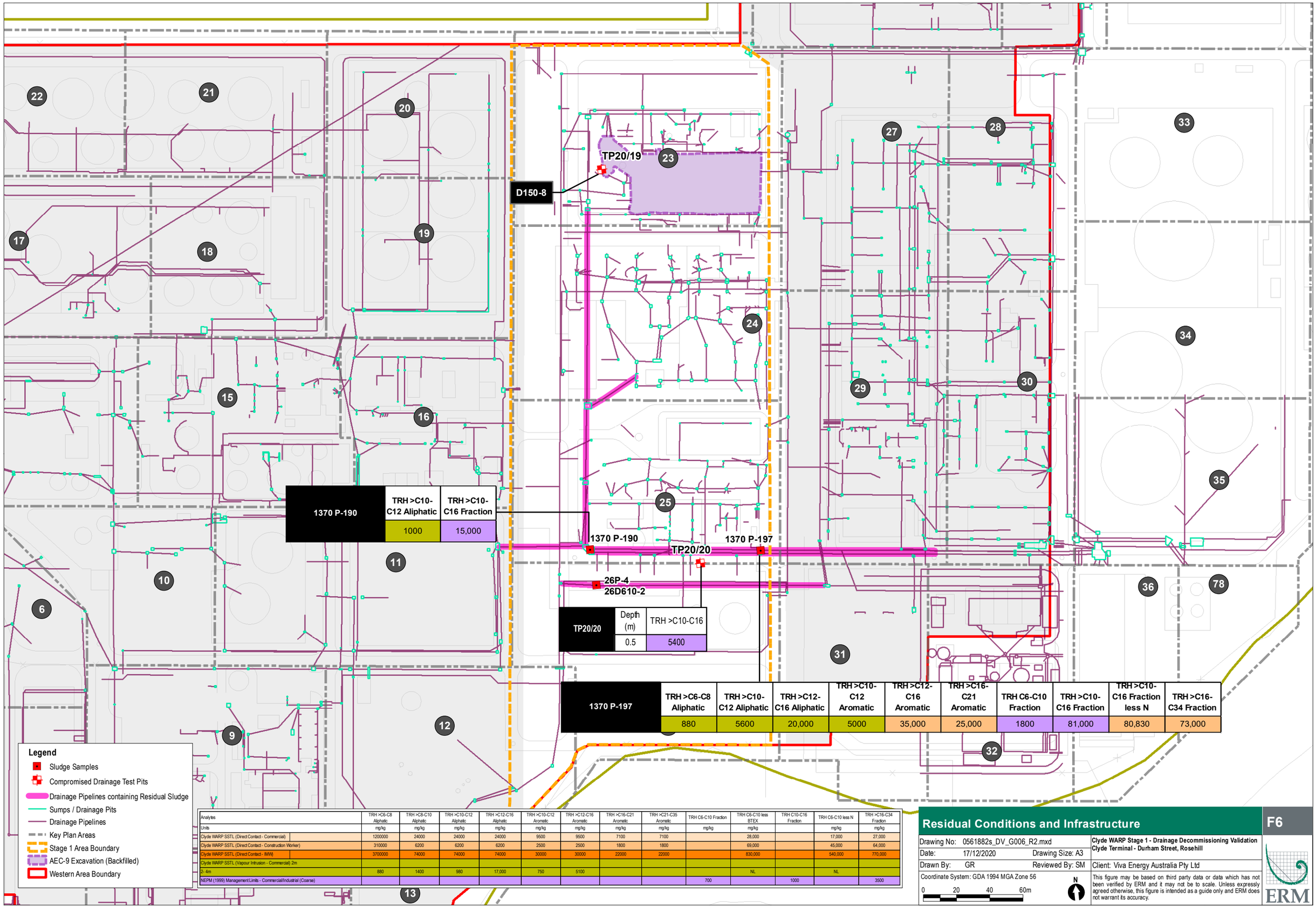
Drawing No: 0561882s_DV_G005_R2.mxd		Clyde WARP Stage 1 - Drainage Decommissioning Validation Clyde Terminal - Durham Street, Rosehill
Date: 09/12/2020	Drawing Size: A3	
Drawn By: GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM



Analytes	TRH >C6-C8 Aliphatic	TRH >C8-C10 Aliphatic	TRH >C10-C12 Aliphatic	TRH >C12-C16 Aliphatic	TRH >C10-C12 Aromatic	TRH >C12-C16 Aromatic	TRH >C16-C21 Aromatic	TRH >C21-C35 Aromatic	TRH C6-C10 Fraction	TRH C6-C10 less BTEX	TRH C10-C16 Fraction	TRH C6-C10 less N	TRH >C16-C34 Fraction
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
Clyde WARP SSTL (Direct Contact - Commercial)	1200000	24000	24000	24000	9500	9500	7100	7100		28,000		17,000	27,000
Clyde WARP SSTL (Direct Contact - Construction Worker)	310000	6200	6200	6200	2500	2500	1800	1800		69,000		45,000	64,000
Clyde WARP SSTL (Direct Contact - IMW)	3700000	74000	74000	74000	30000	30000	22000	22000		830,000		540,000	770,000
Clyde WARP SSTL (Vapour Intrusion - Commercial) 2m													
2- 4m	880	1400	980	17,000	750	5100				NL		NL	
NEPM (1999) Management Limits - Commercial/Industrial (Coarse)									700		1000		3500

Residual Conditions and Infrastructure

F6

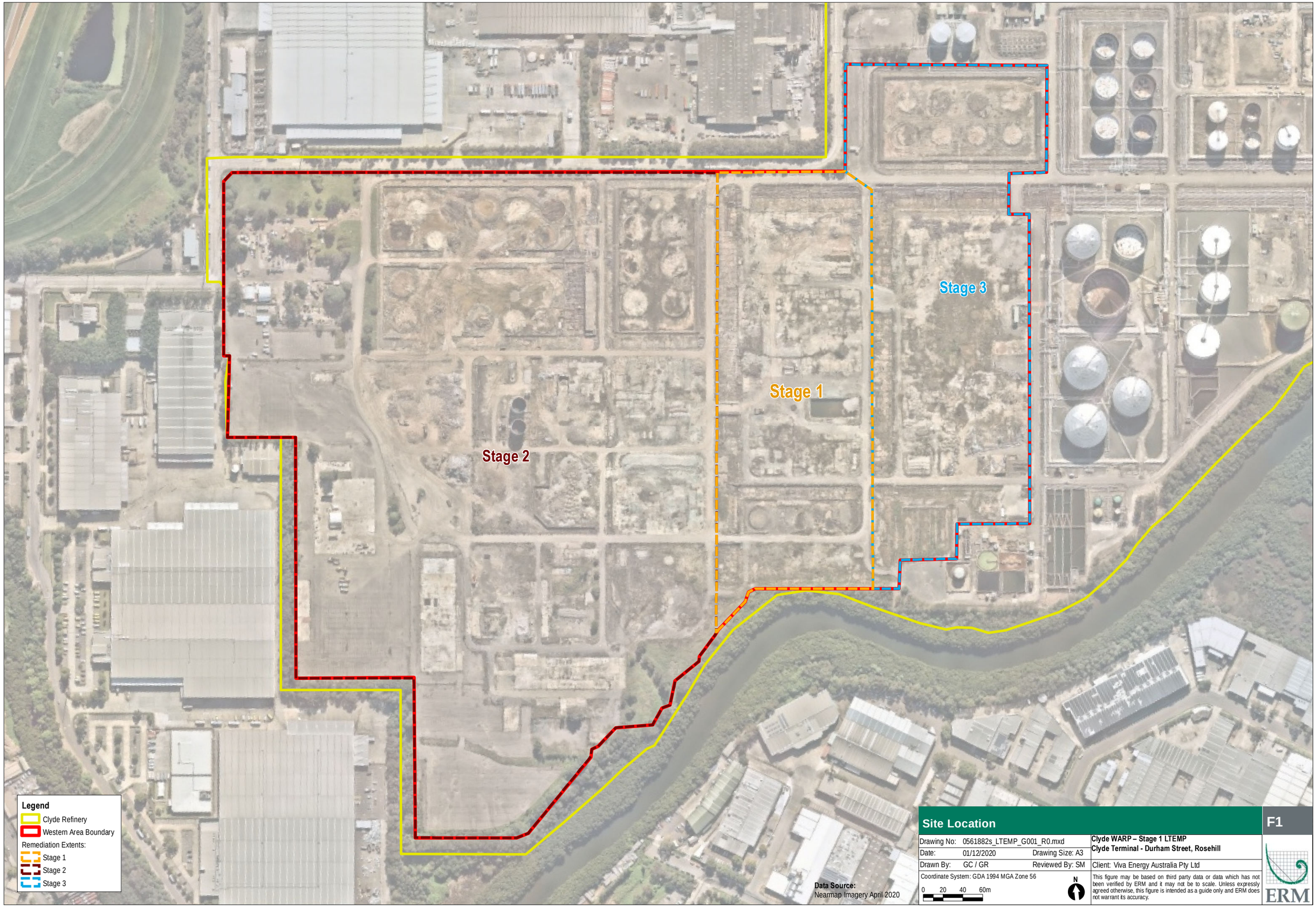
Drawing No: 0561882s_DV_G006_R2.mxd	Clyde WARP Stage 1 - Drainage Decommissioning Validation Clyde Terminal - Durham Street, Rosehill
Date: 17/12/2020 Drawing Size: A3	
Drawn By: GR Reviewed By: SM	Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56	This figure may be based 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 20 40 60m

N

ERM

LTEMP



Site Location

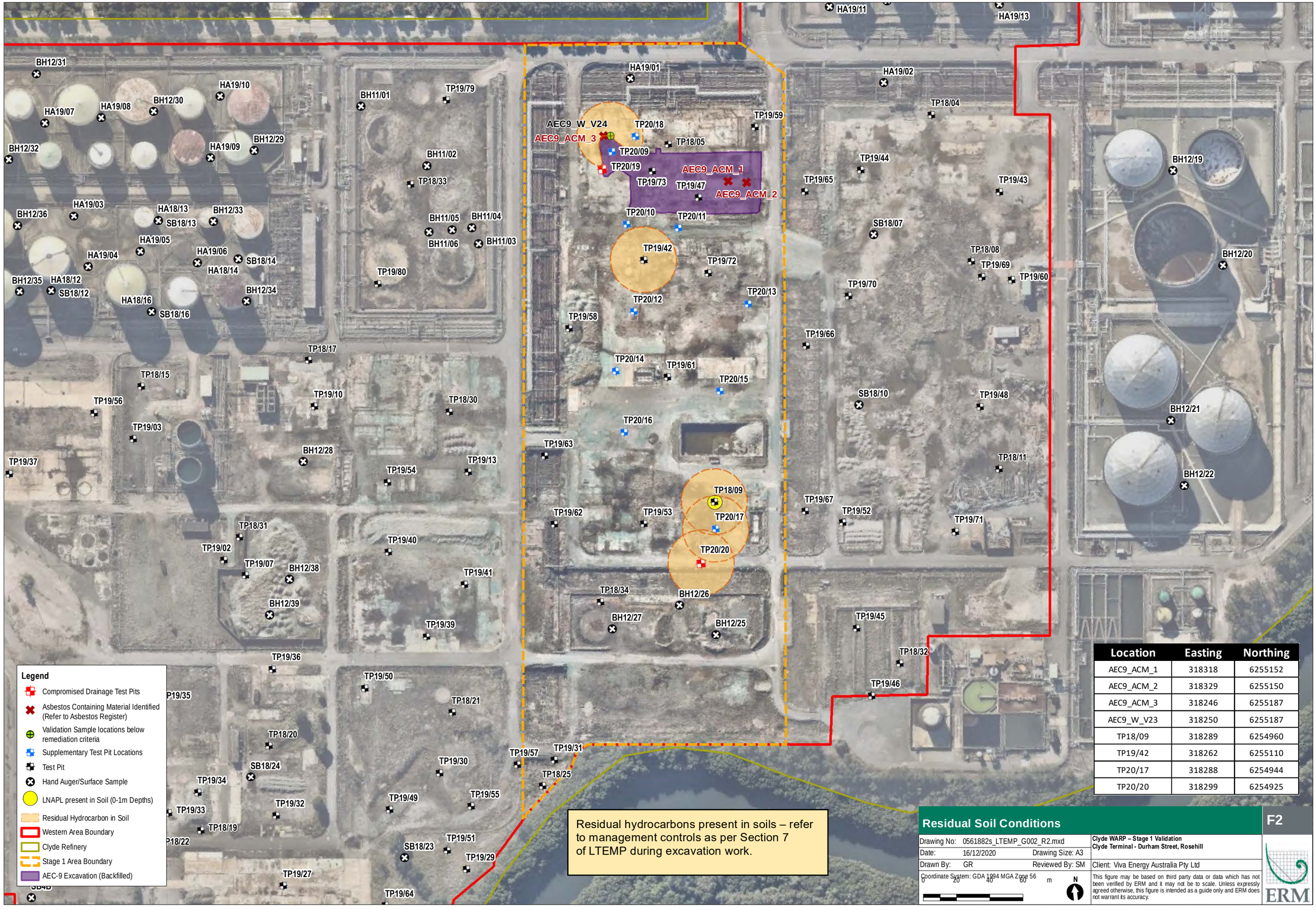
F1

Drawing No:	0561882s_LTEMP_G001_R0.mxd		**Clyde WARP – Stage 1 LTEMP** **Clyde Terminal - Durham Street, Rosehill**
Date:	01/12/2020	Drawing Size: A3	
Drawn By:	GC / GR	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 20 40 60m

N

ERM



Location	Easting	Northing
AEC9_ACM_1	318318	6255152
AEC9_ACM_2	318329	6255150
AEC9_ACM_3	318246	6255187
AEC9_W_V23	318250	6255187
TP18/09	318289	6254960
TP19/42	318262	6255110
TP20/17	318288	6254944
TP20/20	318299	6254925

Residual Soil Conditions

F2

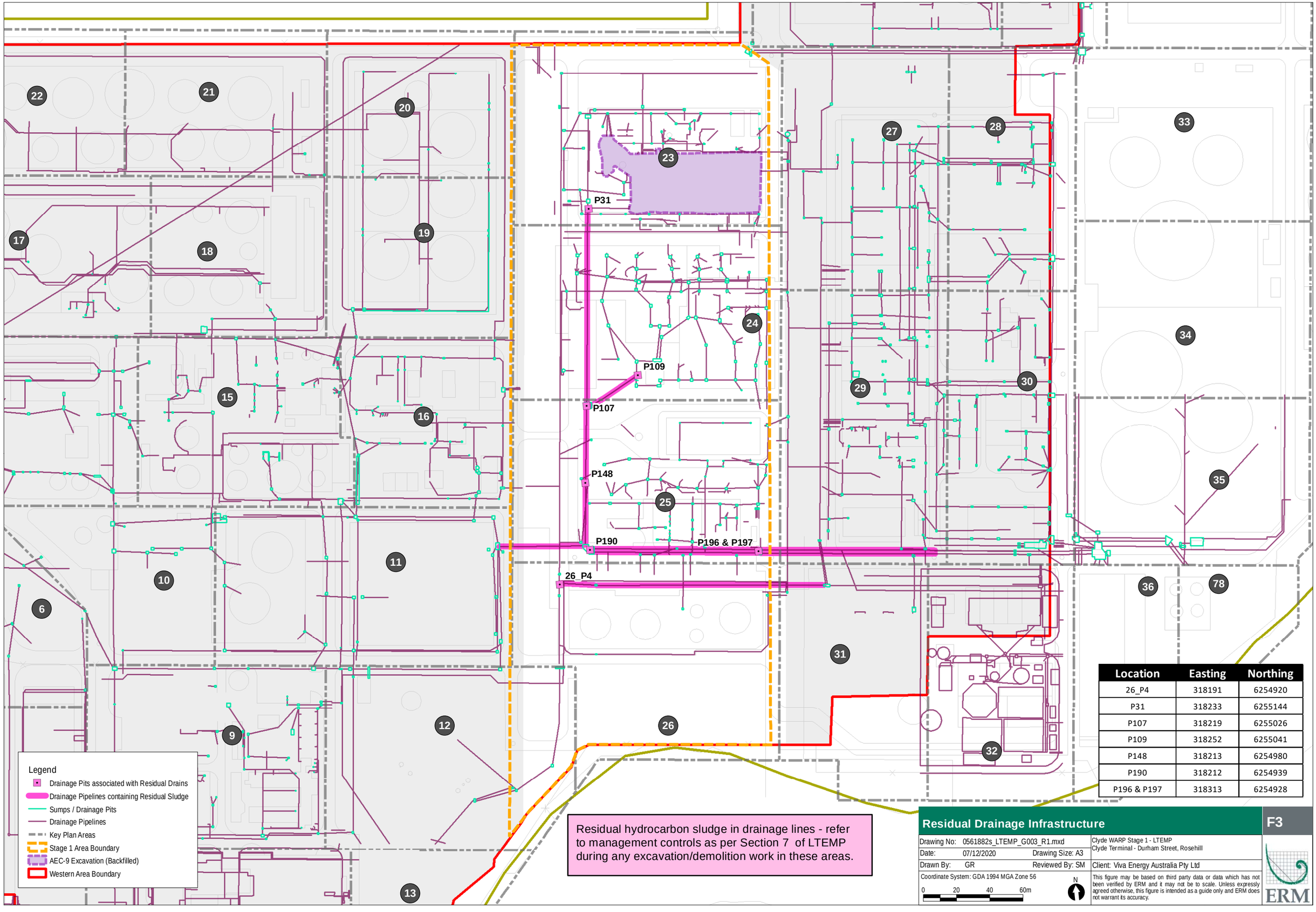
Drawing No:	0561882s_LTEMP_G002_R2.mxd		Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	16/12/2020	Drawing Size: A3	
Drawn By:	GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60 m

N

ERM



Location	Easting	Northing
26_P4	318191	6254920
P31	318233	6255144
P107	318219	6255026
P109	318252	6255041
P148	318213	6254980
P190	318212	6254939
P196 & P197	318313	6254928

Residual Drainage Infrastructure

F3

Drawing No:	0561882s_LTEMP_G003_R1.mxd		Clyde WARP Stage 1 - LTEMP Clyde Terminal - Durham Street, Rosehill
Date:	07/12/2020	Drawing Size: A3	
Drawn By:	GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM

Appendix B Interim Audit Advice Documentation

12 June 2020

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

Our ref: 21/27799/IAA09
Your ref:

Dear Adam

Former Clyde Refinery - Western Area
Interim Audit Advice 09_ Review of Stage 1 Air Emission Verification Report (AEVR)

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 (referred to as the Western Area Remediation Project or WARP). The Western Area is located at Durham Street, Rosehill on the Camellia Peninsula. Viva Energy intends to remediate the Western Area to facilitate future commercial and/or industrial development under the existing land use zoning (IN3 – Heavy Industrial). Remediation is proposed to take place in three stages, the first of which is Stage 1.

As part of this audit, the auditor has reviewed the following report prepared by Environmental Resources Management (ERM):

- *Clyde Western Area Remediation Project, Stage 1 Air Emission Verification Report*, dated 26 May 2020 (the AEVR).

In reviewing the AEVR, the auditor took into account key, relevant information from the following reports that was either referenced or included in the AEVR:

- AECOM (2019) *Viva Energy Clyde Western Area Remediation Project, Response to Submissions Report*.
- AECOM (2019) *Viva Energy Clyde Western Area Remediation Project – Appendix C: Conceptual Remedial Action Plan*, dated 21 January 2019 (the Conceptual RAP).
- ERM (2020) *Clyde Western Area Remediation Project, Stage 1 - Detailed Remediation Action Plan,* dated 4 June 2020 (the Stage 1 RAP).
- ERM (2020) *Clyde Western Area Remediation Project, Remedial Options Analysis,* dated 03 June 2020 (the ROA).

A draft version of the report (dated 30 April 2020) had earlier been reviewed by the auditor, who issued comments in an interim audit advice letter dated 25 May 2020.

The purpose of this audit advice is to comment on whether the AEVR (where relevant) was prepared in a manner consistent with NSW Environment Protection Authority (EPA) made or endorsed guidelines. The EPA guidelines include the NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites* (the Consultant Guidelines) and the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme 3rd Edition* (the Auditor Guidelines). The AEVR was also reviewed to assess whether it met the

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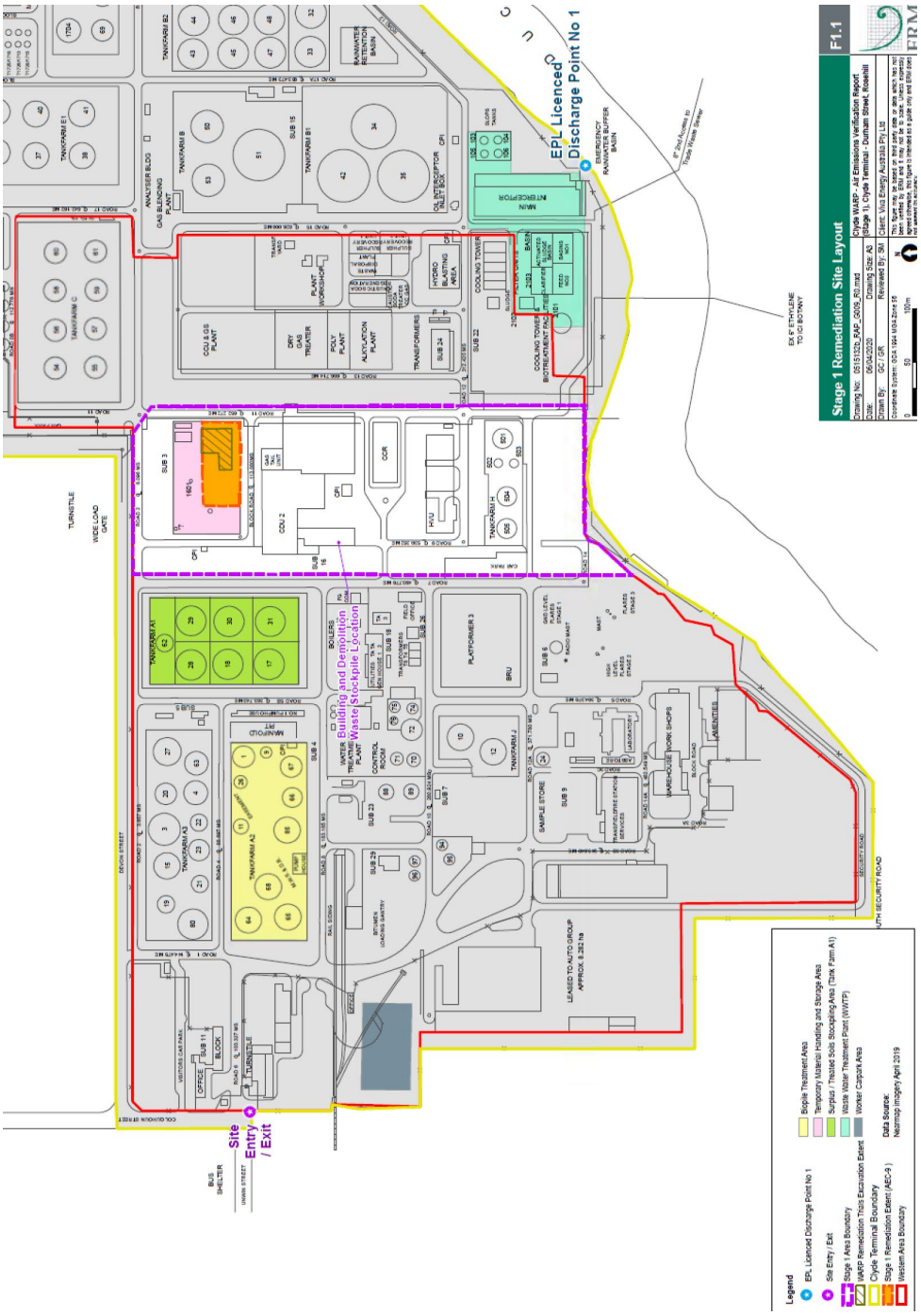
requirements of Condition of Consent B15 for SSD 9302 as issued by the Department of Planning, Industry and Environment (7 May 2020).

2 Auditor review

Stage 1 covers an area of approximately seven hectares situated within the former Process West Area. Based on the HHERA (ERM, 2020b) only the northern portion of the Stage 1 Area requires remediation (AEC-9). The Stage 1 Area (as presented in the AEVR) is presented as follows. AEC-9 is the orange shaded area.



Biopiling has been selected as the preferred remedial option for the Stage 1 area (protocols for the nominated remedial approach in the Stage 1 Area are presented in the Stage 1 RAP). The AEVR provided an assessment of the releases of volatile chemicals measured during biopiling trials conducted in the Stage 1 Area and what factors need to be considered in relation to air emission management during full scale remediation. It is the auditor's understanding that a separate AEVR will be prepared for each of the subsequent remedial stages, taking into consideration changes to, locations of and proximity to receptors.

The remediation design will entail excavation of contaminated soil in AEC-9 to a depth of approximately 1.5 metres. The total estimated excavation volume is approximately 4,000 m³. The trial excavation removed approximately 1,200 m³, leaving approximately 2,800 m³ to be excavated in the full scale Stage 1 Area remedial program. ERM did state however, that based on the proportion of oversize material encountered during the trial excavation, the residual 2,800 m³ is a conservative estimate.

Ambient air monitoring conducted during the trial excavations recorded that Volatile Organic Compounds (VOCs – include BTEX and TRH compounds) concentrations decreased significantly with distance from the excavation area, with all VOCs below the limit of reporting (LOR) at a distance of 165 metres from the excavation area. Hydrocarbon odours similar in nature to diesel oil were noted during the excavation process, however, these odours were not observed beyond 165 metres from the excavation.

Although benzene was identified in excavation water samples collected from the trial pit, neither benzene nor any other principal toxic air pollutants were detected in ambient air measurements in the immediate vicinity of either excavation, stockpiling or biopiling operations.

A range of emission controls were considered based on those identified in best practice references, and the risks associated with each remediation operation, as a function of the proximity, duration and intensity of the proposed activity, as well the practicality with which contingency measures can be implemented. On the basis of the air quality monitoring conducted during the treatment trial and the size and nature of the works that will be required to excavate the contaminated soil and form and operate biopiles, ERM did not identify the need to establish an emissions control enclosure.

3 Conclusions

The auditor considered all elements of Condition of Consent B15 have been appropriately considered in the AEVR and that ERM provided sufficient lines of evidence to support that an emissions control enclosure within Stage 1 Area is not required, as measured ambient VOCs or any other principal toxic air pollutants were below LOR or not considered to pose an unacceptable risk to site workers and/or neighbouring receptors.

This report 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

28 July 2020

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

Our ref: 21/27799/IAA12
Your ref:

Dear Adam

Former Clyde Refinery - Western Area
Interim Audit Advice 12 – Review of Drainage Decommissioning Sampling Analysis & Quality Plan

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 Western Area). The Western Area is located at Durham Street, Rosehill on the Camellia Peninsula.

Viva Energy intends to remediate the Western Area to facilitate future commercial and/or industrial development under the existing land use zoning (IN3 – Heavy Industrial). As part of the remediation project, the drainage infrastructure in the Western Area is to be decontaminated and decommissioned or removed. The auditor noted that part of this infrastructure was already decontaminated by Ventia in 2018 in anticipation of excavation and removal during future remedial works.

As part of this audit, the auditor has reviewed the following report prepared by Environmental Resources Management (ERM):

- *Clyde Western Area Remediation Project - Review of Drainage Decommissioning Sampling Analysis & Quality Plan*, dated 10 July 2020 (the Drainage SAQP)

During the review of the Drainage SAQP, the auditor took into consideration the information presented in the following document prepared by Ventia Pty Ltd (Ventia):

- *Proposed Pipe Decontamination and Decommissioning Scope of Works*

The purpose of this audit advice is to assess whether the Drainage SAQP was prepared in a manner consistent with NSW Environment Protection Authority (EPA) made or endorsed guidelines. These guidelines include the NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites* (the Consultant Guidelines), the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme 3rd Edition* (the Auditor Guidelines) and the NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases* (the Ground Gases Guidelines).

2 Auditor review

The Drainage SAQP presents the strategy for the validation of the decontamination and decommissioning of the sub-grade Continuously Oil Contaminated (COC) and Accidentally Oil Contaminated (AOC) drainage infrastructure in the Western Area. The decommissioning of redundant pipework will require demonstration that sludge and/or oily water has been removed from this infrastructure.

The approach to completing the decommissioning and validation proposed by ERM included the following:

- Reviewing the scope of drainage decontamination works completed by Ventia in 2018 and identifying data gaps to be addressed as part of the proposed decommissioning works.
- Preparation of a planned approach to decontaminating and decommissioning the remaining Western Area sub-grade drainage infrastructure as well as defining the means by which validation and verification data will be collected for drains previously cleaned as well as the current drain cleaning/decommissioning program.
- Development of a drainage validation SAQP program based on Ventia's proposed scope that details the data to be collected to validate that the decommissioning objectives are met

The Chemicals of Potential Concern (CoPC) associated with the COC and AOC drainage network are:

- Total Recoverable Hydrocarbons (TRH) C6 – C40 Fractions
- Benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN)
- Polycyclic aromatic hydrocarbons (PAHs)

The auditor notes that although other CoPCs have been identified in parts of the Western Area, the selected analytes were chosen to specifically validate the presence of chemicals that would have been present in the drainage network.

The scope of Ventia works for the planned in-situ decontamination and decommissioning of the sub-grade drainage infrastructure was presented in *Proposed Pipe Decontamination and Decommissioning Scope of Works* report, included in Appendix A of the Drainage SAQP. The data gaps identified by ERM following review of Ventia's report, as well as the proposed validation program is summarised below:

- **Sub-grade Pipework decontamination**: One gas test from each end of the pipe before and after cleaning. In-situ measurement of Total Volatile Organic Compound (VOCs), Hydrogen Sulphide (H2S) and Lower Explosive Limit (LEL)
- **Pits and/or sumps and other in-ground infrastructure decommissioning**: Visual inspection to confirm pit has been filled with sand and/or cement mix
- **Pipework decontamination (above ground drainage)**: Visual inspection of surface drains to confirm removal of sludge
- **Disconnection of Western Area drainage from wider Clyde Terminal and wastewater treatment plant**: Visual inspection to confirm that all drainage exiting the Western Area and/or contributing to the discharge to the Clyde Terminal wastewater treatment plant has been separated from the Clyde Terminal drainage network outside the Western Area
- **Validating previously completed decontamination and decommissioning works**: One gas test from each end of the pipe before and after cleaning. In-situ measurement of VOCs, H2S and LEL
- **Corrugated Plate Interceptors (CPIs):** As per the requirements of the Detailed RAP for Stage 1 (Walls – one sample per 10 linear metres and, Base - 10 x 10 metres offset grid pattern). Laboratory analysis for CoPC.
- **CPIs where demolition is not possible:** At least one test pit and soil sample per 10 metres length of CPI perimeter. Laboratory analysis for CoPC

- **Compromised pipework:** At least one test pit and soil sample per length of compromised pipework. One test pit and soil sample will be collected per 10 linear metres of compromised pipework. Laboratory analysis for CoPC
- **Solid Waste (sludge):** One sample per 50 m^3 of material. Laboratory analysis for CoPC, heavy metals, phenols and TCLP analysis (if required)

The proposed data quality indicators and assessment criteria are to include the following:

- **Intra-laboratory and inter-laboratory samples**: one sample for every 20 primary samples, with a minimum of one sample for each matrix type. Criteria: RPDs to be less than 30% for inorganic and organic analyses where the results of one or both values are greater than 10 times the limit of reporting. Where both values are less than 10 times the LOR, RPDs of less than 100% will be considered acceptable.
- **Rinsate blank samples** (from an item of sampling equipment): one per day. Criteria: Concentrations of analytes to be less than the laboratory limits of reporting.
- **Trip spikes**: one sample per batch for the soil investigation for BTEXN analysis. Criteria: Recovery of analytes in trip spikes to be within the range of 70% to 130%
- **Trip blanks**: one sample per batch for the soil investigation for BTEXN and volatile TRH analysis. Criteria: Concentrations of analytes to be less than the laboratory limits of reporting.

Where off-site disposal material extracted from pipes or excavated from test pits is required, it will be classified and managed accordance with the NSW EPA (2014) *Waste Classification Guidelines*: *Part 1: Classifying Waste.* Where fill is required, only material certified to be VENM, ENM or other material approved in writing by the NSW EPA is to be brought into the Western Area.

3 Conclusions

It is the auditor's opinion that the Drainage SAQP includes the key elements for a SAQP as stipulated in the Consultant Guidelines. However, a few matters require clarification and/or review prior to the finalisation of the proposed SAQP, as presented in Attachment A.

The auditor notes that any uncertainty in relation to the locations of the pipes and/or ability to effectively decommission the pipes will have to be recorded in the Long-Term Environmental Management Plan (LTEMP).

This report 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
Encl. Attachment A

Attachment A – SAQP Checklist

Site: Clyde Western Area
Consultant: ERM
Report: Clyde Western Area Remediation Area - Drainage Decommissioning Sampling Analysis & Quality Plan, dated 10 July 2020.
Interim Audit Advice (IAA) 12

Checklist - Sampling and Analysis Quality Plan			
Report section	**Required information**	**Yes/No -Auditor comments**	**ERM responses**
Document control	Date, version number, author and reviewer (including certification details) and who commissioned the report	Yes, on the document control table and signature page. Signatures should be included in the final version of the report.	
Objectives	The objectives of the plan and the broader objectives for the site/investigation	Yes, in Sections 1.2 (Project objectives) and 1.3 (Drainage decommissioning objectives). No further actions are required.	
Scope of work	Scope of work to be performed (and work outside the scope where relevant)	Yes, in Sections 4 (Contractor scope of work) and 5 (validation works).	
Site identification	Site identification and detail items from ASC NEPM Field Checklist 'Site information' sheet. A summary is enough if detailed information was included in an available referenced previous report	Yes, in Section 2.	
Site condition and surrounding	Site condition and surrounding environment items from ASC NEPM Field Checklist Site information sheet. A summary is enough if detailed information was included in an available referenced previous report	Yes, in Section 2.2 (description of drainage network). Although the description of surrounding areas has not been presented, the auditor considers that this information is not relevant to the purpose of this SAQP.	
Assessment criteria	Rationale for the selection of assessment criteria, including assumptions and limitations of the criteria (relevant to the assessment and current or proposed land use) and any deviations from approved guidelines	Yes, in Sections 7.3 to 7.5, but the NSW EPA (2020) Ground gases guidelines should be adopted in relation to ground gases such as methane.	
Sampling and analysis strategy and sampling methodology	Sampling and analysis data quality objectives	Yes in Section 3, but it is noted there are a few pdf errors in Section 3.5 "Error! Reference source not	
	A strategy to achieve pre-determined data quality objectives, including the sampling strategy and justification for the sampling design	Overall yes, but the following is noted: * Table 5.1 - **Validating previously completed decontamination and decommissioning works**: One gas test from each end of the pipes is proposed before and after cleaning. Please include rationale supporting the proposed frequency of sampling. * Based on the Ventia plans, clarify if it is possible to estimate the number of primary and QA/QC samples proposed to be collected/analyzed. * Please consider sampling using summa canisters for accurate quantification of ground gases that exceeded the LEL. The auditor has recently noted in a few audits where very high (in the explosive range) methane measurements have been recorded in the field using gas analysers such as the GA5000, which then could not be resolved because vapour samples were not analysed for bulk gases in the laboratory. Hydrocarbon vapours are known to cause interference with infrared methane sensors on some common gas analysers. Alternatively other field equipment that do not suffer from VOC interference could be used. * Please ensure that laboratory analysis for methane is conducted on the vapour canister samples when field measurements indicate methane >1% v/v and carbon dioxide when field measurements >5% v/v to confirm (or not) the field measurements. Table 5.1 - **Solid Waste (sludge)**: Please present rationale supporting the sampling ratio proposed.	
	Procedures to be undertaken if the data does not meet the expected data quality objectives	Yes, in Section 8 (Contingency planning). Please refer to the genaral auditor comments referent a summa canister sampling/analysis for ground gases that exceeded criteria.	
	Refer to the updated conceptual site model and identified data gaps to determine sampling locations (to ensure source-pathway-receptors have been considered)	No. However, the auditor considered that the proposed sampling locations are adequate to address the data gaps mentioned in Table 1.1. No further actions are required.	
Data quality indicators	Details of the required quality assurance/quality control samples for the project (e.g. field blank, rinsate blank, trip blank, laboratory prepared trip spikes), including acceptable limits for field quality assurance/quality control	Yes in Section 7. No further actions are required.	
Auditor's additional comments	Section 5.4 - Gas Testing Methodology	Please record flow readings as these will inform the risk profile associated with any elevated concentrations of ground gases (if required) in accordance with NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases* .	
	Section 10 - References	* Please include the NSW EPA (2020) Assessment and Management of Hazardous Ground Gases. * The reference to the *Consultants Guidelines* should be updated.	

18 December 2020

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

Our ref: 21/27799/IAA13
Your ref:

Dear Adam

Former Clyde Refinery - Western Area Remediation Project
Interim Audit Advice 13 - Stage 1 Area – Long Term Environmental Management (LTEMP)

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 (referred to as the Western Area Remediation Project or WARP). The Western Area is located at Durham Street, Rosehill on the Camellia Peninsula. Viva Energy intends to remediate the Western Area to facilitate future commercial and/or industrial development under the existing land use zoning (IN3 – Heavy Industrial). Remediation is taking place in three stages, the first of which is Stage 1.

The auditor issued a Site Audit Report (SAS) and Site Audit Statement (SAS) for the Stage 1 Area RAP on 22 June 2020, confirming that following remedial and validation works, the Stage 1 Area would be suitable for the proposed future use (commercial or industrial) as per the permissible land use IN3 – Heavy Industrial under the Parramatta Council Local Environmental Plan 2011.

Remedial work as outlined in the RAP was completed in November 2020. The outcome of the remedial validation was presented in the following Environmental Resources Management (ERM) report:

- *Clyde Western Area Remediation Project - Stage 1 Validation Report*, 10 December 2020 (The Stage 1 Validation report).

The Stage 1 Validation report identified that the site is suitable for uses under the IN3 zoning provided a long term environmental management plan (LTEMP) is implemented. ERM prepared the following LTEMP taking into account key information in the previous reports that formed the basis for the SAR and SAS as well as the data generated and observations made during the validation program:

- *Clyde Western Area Remediation Project - Stage 1 – Long Term Environmental Management Plan*, 17 December 2020 (the Stage 1 LTEMP).

A draft version of the LTEMP dated 2 December 2020 had been reviewed by the auditor, who issued comments in an auditor commentary spreadsheet. The auditor commentary spreadsheet as well as the consultant's responses will be presented in the SAR for the Stage 1 Validation.

The purpose of this audit advice is to comment on whether the LTEMP was prepared in a manner consistent with NSW Environment Protection Authority (EPA) made or endorsed guidelines. The EPA guidelines include the NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites*

(the Consultant Guidelines) and the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme 3rd Edition* (the Auditor Guidelines).

2 Regulatory requirements

The following conditions of consent for SSD9302 are relevant to the LTEMP:

B8 Prior to the finalisation of the Site Audit Statement and Site Audit Report, required by Condition B6, the Applicant must prepare a Long Term Environmental Management Plan (LTEMP) for the development, to the satisfaction of the Site Auditor and the Planning Secretary.

B9 *The LTEMP must:*

(a) be prepared in consultation with Council and the EPA;

(b) identify where the LTEMP applies and who is responsible for implementing the LTEMP;

(c) detail how the LTEMP will be implemented, including corrective actions and reporting requirements;

(d) recommend any systems/controls to be implemented to minimise the potential for any material harm;

(e) include a groundwater monitoring program to verify natural attenuation is occurring over time, consistent with the requirements of condition B21;

(f) include biodiversity management measures for the Green and Golden Bell Frog, consistent with the Revised Plan of Management: Restoration of Green and Golden Bell Frog Habitat, Clyde Terminal, January 2019, or its latest version;

(g) detail procedures for managing and monitoring any remaining contamination, including triggers that would indicate if further management or remediation is required;

(h) detail procedures for managing and monitoring any remaining contamination that has potential for off-site migration so that it does not present an unacceptable risk to either the on-site or off-site environment;

(i) include measures to be implemented if any parts of the remediated area are required to be physically disturbed;

(j) describe any required planning controls for future development that may interact with any remaining contamination at depth;

(k) incorporate a programme for ongoing monitoring and review to ensure that the LTEMP remains contemporary with relevant environmental standards;

(l) include mechanisms to report results to Council and the EPA;

(m) be written in plain language to be understood by all personnel involved in the maintenance activities on the site.

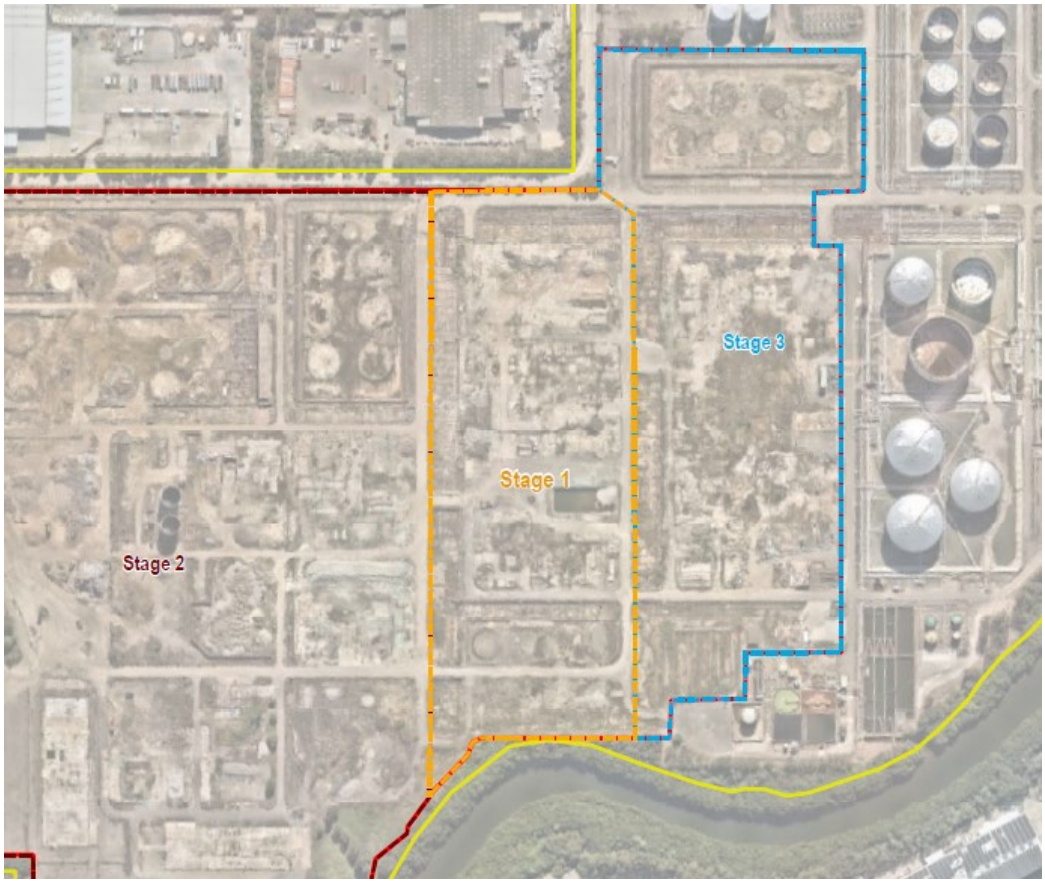
B10. Upon completion of the Site Audit Statement and Site Audit Report, the Applicant must:

(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

3 Auditor review

The Stage 1 Area comprises approximately seven hectares situated within the WARP that contained former refinery processing units, aboveground pipework for the transfer of product, electrical substations, the refinery Central Control Room (CCR), an underground drainage pipe system and oil-water separator unit. The Stage 1 RAP identified that only the northern portion of the Stage 1 Area required remediation (AEC-9) of hydrocarbon contaminated soils to address potential human health risks. The Stage 1 Area is shown in the following figure as defined by the yellow dashed line (Figure F1 from LTEMP). AEC-9 is shown as the purple shaded area on the figure on page 3 of this IAA.



Remedial works within the Stage 1 Area were undertaken to remove hydrocarbon contaminated soils that may present a vapour intrusion risk to future occupants of commercial premises. Validation sampling demonstrated that the are had been effectively remediated. There were some residual contaminated soils that if disturbed may pose an increased risk of exposure. The soils, along with isolated areas where LNAPL was identified are to be managed as part of the LTEMP.

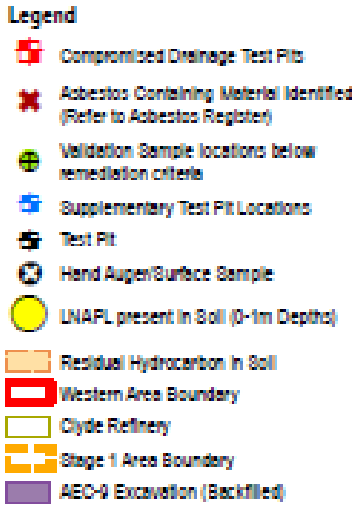
The objective of the LTEMP is to document the locations of residual contamination within the Stage 1 Area and outline mechanisms for managing potential human health and environmental risks. The LTEMP is considered to be passive as there are no mechanical components required for its implementation. The residual contamination that is to be managed as per the LTEMP comprises:

- Oily water / sludge associated with former underground drainage infrastructure
- Asbestos formwork attached to remaining underground building foundations
- Hydrocarbon impacted soils, and

- Residual hydrocarbon impacted groundwater

The areas where management controls are required are presented in the following figure (Figure F2 from LTEMP).

Location	Easting	Northing
AEC9_ACM_1	318318	6255152
AEC9_ACM_2	318329	6255150
AEC9_ACM_3	318246	6255187
AEC9_W_V23	318250	6255187
TP18/09	318289	6254960
TP20/17	318288	6254944
TP20/20	318299	6254925



Based on the nature and extent of residual contamination identified within the Stage 1 Area, the following management controls have been identified:

- Non intrusive works (i.e. above ground) – No management controls required.
- Intrusive excavation works – Implementation of environmental management controls as listed in Section 7 of the LTEMP.

Prior to the commencement of intrusive works, it will be the responsibility of site owner and / or its nominated representative to determine if proposed works within the Stage 1 Area require intrusive

excavation. Where any intrusive excavation works are undertaken within the Stage 1 Area the environmental management requirements presented in Table 5 of the LTEMP must be implemented.

Ongoing requirements for groundwater monitoring post-remediation have been established and documented within the Groundwater Monitoring Program prepared by ERM. The groundwater monitoring events will collect data to confirm the stability of residual groundwater contamination and to evaluate if attenuation of residual groundwater impacts is occurring.

4 Conclusions

The LTEMP has been prepared in a manner consistent with NSW EPA made or endorsed guidelines. It identifies areas that need to be managed if intrusive works are to be undertaken on the Stage 1 Area and the protocols necessary to protect human health and the environment should such activities occur.

In relation to condition of consent B9, the auditor has consulted with Parramatta Council and this IAA forms consultation with NSW EPA. All other items in condition of consent B9 have been addressed in the LTEMP.

The LTEMP is considered to be legally enforceable via existing Development Consent Condition B10(a) and (b) of SSD 9302 and Parramatta Council will be advised to add a notation under section 10.7(5) of the EP&A Act that the property is subject to this LTEMP.

This report 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

Client Viva Energy
Project **Clyde Audit**
Report Clyde Western Area Remediation Project - Remediation Site Investigation

Item	Report Section	Auditor comments	Consultant responses	Auditor comments
1	Executive summary	Please clarify under what mechanism the LTEMP is 'legally enforceable' (e.g. it will be publicly noted via the s10.7). This information should be presented in both the LTEMP and the validation report.	The legal enforceability of the LTEMP is explained within the LTEMP document as below: Upon Site Auditor endorsement of this LTEMP all requirements are legally enforceable via existing Development Consent Condition B10(a) and (b) of the State Significant Development 9302, as issued under Section 4.38 of the Environmental Planning and Assessment Act 1979 (the 'EP&A Act'). This condition is 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* As per condition B10 (b), Parramatta Council will be requested to add a notation under section 10.7(5) of the EP&A Act that the property is subject to this LTEMP. A statement to this effect has been added to the executive summary	Amended.
2	1	1 - Please review the site details for consistency. Reference here to 'Devon Street', further reference in section 1.1 to 'Durham Street'. 2 - Please provide a definition of the site within the introductory statement. This appears split over the report areas such as the refinery, the western area, stage one area etc. Update figures to be consistent with these definitions.	1- Site details are consistent with the previously reviewed and endorsed Stage 1 RAP and details provided within the EIS. Clyde Refinery and Clyde Terminal identified as being located on Durham Street. Only reference to The Stage 1 Area is "The Stage 1 Area is situated within the eastern portion of the former Process West area and extends from Devon Street to the North to the Duck River at the southern boundary of the Western Area". This statement is correct. 2- Glossary has been added up front which defines all of these areas. No figure edits are required.	Amended.
3	1.1	1 - Use of future tense (e.g. 'proposing'). This is encountered throughout the document and should be updated to reflect that work has already occurred. 2 - With respect to the statement about natural attenuation and reduction of residual groundwater impacts over time. This is mentioned a number of times throughout the validation report - a summary of the LTEMP and the end goals/objectives would be useful to contextualise this.	1 - Noted. The use of future tense within opening sections of the document often refers to the Wider Western Area Project, which is not complete. 2 - The objectives of the LTEMP are outlined within it's own document. The objectives of monitoring under the LTEMP have been provided as per other comments throughout this report.	Amended.
4	1.5.2	Please define jurisdictions of regulatory bodies (i.e. 'NSW' EPA, 'Parramatta City' Council)	This is a direct quote out of the consent conditions. No changes are proposed	Amended.
5	1.7	Please note that the validation of Drainage Decommissioning Process should be reviewed by the auditor prior issue SAR/SAS and the LTEMP.	Noted. This has been provided separately.	Amended.
6	2	Table note: source appears to be referring to wrong table entry, i.e. should be for 'permissible land use(s)', not 'area'.	Noted. Table 2-1 amended	Amended.
7	3.2	1 - Should be written as past tense. 2 - Bullet 5: does this stockpile still occupy this area?	1 - Noted, amended as requested. 2 - This stockpile is SP44 and was characterised as suitable to remain on site. This dot point was amended to clarify.	Amended.
8	3.3	As the drainage network was being decommissioned, this section should be updated to reflect current surface water drainage.	Some minor amendments to tense have been made here, with clarifying statement on current drainage added" Following drainage decommissioning works, surface drainage from the Stage 1 Area drains via overland flow to the east and west and is captured within the low-lying surrounding pipe-tracks, which ultimately evaporates and infiltrates into unsealed ground.	Amended.
9	Table 3-1	Please provide a date and reference for the 'recent' gauging activities.	December 2019 was most recent gauging round of the wider Western Area. Amended and reference added as requested	Amended.
10	3.5.1.1	Please provide dates/references for observations in this section	References added to this section as requested	Amended.
11	3.5.2	Has LNAPL been observed more recently within this well? Conversely, has LNAPL *not* been observed?	Added clarifying text as requested: Measurable LNAPL thickness and/or observations consistent with the presence of LNAPL were noted from March 2012 to June 2019. MW12/16 was destroyed during remediation trial excavations in October 2019.	Amended.
12	3.5.2	1 - Bullet 4: please define ASLP and explain what this means in terms of groundwater. 2 - Where were these samples collected from?	Revised text as requested: *Australian Standard Leachate Procedure (ASLP) was conducted on selected soil samples and is*	Amended.
13	3.5.2	Please confirm whether this is delineated to the north or south as groundwater flow in both directions was identified in section 3.3.2.	Delineated downgradient to the south, text updated to clarify	Amended.
14	3.5.3	SV19/07 is not shown in key figures.	Noted. Figure 6A has been amended to show groundwater and soil vapour monitoring well locations	Amended.
15	3.5.3	Please describe why CCME (2008) criteria were adopted in lieu of the NEPC management limits? Context should be provided to explain why criteria were sought outside of the project's jurisdiction.	The CCME (2008) criteria were adopted in support of the ASC NEMP ML to support appropriate management actions due to ML exceedances. The ML as presented ASC NEPM cover a wide range of issues which does not allow for an understanding of what the underlying management issue raised by an exceedance. The CCME (2008) guidance which served as the basis for the ASC NEPM ML, provides further detail of a range of screening levels for a range of management concerns. In the interest of simplification and use of screening criteria previously agreed in the RAP, we have reverted to screening against NEPM management limits. Additional lines of evidence as to potential for 'fire and explosion risk' where exceedances are noted will be discussed as requested.	Amended.

16	3.6	1 - Clarify why LNAPL is not shown in Figure F6A. 2 - ERM stated that the LNAPL observed within the fill would be resulting in SSTLs exceedances in groundwater and soil vapour. Clarify if SSTLs exceedances were recorded in groundwater samples, as it was stated in RSI and HHERA that the clay layer (located below the landfill) would be a natural barrier to aquifer contamination.	1 - LNAPL identified in the soil profile is shown on Figure 6A (TP18/09). Monitoring well locations have been added on, also showing LNAPL and MW12/16 2 - SSTL exceedances (as per table 3-3) were noted in groundwater samples collected in 2012 from well MW12/16. It is noted that this sample was visually described as containing LNAPL. This monitoring well was screened across the fill layer. ERM notes that this monitoring well was situated within the footprint of the excavation and destroyed during remediation trial excavations in 2019	Amended.
17	3.7	LTEMP has now been prepared and should be referenced here.	Reference to the LTEMP has been added as requested	Amended.
18	4.1.2	Should there be a decision regarding areas used for stockpile storage?	ERM considers this is covered by the second dot point *"Is excavated soil material suitable for on-site re-use, or does it require further treatment (via biopiling) or off-site disposal?". This process is sufficiently detailed within Section 5.5*	Amended.
19	5.1	First paragraph after Table 5-1: reference LTEMP and the monitoring objectives stated within.	Reference added as requested	Amended.
20	5.2.2	1 - Please provide rationale for why the CCME (2008) management limits were adopted. 2 - Clarify why additional excavations have not been carried out to eliminate this issue. All lines of evidence to eliminate this potential risk should be presented, since this result will require restrictions under the LTEMP other than groundwater monitoring. 3 - Please clarify if the following statement considered the age and composition of LNAPL "Where residual LNAPL is present within soils should be conservatively as an exceedance of this criteria."	1 - see above response for Comment 15. Management limits to be adopted. 2 - Noted. Additional lines of evidence have been provided within new section 6.5. These include: 1) air monitoring data collected durig excavations 2) gas testing data from drainage decommissioning works 3) direct measurement of soil vapour within AEC-9. the lines of evidence presented are considered to eliminate this potential risk. 3 - this statement has been removed in light of the revised approach and lines of evidence presented above.	Amended.
21	5.2.4	Should the CCME (2008) criteria be included here?	See response to Comment 15. CCME criteria not to be used as screening criteria	Amended.
22	5.2.6	1 - Please amend use of 'site' in this section to reflect the Stage 1 Area. 2 - If the requirements for VENM classification are listed, should the requirements for ENM classification also be listed?	1 - Noted and amended 2 - For completeness, reference to the ENM Resource Recovery Order has been added. ERM notes that no ENM was imported to the Stage 1 Area and therefore this is immaterial to the validation report.	Amended.
23	5.3.1	Please provide IDs for test pits and present on a figure.	IDs added to text in this section, noting that it cross references the detailed results section. Test Pit Locations are shown on Figure 6A	Amended.
24	5.3.2	1 - Update reference to table (I think this should be 5-2). 2 - Please check these grid references - Figure F5 doesn't doesn't indicate excavation in grid references A2 or A3.	1 - Noted and amended 2 - Noted and amended	Amended.
25	5.3.4	1 - Please describe where the Tank Farm A2 and Tank Farm A1 are in relation to Stage 1 area and provide reference to figure. 2 - 'Bio-pad area': referred to as 'biopiling area' in Figure 3. Please update throughout report for consistency.	1 - Noted, updated and added reference to figure 4 2 - Updated throughout as requested	Amended.
26	5.5.1	biopad or surplus materials area': please describe where these are located.	previously described in 5.3.4 as above. Added reference to Figure 4.	Amended.
27	5.2.2	Please review the content of this section - it appears that this heading was not meant to be included here.	Noted and amended, this was to be included under heading 5.5.	Amended.
28	5.5.3	1 - 'Tank Farm Area referred to as A1' - this is referred to as 'Tank Farm A1' elsewhere. Please amend throughout document for consistency. 2 - Please clarify whether it was the VENM sources or the VENM classifications which were reviewed. If sources, consider amending to 'inspected in situ' or similar.	1 - Amended 2 - VENM classifications were reviewed. Minor text amendment made	Amended.
29	5.5.4	1 - Please provide reference to the EPS survey discussed in paragraph 1. 2 - Bullet 1: do you mean <100ppmv (as opposed to 100ppmv). 3 - Please provide air quality and odour records for completeness. 4 - 'The extent of residual structures' is shown in the photolog. Are these also shown on a figure (e.g. showing residual contamination/structures)?	1 - This was an initial survey to mark out the RAP extent and does not refer to the final completed extent 2 - Noted and amended 3 - Air Quality and odour monitoring records provided as Appendix L. 4 - Survey of former building footings is outside of the scope of soil validation. Relevant residual structures and contamination requiring management are shown on Figure 7, the LTEMP deals with this in more detail	Amended.
30	5.5.5	1 - Please provide reference to Stockpile Material Tracking Register (a summary of the management is sufficient). 2 - How was the spent carbon media disposed of? 3 - Further discussion of SP73 is required. This is material that was initially identified as requiring biopiling, however upon screening was deemed too big (due to clay content) to biopile. SP73 was then screened for volatiles using a PID, with initial PID >100ppmv. It was then deemed to be suitable for reuse. 4 - Please explain why field screening results were disregarded. Please justify the suitability of a PID for screening of volatile compounds in clayey material.	1 - Reference to Table 8 added 2 - Spent carbon media has not yet been generated at the time of reporting and is still currently being used within SVE units within the biopiling area on Stage 2. 3 - Stockpile 73 was subject to PID headspace screening following the required soil handling and physical screening process of amalgamated material from SP69, SP70, SP71 and SP74. This process inherentely results in a reduction in VOCs from freshly excavated material. Owing to the cohensive physical properties of clays, a large proportion of the oversized screened material from this stockpile included the thin layer of clay material excavated from immediately below more heavily impacted fill. Consistent with the CSM, clay material was less impacted than sandy fill material which was able to pass readily through the 50mm screen was preferentially sorted to SP72. 4 - Field screening results were not disregarded. All stockpiles were re-characterised following the screening process to be representative of the physically homogenised material, including SP72.	Amended.
31	5.5.6	1 - Should this read 'to confirm the *absence* of any foreign material…' 2 - How does the presence of foreign material in SP44 align with the suitability assessment for material to be used/reused on site?	1 - you are correct, amended 2 - Stockpile 44 originated from on-site demolition works and is not VENM and is not subject to the	Amended.
32	5.5.8	How was runnoff from stockpiles or biopiling captured? In particular, LNAPL excavated and transported to stockpiles.	LNAPL was able to be excavated and mixed with surrounding impacted fill materials such that free-flowing liquids were not present during transport and stockpiling. Stockpiles were placed on concrete hardstand and surrounded by sediment controls including hay bales. Ingress of rainfall was controlled into stockpiles by application of a polymer covering over stockpile surfaces (Vital Bon Matt product, as specified in Section 5)	Amended.

33	Table 5-4	Table should be rewritten to reflect that these activities have already been undertaken.	This table is a summary from the RAP - added specific reference to that. Sufficient information on validation tasks completed have been provided elsewhere in the document, in particular Section 6	Amended.
34	6	Please update missing dates	Missing dates were provided in the revised draft issued to the Auditor on 10th December 2020.	Amended.
35	Table 6-1	1 - Please clarify what you mean by 'suitability' - for reuse on-site? 2 -	1- Validation of stockpile suitability for on-site re-use or biopiling. Table amended to clarify 2 - ??	Amended.
36	Table 6-1	Was any material other than VENM used to backfill excavations (e.g. material assessed to be suitable for reuse on-site)?	No - only VENM used for backfill. Material assessed for re-use remains stockpiled on the Stage 1 Area	Amended.
37	6.1.1	1 - Please clarify if the nature and extention of material beneath the secondary slab was carried out. 2 - ERM stated that “Hydrocarbon impacted fill materials extended to greater depths surrounding sub-surface structures such as concrete slabs, concrete footings and foundations and redundant service trenches, pipework and pits.” Please describe why this is not applicable in this particular instance. Could further fill material be present beneath the secondary slab? 3 - Further restriction within this area should be presented in the LTEMP. 4 - Please describe how LNAPL was managed, in particular, how runoff was controlled to prevent potential cross-contamination with other areas.	1 - ERM can confirm the secondary slab encountered at TP20/09 was removed as part of the extension of the AEC-9 excavation. Further fill material was excavated beneath this test pit and the base of the excavation validated. The area of completed excavation "TP20/09 chase-out" beneath the secondary slab was excavated and is shown in photos 50, 54 - 58, Appendix C. Excavation validation sample locations are shown on Figure 6B. The depth of excavation required within this area was consistent with the assessment of deeper material around structures. The depth of fill removal is demonstrated on the EPS survey, provided as Appendix I 2 - See note 1. 3 - See note 1. Refinement of characterisation of acute hazards have been further refined within new section 6.5 (as per comment 20-2	Amended.
38	Table 6-3	Please define 'RAC' and update document for consistency (referred to elsewhere as SSTL)	Noted, amended to SSTL	Amended.
39	6.1.3.2	Please update final paragraph to reflect work that has allready been completed, e.g. preparation of an LTEMP which should be specifically referenced here.	Noted and amended as requested	Amended.
40	Table 6-5	1 - Where asbestos was encountered, was this area validated to be free of asbestos (e.g. by asbestos clearance inspection and/or laboratory analysis of surrounding soils)? Please discuss. 2 - Clarify if where was this material disposed of to? (i.e. impacted soil and/or ACM fragments). 3 - AEC9_W_22 - it's not clear from the figures that the wall was extended to the west. In addition, the subsequent validation sample (AEC9_W_V25) was collected much further to the south than the original location.	1- As verbally discussed with the auditor on site, asbestos formwork was identified stuck to concrete structures at depths >1m BGL. As stated within Table 6-5, asbestos was left in-situ and was not subject to asbestos clearances or validation sampling. The excavation was backfilled and has been documented for management within the LTEMP. This approach was one agreed as a contingency measure in the RAP 2- Vast majority of ACM left in-situ, none taken off-site for disposal. Footnote added to table "ACM fragments on the floor of excavation were hand picked and removed for safety purposes. Doubled bagged ACM fragments were added to existing asbestos containing stockpile on the Western Area (SP29), located within Tankfarm A3, as shown on Figure 4". The future management and/or offsite disposal of this stockpiled material will be undertaken as per the future Stage 2 RAP and subsequent remediation/validation works. 3- Text added to table to clarify. "Exceedance at AEC9_W_22 was associated with backfill material around a pipe which was orientated north-south. This material was 'chased out' towards the south. The subsequent validation sample (AEC9_W_V25) was collected of remaining sandy backfill material within the wall at the extent of this chase-out. The orientation of this pipe can be seen on *Figure 5*."	Amended.
41	6.2.3.1	Please see comment regarding location of AEC9_W_25 and its suitability as a replacement sample	Added similar text to that in table 6-5 for completeness. This sample is considered suitable on the basis of the orientation of contaminated material (backfill sands in service trench).	Amended.
42	6.3	Table H1 is not provided. Please include this and inspection records for imported material.	Table H1 has been excluded from the report and superceded by EPS imported materials register. In-test references will be updated	Amended.
43	6.4	Please describe whether the stockpiles were placed on hardstand areas, and if not, how validation of these areas was undertaken. Required validation described in Table 5-4.	Noted. Statement added *"It is noted that stockpiles were placed on existing hardstand surface. As such, validation sampling of stockpile footprints was not required to be undertaken (as per the Stage 1 RAP)."*	Amended.
44	6.4.1	Update missing data	Has been provided in updated revised Draft Issued 10/12	Amended.
45	6.4.3	Update missing data	Has been provided in updated revised Draft Issued 10/12	Amended.
46	6.4.3	Please clarify whether stockpiled material left in the Stage 1 area is to be reused within the Stage 1 area, or elsewhere. Are these located on hardstand/HDPE or similar material? How will the area beneath these be validated and where will this be reported?	Material will be re-used on the stage 1 area during future landforming works. Stockpiles are situated on hardstand. Clarifying statement added to text. As previously discussed with the auditor, if stockpiled material is suitable for re-use and complies with SSTLs, validation of underlying material will be of limited value given the overlying stockpile does not pose any risk to site users.	Amended.
47	7.2	This is listed as a focus in the conceptual RAP and in Section 1.4 of this report. See comment 13 regarding the drainage network.	Noted. The drainage network is not validated as per the Stage 1 RAP and has a separate SAQP, hence a separate validation report was prepared for this.	Amended.
48	7.5.2	Final sentence of this section incomplete	Amended: "As such, potential exposure pathways to offsite ecological recptors are considered incomplete."	Amended.
49	Table 1	1 - Table 1 currently lists the NEPC Management Limits as the assessment criteria. 2 - Please check the depth ranges provided are correct.	1 - As discussed and responses provided RE CCME criteria application, TRH management limits are to be adopted 2 - Will check and amend as appropriate	Amended.
51	Table 4	Both NEPC (2013) and CCME (2008) listed within Table 4 but only CCME described as applicable criteria within Section 5.2.2	1 - As discussed and responses provided RE CCME criteria application, TRH management limits are to be adopted. All tables to be amended to remove CCME 2008 criteria	Amended.
52	Photograph 23	Update missing data	Noted - to be updated	Amended.
53	Appendix H	Please elaborate on concentrations of TRH identified in VENM obtained from the Goldfields basement in the context of a former UST and observations of hydrocarbon staining, and therefore the validity of the VENM classification.	ERM reviewed the VENM report and noted the following qualifying statement within the VENM certificate. *"It is noted that there was a minor detection of TRH slightly above the LOR in one sample collected from the sandstone outcrop within the Goldfields Basement, this trace amount may be associated with sediment runoff or slurry from the rock cutting operations and is unlikely to be associated with contamination impact within the sandstone bedrock. The surface of this outcrop must be*	Amended.

Client Viva Energy
Project **Clyde Audit**
Report Stage 1 Drainage Decommissioning Validation Report

Item	Report Section	Auditor comments (report dated 12/12/2020)	Consultant responses	Auditor comments
1	General	Broken reference links should be corrected.	Noted	Amended
2	1.1.2	Please provide a summary of the ERM (2020d) review of previous works completed by Ventia.	Summary provided, focussing on data gaps identified	Amended
3	2	Please check whether streets referenced in this section are correct (i.e. Durham vs Devon Streets)	Confirmed as correct.	Amended
4	2.2.1	1) Should the pipe tracks in the north of the Stage 1 Area also be included here? 2) It is noted that the pipe tracks to the east are outside of the Stage 1 Area.	1) Amended 2) Noted	Amended
5	2.2.2	1 - Paragraph 2: The validation report for Stage 1 states that the Stage 1 Area is predominantly within a Class 4 PASS area. Please be consistent and clear when referring to 'the site' and/or Stage 1 Area. 2 -Paragraph 3: It is stated that estuarine sediments are absent (with regards to probability of ASS in estuarine sediments), however then states that sub-surface drainage infrastructure will be within estuarine sediments. Please clarify.	1) Noted. In this instance we are refer to the Site as per the Glossary definition. 2) Noted. Text amended. Field inspections during the work confirmed not interception of estuarine materials, with fill overlying natural clays clearly evident.	Amended
6	2.2.3	1 - Paragraph 1: Similarly, inconsistency between expected absence of estuarine sediments c.f. expected preferential pathways in the estuarine sediments. 2 - Paragraph 5 is inconsistent with the following descriptions of hydrogeological observations, which appear to be in both the shallow (unconfined) aquifer, and the deeper (semi-confined) aquifer. Please clarify. 3 - Bullet points: please clarify whether these are describing the shallow (unconfined) aquifer, or the deeper (semi-confined) aquifer.	This section has been replaced with the reviewed and endorsed hydrogeology section from the Soil Validation Report which was compiled with greater focus on the Stage 1 Area.	Amended
7	2.3	Paragraph 6/9 ("Given the relatively…") please ensure this description describes the expectations for the Stage 1 area only.	Noted	Amended
8	2.4	Paragraph 2: please update "the COPCs selected for this SAQP..." to refer to the current document.	Amended.	Amended
9	General	1 - The statement that the isolation of Stage 1 and 2 from header box is anticipated mid-December should be updated or removed if it has not been completed.	Noted. Amended to reflect the isolation achieved to date.	Amended
10	4.2.1	Please describe what happened to the pipes and pits following completion of cleaning/flushing. Were these left insitu/removed/plugged/filled with cement?	Pipes were left in-situ, pits were filled. This is detailed within the results section	Noted
11	4.2.3	1) Consider specifically identifying the twin/two 1370 mm trunk lines on a figure, as they are referred to repeatedly. 2) Please identify the 'header box' and 'wastewater treatment plant' on a figure, as they are often referred to. Please consider describing their spatial relationship with respect to the Stage 1 Area.	Noted, these have all been added to Figure 3	Amended
12	Table 4-2	1 - Sub-grade pipework decontamination: should methane and CO2 be included in the real-time gas testing suite? 2 - Disconnection of Western Area drainage from wider Clyde Terminal and wastewater treatment plant: can the methodology be updated to reflect what was actually undertaken? 3 - Corrugated Plate Interceptors (methodology): 'good condition' and 'compromised' should be defined. 4 - Solid materials/sludge: the laboratory analysis requires metals and phenols, however these weren't identified as COPC. Please provide rationale for this analysis. If these are required for waste classification, should they also be considered COPC for Stage 1 Area?	1) amended to include methane and CO2 in table as requested. 2) For Stage 1 - limited to backfill of adjoining 1370mm pits with stabilised sand. This has been updated throughout the document. Appendix K with previous proposed isolation methodology has been removed as it is understood that the permanent isolation of the drainage network is to be finalised in early 2021. 3) Noted and amended "If walls and base of CPI structure validated as being in good condition (no evidence of cracking, compromised structure)– backfill in situ If walls and base of CPI structure are compromised (cracked, broken cannot hold liquid) and are deemed to have potentially impacted surrounding soils..." 4) Rationale of inclusion was simply to provide a broad enough suite to provide confidence to potential waste receivers in the classification given the site's history as a refinery and industry perception. Surrounding soil materials in previous investigations have shown no evidence of these COPCs in surrounding soils so is not considered to be relevant as a COPC for the Stage 1 Area.	Noted
13	4.4.4.1	1) Should total chromium and chromium also be listed as COPC in Stage 1 Area? Should analytical suites listed in Table 4-2 include these? Update to reflect Stage 1 requirements/COPC only. 2) 'acute' exposure should be defined or put into context in relation to risks. 3) The rationale for the use (or not) of ESLs and EILs is not consistent with Section 7.5.2 of the Validation Report. In addition, NEPC (2013) describe EILs as applicable to the top 2 m of soil. Pipes and other infrastructure is expected at depths less that 2 mbgl, as described in Section 2.3 of this report.	1) No evidence of Chromium impacts have been noted in Stage 1 from historical investigation and are therefore not a COPC. HHERA was developed for the range of COPCs present across the western area. Clarifying statement provided to this effect and added that SSTLs only apply to relevant COPCs. 2) Statements about acute exposure have been removed throughout the document in line with edits and rationale provided in the Stage 1 Soil Validation report. 3) Amended for consistent rationale wioth CSM presented in validation report	Noted
14	4.4.4.3	Should this section also describe the ENM criteria? Was there any requirement for visual inspection of material as for the remainder of Stage 1 validation?	ENM criteria added, noting no ENM was used as part of stage 1 works. SAQP did not specify any requirement for visual inspection of imported material. ERM notes that materials imported to site were certified quarried products in order to meet stability requirements for backfill of pits. As such the risk of loads of material containing foreign material or contamination are negligible.	Noted
15	4.4.4.4	1) Bullet point 6: both CCME (2008) and NEPC (2013) management limits are listed as SSTL and presented in tables. This sentence is not clear. Please refer to comments in the validation report regading MLs and the CCME 2) Please clarify what the soil type was adjusted to.	Statements and reference to acute exposure and CCME criteria have been removed throughout the document/tables/figures in line with edits and rationale provided in the Stage 1 Soil Validation report.	Amended

16	Table 4-4	Enabling works: It is not clear in the SAQP that this was for the purpose of Occupational Hygiene assessment. These would also have provided information on the baseline conditions and would have allowed for determination of whether surface water (and surface water runoff) was contaminated by remediation activities.	The purpose of this sampling was primarily for Ventia's OHH purposes. ERM notes that drain cleaning works within the vicinity of remediation areas in Stage 1 were cleaned several months in advance of execution of remediation works so would not have served this purpose	Noted
17	Table 4-4	Gas testing...: Could this not have been undertaken at a later date, for completion?	Pits had to be backfilled and sealed progressively for safety purposes and to prevent recharging of downstream pits/CPIs being cleaned via filling with rainwater. As such there was no opportunity to revisit these pits for additional gas testing parameter collection.	Noted
18	General	All references to 'management' or 'long term management' or 'Long Term Environmental Management Plan' should be updated to: a) reference the LTEMP that has already been prepared b) if relevatn, describe specific management strategies should be described within the LTEMP	a) noted, this will be amended throughout b) a high level summary of items to be managed by the LTEMP is provided in section 6.5, the provision of detailed of management strategies but does not fall within the scope of a validation report. The finalised LTEMP has incorporated the findings of this report in management strategies	Amended
19	4.8	Please elaborate within this section on how these limitations were addressed or managed. In particular, pipes with risers/down-pipes with 90° bends - were these left insitu? Were they plugged? Were they filled with stabilised cement?	These were left in-situ if they weren't within the footprint of remediation excavation. Reference has been provided to the drainage decommissioning register (appendix A), which provides a case by case assessment of the circumstances of each pipe unable to be accessed.	Noted
20	5.1	1) Paragraph 2: 'Area Identifications' are referred to as 'Key Plan Areas' in figures F2-F6. Please update for consistency. 2) Please describe how pipes in Areas 23-25 were identified 3) 'collection of a visual sample' - do you mean 'collection of a grab sample'? 4) 'for deeper pits, visual assessment...' should be described within section 4.7 'Summary of SAQP Deviations' 5) 'The following large diameter mains…': are these to be managed within the LTEMP? 6) 'time and budget constraints of the project...': consider describing or refering to the contingency described in Section 4.7.	1) noted, text to be amended 2) amended with an example. Prefix of area ID was added only to area 26 and stages 2-3 given the complexity in maintaining unique pipe IDs. 3) Grab sample for visual assessment. Amended text 4) Noted and added to table 4.7 5) yes 6) time and budget constraints removed. this section already refers to section 4.7	Amended
21	Table 5-1	Were the 'inaccessible/pipe not located' or 'unable to be cleaned' pipes also considered to require further management?	Discussion of this is covered under Section 6.1. Management not considered required in consideration of the diameter, volume and negligible potential to act as a source of soil or groundwater impact	Noted
22	Table 5-2	1) Please provide commentary (perhaps in section 4.7) on the applicability of these assessment criteria to the sludge, noting that these criteria were developed or derived for a specific soil type, not for petroleum product. 2) Please provide commentary on how these exceedances are to be managed as residual impact (i.e. in the LTEMP). Lines of evidence supporting why additional excavation was not undertaken should be provided. 3) Please refer to figure F6 here, as it provides a good visual reference for residual contamination in the Stage 1 Area. 4) 1370 P-190 also exceeds NEPC (2013) Management limits 5) 1370 P-197 also exceeds NEPC (2013) Management limits 6) 26P-4 26D610-2 also exceeds NEPC (2013) Management limits	1) Added the following statement to the table of SAQP deviations in Section 4.7 *"Sludge samples were screened against soil assessment criteria for the purposes of risk characterisation. Given the matrix of sludge sampled included sandy material and the purpose of assessment was to assess potential to impact surrounding soils, the application of SSTLs developed conservatively for sandy soils are considered appropriate."* 2) Sludge is contained within in-tact steel pipework and is not contaminated soil. Discussion of this point is provided in Section 6.1 "..Potential release mechanisms are limited to disturbance during future intrusive works. Potential risks of release of these residual sludges to surrounding soil and/or groundwater do not exist under regular site conditions where this infrastructure remains undisturbed (i.e. works conducted at the ground surface).." 3) Noted - reference added 4 - 6) Noted, Table 5-2 updated	Amended
23	5.2	Please describe how the CPI was considered to meet the validation criteria (i.e. structure visibly assessed and observed to be in good condition), provide the rationale for why demolition was not required.	Suitable descriptions on how validations criteria have been met, and therefore why demolition was not required, are considered to be supplied in Table 5-3. Commentary is supplied on the observations made following cleaning, including descriptions on the observed integrity of each pit, and specifics on why ERM believe the validation criteria outlined in the SAQP have been met.	Noted
24	5.3	1) Please describe how runoff of compromised pipework was managed and how surfaces impacted by this (if any) were validated 2) Bullet point 1: These pipes are not referred to by name within the validation report - please update for consistency. 3) Bullet point 2: fill material was not successfully validated as suitable to remain on site.	1) It is unclear what 'run-off' refers to in this context. Removal of pipes did not form part of the drainage decommissioning validation scope and has been reported as part of the Stage 1 Soil Validation Report. During remediation works, some small amounts of residual LNAPL drained into surrounding soils which were already visibly contaminated. These soils were excavated and managed as contaminated soils as part of the soil validation program. Pipe sections removed were stockpiled spearately from soils on hardstand and therefore validation of underlying soils was not required to be undertaken. 2) Noted 3) ERM disagrees with this comment. An exceedance of TRH Management Limits does not deem soils as unsuitable to remain on site. Should this comment be referring to the refusal encountered at TP20/20, further clarifying text has been provided in Section 5.3.1 to justify the suitability of validation achieved (considered to be suitable)	Noted
25	5.3.1	1) Bullet point 4: please describe observations of groundwater inflow (i.e. olfactory/visual) 2) Paragraph 3 'A slight degraded…': Refusal on concrete slab should be described here, and the rationale for not advancing the testpit, or concrete coring and drilling, below this.	1) Noted and added 2) Added clarifying statement "Test Pit TP20/20 was terminated on a concrete slab at a depth of 0.5m bgl. Further advancement beyond this secondary slab was not considered necessary for the purposes of validation given the excavation had been extended beyond the depth of the compromised pipe (D300-49), which was located at approximately 0.4 m bgl."	

26	Table 5-4	1) It is noted that this test pit was abandoned at 0.5 mbgl due to refusal on a concrete slab. How does this depth correspond to the depth of compromised pipe that this was intending to assess? 2) Please comment on whether contamination in this area is considered to be delineated laterally and/or vertically? 3) NEPC (2013) Management limits also exceeded. 4) Provide discussion around why this impacted material was considered suitable to remain in situ having failed validation criteria.	1) as per above comment. 0.5m test pit vs 0.4m depth of pipe. 2) Vertical and lateral delineation of management limit exceedances is not considered necessary given these impacts do not represent a risk to receptors and are limited to aesthetic impacts during excavation. The 20m buffer applied to management of these impacts applied within the LTEMP is considered conservative given the localised nature of hydrocarbon impacts reported across the wider Clyde Site. 3) Noted, table amended 4) This discussion is provided in Section 6.3, a reference to this section already exists. No changes proposed.	
27	5.4	If the material is VENM the SAQP states "If VENM is brought to the site accompanied by a VENM certificate, sampling may not be required." However a VENM certificate was not provided and therefore sampling should have been conducted or evidence that the material was from a supplier. Section 7.5 of the SAQP also states "If the required volume of material is less than 1,000 m3, samples will be collected at 1 per 100 m3." 1) Please provide a rationale for why sampling was not undertaken. 2) Please describe this in Section 4.7 'Sumary of SAQP deviations'	1) Imported material was quarried material imported from a supplier (Boral). Appendix I provides letter of approval from the NSW EPA. Imported materials tracker and dockets indicate material sourced from Boral's Peats Ridge and Dunmore Quarries. 2) Noted, addition to Section 4.7 to be added.	Noted
28	5.5	Can this section be updated to describe works that have been completed?	Section has been amended to reflect actual activity completed, and not speculate or rely on potential future works to meet project objectives.	Amended
29	5.6	1) Please check waste tracking as a lot of liquid waste is described as being transported to the hydrowash area when it should have gone to the 'sludge drying bay'. 2) What happened to the material after it was dewatered in the sludge drying bay? 3) Please check waste tracking appendix. A lot of material appears to have ended up in the former Tank Farm A3 area. There is no description of screening for suitability for biopiling of material from the drainage decommissioning, however material is described as 'remediated material' in Appendix I. 4) Consider providing a summary of how much material (volume/tonnage) was removed from the Stage 1 area, and where it ultimately was moved to. 5) Did any material remain within the Stage 1 area? How were the footprints of stockpile areas validated?	1) Hydrowash area is where bins of solid material from vaccuum excavation trucks were takien so that bins could be cleaned out. This area of the site was designed for high pressure washing of oily equipment and is still connected to the contaminated drainage system. See comment on Appendix I below. 2) This material still remains on site within the sludge drying bay. The classification and disposal of this material will be reported within future drainage validation reports for Stages 2 and 3. 3) Noted. This register contains material tracking for the entire scope of Ventia's works and has been greyed out where not relevant to Stage 1. The 'remediated material' in question is what ERM have referred to as SP1, SP2, SP3 and SP4. These stockpiles are material from bio-remediation trials conducted by ERM in 2019, which was transferred from the sludge drying area to the Western Area early in Ventia's program to make room for geobags in the sludge drying bay 4) Noted 5) No material remains stockpiled within the Stage 1 Area from drainage decommissioning works	Amended
30	6.1	1) Bullet point 9: can this be updated (i.e. has this been completed)? 2) Bullet point 10: Clay will not prevent lateral migration if pipes are within backfill sands/fill 3) Bullet point 10: please provide a reference for where monitoring data is reported. 4) Paragraph 6 'Owing to the...': is this included in the LTEMP? If so, please reference 5) Paragraph 8: it's not clear whether the pipes have been removed or remain in situ. Please elaborate.	1) Text amended to reflect completed activities. 2) Text amended to clarify point being about migration beyond the immediate vicinity of pipes/backfill to broader environment. 3) Reference included. 4) Amended to reflect 5) Pipes remain in-situ, text edited to reflect.	Amended
31	6.3	1) Paragraph 5: Please provide rationale for why this material was left in situ. 2) Paragraph 5: Please provide discussion around the lateral and/or vertical delineation of this material 3) Paragraph 6: please reference the LTEMP here.	1) Rationale related to drivers for remediation included. 2) Commentary on delineation supplied, relating Stage 1 Area characterisation achieved through assessment stage, and observations and data collected during test pitting. 3) LTEMP referenced.	Amended
32	6.5	1) Please include a summary of inclusions in the LTEMP that relate specifically to this phase of works. 2) Please note that hydrocarbon impact in the vicinity of TP20/20 is not considered to be delineated laterally or vertically.	1) Summary of residual conditions and management procedures added. 2) Noted. Formerly provided text on acute hazards related to TP20/20 amended.	Amended
33	Table 7-1	1) Update with references to the LTEMP where required. 2) Update with details of the permanent isolation to be undertaken in December 2020 (has this been completed?)	1) Referencing included 2) Details on permanent isolation completed to date have been presented.	Amended
34	7	Paragraph 4 and 5: Please reference the LTEMP and specific controls described within.	Section 7 (Conclusions) amended.	Noted
35	Appendix I	1) Imported material table: final column is labelled 'waste type', condsider amending to 'material type' 2) Internal waste materials tracking - units missing for many loads 3) Material movement on 7/09/2020 described as 'ERM Approved Material' - what is this? Please elaborate. Under what mechanism was this approved? 4) Material movement on 16/09/2020: please update with origin and waste type 5) Material movement on 17/09/2020: Contaminated water described as going to the Hydrowash Bay - this should have gone to the Sludge Drying Bay 6) Material movement on 12/10/2020 - where is the 'Wash Pad' - not previously described. Please update/elaborate 7) Material movement on 21/10/2020 'MCR East' not previously described. Please elaborate.	In general, this register was prepared by Ventia for their entire program of works, including Stage 2, 3 and works completed on the Clyde Terminal. Material movements not relevant to the Stage 1 Area have been greyed out but are included for overall transparency. 1) Noted and amended to 'material type' 2) These will all be in tonnage. Amended table 3) Stockpiles 8 and 9, which were characterised consistently with SP44 in the Stage 1 Validation report for on-site reuse. This material was sourced and placed on the Stage 3 area and as such, this data has not been included in this Stage 1 report. 4) Updated 5) Residual solids collected in the bin from that day which cannot be discharged into the geobag, are washed out at the hydrowash bay with solid materials stockpiled on hardstand. Runoff is drained from this area to the contaminated water drainage system and the WWTP. 6) wash pad is the hydrowash bay and has been updated in tracking sheet. 7) General solid waste material stored in the sludge bay (Clyde Terminal) was relocated to create space for more geobag capacity. All movement occurred on Clyde Terminal and is not relevant to Stage 1.	Amended

36	Bore logs/analytical results tables	It is noted that the sample depths are inconsistent with the logs (i.e. sample depth 0.9-1.1 mbgl however test pit terminated at 1.0 and sample nomenclature described as discrete depths rather than depth range). Please amend for consistency.	Depth interval required for sample display on logs, no amendment proposed. Tables will be updated with discrete depths as required	Amended

Client Viva Energy

Project **WRAP - Stage 1**

Report Stage 1 – Long Term Environmental Management Plan

Item	Report Section	Auditor Comments - Issued 4/12/2020	Consultant Responses	Auditor comments
1	General	Given the amount of information in the document, it would be beneficial to have a synopsis of the key elements of the LTEMP with references to sections where actions/controls are presented. It is considered that the LTEMP is a passive EMP (as defined by the NSW EPA) and this should be reflected in the document. Perhaps the synopsis could state that if site soils and/or groundwater are not disturbed then there is no risk to site users. Should disturbance of site soils and/or groundwater be necessary, management of the presence of known hazards (as listed in Section 5) is required, adopting the protocols in Sections 7 and 8.	Executive summary has been included that summarises / cross references key portions of the LTEMP.	Amended
2	1.1	1 - Discussion regarding the endpoints of this LTEMP should be presented (groundwater monitoring and soil/asbestos). 2 - Please clarify if basements are permitted to be constructed in the Stage 1 Area following remediation and validation as this action may require additional management protocols. 3 - All restrictions within Stage 1 area should be discussed in the LTEMP. Otherwise, how restrictions will be enforceable? Will Downer update the title of land annually based on groundwater results?	1- the following text has been added "The requirements outlined within this LTEMP relating to residual soil / asbestos contamination will remain in place until residual contamination is appropriately removed and validated with no remaining potential risks to identified human health / ecological receptors. Any changes to the requirements outlined within this LTEMP will require review / endorsement by a NSW EPA accredited Site Auditor" 2- no allowance for basements as the SSTLs were developed within the HHERA based on a commercial / industrial slab-on-grade screnario - table 3 updated to include this detail, along with Section 1.3 (Limitaations of this LTEMP) 3 - The restrictions on land uses are detailed within table 3 "allowable land uses". In regards to the beneficial use of groundwater the following text has been added to the LTEMP in Section 1.1 and 3.3 "□ Where beneficial re-uses of groundwater are proposed, further assessment of the suitability of groundwater is to be completed by a suitably qualified environmental specialist with findings reviewed / endorsed by a NSW EPA accredited site auditor"	Amended
3	2.4 and 3.1	The auditor noted that the information highlighted in yellow should be presented before endorsement of the LTEMP.	Noted - these highlighted sections have been removed	Amended
4	3.2	A survey plan showing the area that this LTEMP is applicable including coordinates should be presented. All items such as drainages, asbestos and hydrocarbon impacted areas that need to be managed under the LTEMP should be presented on a survey plan including coordinates (please see figure attached in the auditor's email).	Figure 2 and 3 have been updated with details and co-ordinates of asbestos / pipework / residual hydrocarbon impacted areas. In terms of pipework survey, the co-ordinates of drainage pits for pipework containing residual sludge which is subject to management have been provided. Site survey to be included as Appendix D.	Amended
5	3.3	1 - ERM stated that the controls outlined within the LTEMP are not required under normal site operations. Please clarify what is the meaning of "normal site operations"? Does it mean above-ground activities? Perhaps it would be preferable to state *provided the site surface is not disturbed, including groundwater extraction, none of the controls in this LTEMP are necessary* 2 - ERM stated that additional controls are required for any works undertaken within 20 m of identified residual contamination. Which additional controls are these? 3 - ERM noted that potential future beneficial uses of groundwater have not been considered in this LTEMP. Please clarify if based on the remedial validation, groundwater use and/or basements would be permissible...or would be subject to site and/or activity specific assessment.	1 - Section has been updated to reflect requested wording 2 - additional information included within Section 3.3 clarifying what additional controls are required 3 - ERM does not considers that the potential future use of groundwater requires additional assessment - Section 3.3 has been updated to read "Where groundwater is proposed for future beneficial re-uses, an assessment of suitability must be undertaken by a suitably qualified environmental professional. The assessment and any recommendations for re-use etc. must be reviewed and endorsed by a NSW EPA Accredited Site Auditor"	Amended
6	4.1	1 - Clarify if Downer is already occupying the Stage 1 Area, as presented in Table 3. 2 - Permissible Land Use - Please clarify if the Stage 1 area was remediated for all permissible land uses listed in Table 3 (e.g. Horticulture; Kiosks etc.).	1 - Downer is responsible for the see construction activities and are anticipated to be in occupation of the Stage 1 Area in Early 2020. Table 3 updated accordingly 2 - All land uses under the current zoning are permissible subject to the assumptions in the HHERA as detailed within the validation report. Table 3 has been updated to state that the site is suitable for development with no basements or beneficial use of groundwater	Amended

7	5	1 - ERM stated that there are a number (please consider using a more specific term than "a number") of underground pipes/drains throughout the Stage 1 Area which were decontaminated to the extent practical. The definition of "extent practicable" should be presented. 2 - Figure 2 Location of drainage: All drainage lines that remained within the Stage 1 Area should be presented on a surveyed plan with respective coordinates. 3 - Asbestos associated with former underground structures - ERM stated that during remedial works, asbestos was noted in a limited number of underground structures, which, due to structural reasons, were not removed during site remediation. The locations of those underground structures should be shown in a survey plan with associated coordinates. 4 - ERM stated that several (please consider deleting "several") concrete structures containing asbestos form work remain in-situ as illustrated on Figure 2. 5 - Hydrocarbon impacted soil - Acute hazard criteria - Additional clarification of the 'acute hazards' is required. Does this incorporate acute hazards during subsurface intrusive and/or maintenance works and/or acute hazards in enclosed indoor environments. Please note that the nature of these hazards was already discussed during review of HHERA and the data collected during the remedial works conducted at AEC9 could be a line of evidence to qualify the nature of these hazards. 6 - Residual hydrocarbon impacted groundwater - Please refer to comment above regarding the meaning of "normal site operation".	1- text has been updated to read 11 drainage lines 2 - Figure 3 has been updated to show co-ordinates for pit junctions for all drainage lines that may require future management. Given almost 350 individual pipe segments exist across the stage 1 area (most of which do not require specific management), co-ordinates 3- Locations (including co-ordinates) of asbestos finds are included on Figure 2. 4 - Asbestos structures updated to read "three (3) redundant structures" 5 - The intention of the acute hazard criteria is that safety controls, including air monitoring for vapours/ LEL is adopted within these areas of the site during future excavations. While SSTLs for vapour intrusion were not exceeded, the concentrations of TRH C10-C16 fractions warrant consideration of potential to accumulate in excavations. Hydrocarbons in soil text has been updated to read "Following completion of remedial works, residual LNAPL or soil contamination exceeding TRH Management limits and acute hazard criteria (for intrusive maintenance workers)". Detailed discussion on the application of the acute hazard criteria is provided within the Stage 1 Validation Report. 6 - text has been updated to read "and do not pose a risk to identified receptors where intrusive excavation and / or contact with groundwater does not occur"	Amended
8	5.1	Acute hazard criteria - Additional clarification of the 'acute hazards' is required. The management limits listed in the NEPM are not defined as acute hazards. Do the acute hazards refer to subsurface intrusive and/or maintenance works and/or acute hazards in enclosed indoor environments? Please note this matter has already been discussed during review of HHERA (and the recorded concentrations do not exceed the SSTLs for soil vapour) and there have been subsequent lines of evidence collected on soils where MLs have been exceeded.	Section has been updated to read "Potential acute hazards during intrusive excavation / maintenance works from pooling of vapours from hydrocarbons or other hazardous ground gases resulting from degraded hydrocarbons within open excavations"	Amended
9	6.1	1 - Table 6-1: Clarify if normal site operation means only on-ground activities. There would therefore be no restrictions necessary under this scenario. If this is the case, shouldn't the Management Control be - No controls required? 2 - Table 6-2: ERM stated that "Potential acute hazards during intrusive works from pooling of vapours from hydrocarbons or other hazardous ground gases (methane, carbon dioxide) resulting from degraded hydrocarbons within open excavations". Please note that this topic was already discussed during the review of HHERA.	1 - table 6.1 has been updated to read "risks where no intrusive excavation works are undertaken" controls have been updated to read "NA - no controls required".	Amended
10	6.2	1 - The auditor notes that as stated by ERM in this LTEMP, the LNAPL is degraded and non-volatile. If it is the case, it is not clear why acute risks, hazards and pooling of gases are applicable. 2 - It would be of benefit (and an appropriate line of evidence) if a comment can be made on whether ground gases above criteria were detected within the Stage 1 Area. 3 - Ambient air data collected during the remedial works would be useful as a line of evidence to support that there are no acute risks and hazards for IMW. 3 - Please clarify the meaning of "high" and "lower" concentrations. Do these mean above and below the remediation criteria? 4 - Clarify how the short periods (5 - 10 minutes) were defined. 5 - ERM stated that "Potential for generation of flammable atmospheres". Please clarify what is the basis for this statement, if LNAPL is degraded and non-volatile as stated by ERM (and there was little if any recordings of volatile chemicals during the remedial works at AEC9).	1 - While ERM notes that the LNAPL is degraded, concentrations of TRH C10-C16 fractions exceeding the adjusted criteria for acute hazards (CCME 2008, upon which management limits for 'potential fire/explosion' are based). As such, it is considered prudent to undertake gas monitoring during future intrusive works. 2 - Direct measurement of ground gases has not been undertaken within the Stage 1 Area outside of a targeted soil vapour well with AEC-9 and as such ERM can not comment on specfic concentrations. 3 - reference to high and low has been removed 4 - reference to the timeframe of 5 - 10 minutes was removed. 5 - While ERM notes that the risk of flammable atmospheres is considered to be low, it would be considered prudent to undertake LEL / ground gas monitoring during future intrusive excavation works in these areas.	Amended

Appendix C Tables

Stage 1 Validation

COPC	Soil									
	Direct Contact (mg/kg)			VI (mg/kg)						Management Limits (mg/kg)
	Commercial	IMW	Construction	Commercial (0.15mbgl)	Commercial (1 mbgl)	Commercial (>2-4mbgl)	Commercial (>4mbgl)	IMW	Construction	
Benzene	400	15000	1200	3.2	3.2	3.2	3.2	NL	NL	-
Naphthalene	9800	810000	67000	NL	NL	NL	NL	NL	NL	-
Benzo(a)pyrene TEQ	40	3000	200	-	-	-	-	-	-	-
Total Chromium[a]	21000	100,000	8200							
Chromium VI	3600	17000	1400	-	-	-	-	-	-	-
TRH C6-C10 (less BTEX)	28000	830000	69000	600	770	NL	NL	NL	NL	-
TRH C6-C10	-	-	-	-	-	-	-	-	-	700
TRH C10-C16 (less N)	17000	540000	45000	NL	NL	NL	NL	NL	NL	-
TRH C10-C16	-	-	-	-	-	-	-	-	-	1000
TRH C16-C34	27000	770000	64000	-	-	-	-	-	-	3500
TRH C34-C40	27000	770000	64000	-	-	-	-	-	-	10000
TPH (EC5-6) aliphatic	1200000	3700000	310000	-	-	-	-	-	-	-
TPH (>EC6-8) aliphatic	1200000	3700000	310000	480	610	880	1400	NL	NL	-
TPH (>EC8-10) aliphatic	24000	740000	62000	760	980	1400	2200	NL	NL	-
TPH (>EC10-12) aliphatic	24000	740000	62000	430	600	980	1800	NL	NL	-
TPH (>EC12-16) aliphatic	24000	740000	62000	4300	8300	17000	33000	NL	NL	-
TPH (>EC16-21) aliphatic	470000	4400000	370000	-	-	-	-	-	-	-
TPH (>EC21-34) aliphatic	470000	4400000	370000	-	-	-	-	-	-	-
TPH (>34) aliphatic	4700000	44000000	3700000	-	-	-	-	-	-	-
TPH (>EC8-10) aromatic	9500	300000	25000	110	150	230	420	NL	NL	-
TPH (>EC10-12) aromatic	9500	300000	25000	280	430	750	1400	NL	NL	-
TPH (>EC12-16) aromatic	9500	300000	25000	430	2800	5100	9800	NL	NL	-
TPH (>EC16-21) aromatic	7100	220000	18000	-	-	-	-	-	-	-
TPH (>EC21-34) aromatic	7100	220000	18000	-	-	-	-	-	-	-
TPH (>34) aromatic	7100	220000	18000	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-										
Trimethylbenzene, 1,3,5-										
Cyclohexane										
Heptane, N-										
Hexane, N-										
Isooctane										
Propene										

a - Assumes Total chromium is 17% Hexavalent chromium

Field_ID	Location Code	Sampled Date	Sample Depth	PID (ppm)
Supplementary Test Pitting				
TP20/09_0.5	TP20/09	21/07/2020	0.5-0.55	0.1
TP20/09_0.65	TP20/09	21/07/2020	0.65-0.7	468
TP20/10_0.1	TP20/10	21/07/2020	0.1-0.15	0.1
TP20/10_1.5	TP20/10	21/07/2020	0.25-0.3	0.1
TP20/10_1.5	TP20/10	21/07/2020	1.5-1.55	0
TP20/11_0.1	TP20/11	21/07/2020	0.1-0.15	0.3
TP20/11_1.5	TP20/11	21/07/2020	1.45-1.5	0.1
TP20/12_0.1	TP20/12	21/07/2020	0.1-0.15	0.1
TP20/12_0.5	TP20/12	21/07/2020	0.5-0.55	0
TP20/12_1.5	TP20/12	21/07/2020	1.45-1.5	0.1
TP20/13_0.2	TP20/13	21/07/2020	0.2-0.25	0
~~TP20/13_0.8~~	~~TP20/13~~	~~21/07/2020~~	~~0.8-0.85~~	~~0.4~~
TP20/13_1.5	TP20/13	21/07/2020	1.45-1.5	0.1
TP20/14_0.25	TP20/14	21/07/2020	0.25-0.3	0.1
TP20/14_1.0	TP20/14	21/07/2020	1.0-1.05	0.1
TP20/14_1.5	TP20/14	21/07/2020	1.45-1.5	0.1
TP20/15_0.25	TP20/15	21/07/2020	0.25-0.3	0.1
TP20/15_1.5	TP20/15	21/07/2020	1.45-1.5	0.1
TP20/16_0.3	TP20/16	21/07/2020	0.3-0.35	1.4
TP20/16_1.0	TP20/16	21/07/2020	1.0-1.05	0
TP20/16_1.2	TP20/16	21/07/2020	1.2-1.25	0.1
TP20/16_1.5	TP20/16	21/07/2020	1.45-1.5	0
TP20/17_0.5	TP20/17	21/07/2020	0.5-0.55	55.9
TP20/17_1.0	TP20/17	21/07/2020	1.0-1.05	63.8
TP20/17_1.5	TP20/17	21/07/2020	1.45-1.5	0.1
TP20/18_0.0	TP20/19	8/09/2020	0.0-0.05	0
TP20/18_0.2	TP20/19	8/09/2020	0.2-0.25	7.2
TP20/18_0.5	TP20/19	8/09/2020	1.0-1.05	15.7
TP20/18_1.5	TP20/20	7/09/2020	1.45-1.5	11.8

Field_ID	Location Code	Sampled Date	Sample Depth	PID (ppm)
Validation Sampling				
AEC9_B_V01	AEC9_B_V01	16/10/2020	-	24.6
AEC9_B_V02	AEC9_B_V02	19/10/2020	-	2.4
AEC9_B_V03	AEC9_B_V03	19/10/2020	-	20.7
AEC9_B_V04	AEC9_B_V04	20/10/2020	-	0.7
AEC9_B_V05	AEC9_B_V05	21/10/2020	-	2.5
AEC9_B_V06	AEC9_B_V06	22/10/2020	-	24.6
AEC9_B_V07	AEC9_B_V07	22/10/2020	-	2
AEC9_B_V08	AEC9_B_V08	22/10/2020	-	0.6
AEC_B_V09	AEC9_B_V09	15/10/2020	-	0.5
AEC9_B_V10	AEC9_B_V10	15/10/2020	1.5-1.5	2.9
AEC9_B_V11	AEC9_B_V11	19/10/2020	-	3.1
~~AEC9_B_V12~~	~~AEC9_B_V12~~	~~20/10/2020~~		~~14.1~~
AEC9_B_V13	AEC9_B_V13	21/10/2020	-	3
AEC9_B_V14	AEC9_B_V14	23/10/2020	-	0.7
AEC9_B_V15	AEC9_B_V15	23/10/2020	-	1.4
AEC9_B_V16	AEC9_B_V16	22/10/2020	-	11.7
AEC9_B_V17	AEC9_B_V17	22/10/2020	-	9.5
AEC9_B_V18	AEC9_B_V18	15/10/2020	1.5-1.5	4.2
AEC9_B_V19	AEC9_B_V19	14/10/2020	1.5-1.5	2.4
AEC9_B_V20	AEC9_B_V20	14/10/2020	1.5-1.5	489.5
AEC9_B_V21	AEC9_B_V21	23/10/2020	-	2.3
AEC9_B_V22	AEC9_B_V22	23/10/2020	-	1.6
AEC9_B_V23	AEC9_B_V23	4/11/2020	-	202
AEC9_B_V24	AEC9_B_V24	4/11/2020	-	29
AEC9_B_V25	AEC9_B_V25	4/11/2020	-	16
AEC9_B_V26	AEC9_B_V26	15/10/2020	1.5-1.5	1
AEC9_B_V27	AEC9_B_V27	14/10/2020	1.5-1.5	315
AEC9_B_V28	AEC9_B_V28	14/10/2020	1.5-1.5	0.9
AEC9_B_V29	AEC9_B_V29	23/10/2020	-	1.3
AEC9_B_V30	AEC9_B_V30	23/10/2020	-	91.3
AEC9_B_V31	AEC9_B_V31	23/10/2020	-	47.6
AEC9_B_V32	AEC9_B_V32	4/11/2020	-	198
AEC9_B_V33	AEC9_B_V33	4/11/2020	-	23
AEC9_B_V34	AEC9_B_V34	4/11/2020	-	1.8
AEC9_B_V35	AEC9_B_V35	10/11/2020	-	4.2
AEC9_B_V36	AEC9_B_V36	10/11/2020	-	4.6
AEC9_B_V37	AEC9_B_V37	11/11/2020	-	7.5
AEC9_W_V16_1.0	AEC9_W_V16	23/10/2020	1	98.5
AEC9_W_V17_1.0	AEC9_W_V17	23/10/2020	1	516.7
AEC9_W_V18_1.0	AEC9_W_V18	4/11/2020	1	11.9
AEC9_W_V19_1.0	AEC9_W_V19	4/11/2020	1	28
AEC9_W_V20_1.0	AEC9_W_V20	4/11/2020	1	187
AEC9_W_V21_1.0	AEC9_W_V21	10/11/2020	1	9.1

Field_ID	Location Code	Sampled Date	Sample Depth	PID (ppm)
AEC9_W_V25_1.0M	AEC9_W_V25	16/11/2020	1	18.5
Failed Wall	AEC9_W_V24	16/11/2020	1.5	26
AEC9_V-C9_5.5	AEC9_V-C9	12/11/2020	5.5	240
AEC9_W_V01_1.0	AEC9_W_V01	16/10/2020	1-1	0.7
AEC9_W_V02	AEC9_W_V02	15/10/2020	1-1	4
AEC9_W_V03	AEC9_W_V03	15/10/2020	1-1	1.8
AEC9_W_V04	AEC9_W_V04	15/10/2020	1-1	17.8
AEC9_W_V05_1.0	AEC9_W_V05	15/10/2020	1-1	4.3
AEC9_W_V06_1.0	AEC9_W_V06	15/10/2020	1-1	3.6
AEC9_W_V07_1.0	AEC9_W_V07	16/10/2020	1-1	0.4
AEC9_W_V08_1.0	AEC9_W_V08	19/10/2020	1-1	0.6
AEC9_W_V09_1.0	AEC9_W_V09	20/10/2020	1-1	96.1
AEC9_W_V10_1.0	AEC9_W_V10	20/10/2020	1-1	145.5
AEC9_W_V12_1.0	AEC9_W_V12	22/10/2020	1-1	59.3
AEC9_W_V13_1.0	AEC9_W_V13	22/10/2020	1-1	1
AEC9_W_V14_1.0	AEC9_W_V14	22/10/2020	1-1	2.5
AEC9_W_V15_1.0	AEC9_W_V15	22/10/2020	1-1	78
AEC9_W_V22_1.0	AEC9_W_V22	11/11/2020	1-1	242
AEC9_W_V23_1.0	AEC9_W_V23	11/11/2020	1-1	3
AEC9_W_V24_2.0	AEC9_W_V24	11/11/2020	2-2	-
AEC9_W_V11_1.0	AEC9_W_V11	21/10/2020	-	12.7
AEC9_W_V07_1.5	AEC9_W_V07	16/10/2020	1.5-1.5	2.4
AEC9_W_V08_1.5	AEC9_W_V08	19/10/2020	1.5-1.5	0.4
AEC9_W_V09_1.5	AEC9_W_V09	20/10/2020	1.5-1.5	10.4
AEC9_W_V22_1.5	AEC9_W_V22	11/11/2020	1.5-1.5	4.6
AEC9_W_V24_1.5	AEC9_W_V24	11/11/2020	1.5-1.5	145
Floor	AEC9_W_V25	16/11/2020		9.3
End Sand	AEC9_W_V25	16/11/2020		86
End Sand #2	AEC9_W_V25	16/11/2020		41
Stockpiles				
SP44_01	SP44	12/11/2020	-	1.8
SP44_02	SP44	12/11/2020	-	2.5
SP44_03	SP44	12/11/2020	-	2.2
SP44_04	SP44	12/11/2020	-	2.2
SP44_05	SP44	12/11/2020	-	1.8
SP44_06	SP44	12/11/2020	-	1.7
SP44_07	SP44	12/11/2020	-	1.9
SP44_08	SP44	12/11/2020	-	2.1
SP44_09	SP44	12/11/2020	-	1.4
SP44_10	SP44	12/11/2020	-	1.3

Field_ID	Location Code	Sampled Date	Sample Depth	PID (ppm)
SP65_01	SP65	10/11/2020	-	1.7
SP65_02	SP65	10/11/2020	-	1.3
SP65_03	SP65	10/11/2020	-	1.4
SP66_01	SP66	10/11/2020	-	1.4
SP66_02	SP66	10/11/2020	-	1.2
SP66_03	SP66	10/11/2020	-	6.1
SP67_01	SP67	10/11/2020	-	8.2
SP67_02	SP67	10/11/2020	-	1.5
SP67_03	SP67	10/11/2020	-	3.2
SP67_04	SP67	10/11/2020	-	1.4
SP67_05	SP67	10/11/2020	-	3.3
SP68_01	SP68	10/11/2020	-	8.6
SP68_02	SP68	10/11/2020	-	5
SP68_03	SP68	10/11/2020	-	9.1
SP68_04	SP68	10/11/2020	-	5.5
SP72_01	SP72	17/11/2020	-	192.6
SP72_02	SP72	17/11/2020	-	164.7
SP72_03	SP72	17/11/2020	-	157.3
SP72_04	SP72	17/11/2020	-	400.3
SP72_05	SP72	17/11/2020	-	337.4
SP72_06	SP72	17/11/2020	-	198.8
SP72_07	SP72	17/11/2020	-	223.7
SP72_08	SP72	17/11/2020	-	167.2
SP72_09	SP72	17/11/2020	-	328.5
SP72_10	SP72	17/11/2020	-	268.9
SP72_11	SP72	17/11/2020	-	345.7
SP73_01	SP73	23/10/2020	-	66.9
SP73_02	SP73	23/10/2020	-	164.6
SP73_03	SP73	23/10/2020	-	54.5
SP73_05	SP73	17/11/2020	-	0.6
SP73_05D	SP73	17/11/2020	-	0.6
SP73_06	SP73	17/11/2020	-	74.8
SP73_07	SP73	17/11/2020	-	3.5
SP73_08	SP73	17/11/2020	-	13.7
SP73_09	SP73	17/11/2020	-	9.5
SP73_10	SP73	17/11/2020	-	9.5
SP73_11	SP73	17/11/2020	-	6.4
SP73_12	SP73	17/11/2020	-	10.3
SP73_13	SP73	17/11/2020	-	6.5
SP73_14	SP73	17/11/2020	-	4.5
SP73_15	SP73	17/11/2020	-	2.3

Note: PID measurements taken from SP73 during October 2020 are prelimary measurements. Final measurements were taken on 17 November 2020.

	BTEX							Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)						
	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
	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
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			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																				
1-1.99m	3.2							NL							770		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																				
2-3.99m	3.2							NL							NL		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																				
0-0.99m	3.2							NL							600		NL			
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)	NL							NL							NL		NL			
Clyde WARP SSTL (Vapour Intrusion - IMW)	NL							NL							NL		NL			
CCME (2008) - Acute Hazard														1400		5200				
NEPM (1999) Management Limits - Commercial/Industrial (coarse)														700		1000		3500		10000

	TRH Aliphatic/Aromatic Split													TRH Silica Gel Cleanup							Inorganics
	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-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	Moisture Content (dried @ 103°C)
	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	20	50	50	50	100	50	100	1
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) > 4m																					
4-6m		1400	2200	1800	33000				420	1400	9800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																					
1-1.99m		610	980	600	8300				150	430	2800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																					
2-3.99m		880	1400	980	17000				230	750	5100										
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																					
0-0.99m		480	760	430	4300				110	280	430										
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								
CCME (2008) - Acute Hazard																1400		5200			
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																1000		3500		10,000	

Lab_Report_Number	Field_ID	Location_Code	Sample_Type	Sample_Depth_Range	Sampled_Date_Time	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
733104; 733385	TP20/09_0.65	TP20/09	Normal	0.65-0.7	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	2.3	280	7400	2600	80	10,080	1600	1600	7200	7200	770	7970	<100
733104	TP20/10_1.5	TP20/10	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/11_0.1	TP20/11	Normal	0.1-0.15	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	50	180	230	<20	<20	<50	<50	120	120	<100
733104	TP20/11_1.5	TP20/11	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/12_0.2	TP20/12	Normal	0.2-0.25	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	110	77	187	<20	<20	<50	<50	140	140	<100
733104	TP20/12_1.5	TP20/12	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/13_0.8	TP20/13	Normal	0.8-0.85	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	51	51	<20	<20	<50	<50	<100	<100	<100
733104	TP20/13_1.5	TP20/13	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/10_0.1	TP20/14	Normal	0.1-0.15	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	210	140	350	<20	<20	<50	<50	260	260	<100
733104	TP20/14_0.25	TP20/14	Normal	0.25-0.3	21/07/2020	<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
733104	TP20/14_1.5	TP20/14	Normal	1.45-1.5	21/07/2020	<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
733104	DO1_20200721	TP20/14	Field_D	1.45-1.5	21/07/2020	<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
ES2025145	T01_20200721	TP20/14	Interlab_D	1.45-1.5	21/07/2020	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<50	<100
733104	TP20/15_0.25	TP20/15	Normal	0.25-0.3	21/07/2020	<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
733104	TP20/15_1.5	TP20/15	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/16_0.3	TP20/16	Normal	0.3-0.35	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	32	1100	<50	1132	<20	<20	460	460	580	1040	<100
733104	TP20/16_1.5	TP20/16	Normal	1.45-1.5	21/07/2020	<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
733104; 733385	TP20/17_1.0	TP20/17	Normal	1-1.05	21/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	53	8200	14,000	7100	29,300	430	430	11,000	11,000	4900	18,300	2400
733104	TP20/17_1.5	TP20/17	Normal	1.45-1.5	21/07/2020	<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
733104	TP20/18_1.0	TP20/18	Normal	1-1.05	22/07/2020	<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
733104	TP20/18_0.5	TP20/18	Normal	0.5-0.55	22/07/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	78	330	320	728	25	25	91	91	580	671	<100

Field_ID	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-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	Moisture Content (dried @ 103°C)
TP20/09_0.65	<0.1	<10	300	2900	5400	590	170	<0.1	1.3	440	1800	300	130	5600	7200*	7800	2200	570	<100	<100	14
TP20/10_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
TP20/11_0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5
TP20/11_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
TP20/12_0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
TP20/12_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
TP20/13_0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
TP20/13_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
TP20/10_0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.8
TP20/14_0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.3
TP20/14_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
DO1_20200721	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
T01_20200721	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.6
TP20/15_0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
TP20/15_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
TP20/16_0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
TP20/16_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
TP20/17_1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	4200	5600*	15,700	7800	2600	3700	1000	8.7
TP20/17_1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22
TP20/18_1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21
TP20/18_0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20

Statistical Summary

Statistical Summary	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
Number of Results	21	21	21	21	21	21	1	21	21	21	21	21	21	21	21	21	21	21	21	21
Number of Detects	0	0	0	0	0	0	0	1	2	4	7	7	8	3	3	4	4	7	7	1
Minimum Concentration	<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
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	2.3	53	32	50	51	51	25	25	91	91	120	120	2400
Maximum Concentration	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	2.3	280	8200	14000	7100	29300	1600	1600	11000	11000	4900	18300	2400
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	2.3	280	8200	14000	7100	29300	1600	1600	11000	11000	4900	18300	2400
Average Concentration	0.052	0.06	0.06	0.06	0.11	0.15		0.35	25	757	894	396	2018	106	106	913	913	383	1389	162
Median Concentration	0.05	0.05	0.05	0.05	0.1	0.15	0.1	0.25	10	10	25	25	25	10	10	25	25	50	50	50
Standard Deviation	0.011	0.044	0.044	0.044	0.033	0.022		0.45	59	2345	3061	1538	6620	354	354	2789	2789	1057	4240	513
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	1	0	0

Statistical Summary	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-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	Moisture Content (dried @ 103°C)
Number of Results	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	21
Number of Detects	0	0	1	1	1	1	1	0	1	1	1	1	1	2	2	2	2	2	1	1	21
Minimum Concentration	<0.1	<10	300	2900	5400	590	170	<0.1	1.3	440	1800	300	130	4200	5600	7800	2200	570	<100	<100	8.5
Minimum Detect	ND	ND	300	2900	5400	590	170	ND	1.3	440	1800	300	130	4200	5600	7800	2200	570	3700	1000	8.5
Maximum Concentration	<0.1	<10	300	2900	5400	590	170	<0.1	1.3	440	1800	300	130	5600	7200	15700	7800	2600	3700	1000	22
Maximum Detect	ND	ND	300	2900	5400	590	170	ND	1.3	440	1800	300	130	5600	7200	15700	7800	2600	3700	1000	22
Average Concentration																					15
Median Concentration	0.05	5	300	2900	5400	590	170	0.05	1.3	440	1800	300	130	4900	6400	11750	5000	1585	1875	525	16
Standard Deviation																					4
Number of Guideline Exceedances	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0

Notes:

* = TRH concentration following silica gel cleanup exceeds management limits

							BTEX							Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)							TRH Aliphatic/Aromatic Split													TRH Silica Gel Cleanup							Moisture
							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 >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-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	TRH >C34-C40 Silica Gel Cleanup	Moisture Content (dried @ 103°C)
							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	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	0.1	10	10	10	10	10	10	0.1	1	10	10	10	10	20	50	50	50	100	50	100	1
Clyde WARP SSTL (Direct Contact - Commercial)							400							9800							28000		17000	27000		27000		1200000	24000	24000	24000	470000	470000		9500	9500	9500	7100	7100								
Clyde WARP SSTL (Direct Contact - Construction Worker)							1200							67000							69000		45000	64000		64000		310000	62000	62000	62000	370000	370000		25000	25000	25000	18000	18000								
Clyde WARP SSTL (Direct Contact - IMW)							15000							810000							830000		540000	770000		770000		3700000	740000	740000	740000	4400000	4400000		300000	300000	300000	220000	220000								
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m																																															
4-6m							3.2							NL							NL		NL					1400	2200	1800	33000				420	1400	9800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																																															
1-1.99m							3.2							NL							770		NL					610	980	600	8300				150	430	2800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																																															
2-3.99m							3.2							NL							NL		NL					880	1400	980	17000				230	750	5100										
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																																															
0-0.99m							3.2							NL							600		NL					480	760	430	4300				110	280	430										
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)							NL							NL							NL		NL					NL	NL	NL	NL				NL	NL	NL										
Clyde WARP SSTL (Vapour Intrusion - IMW)							NL							NL							NL		NL					NL	NL	NL	NL				NL	NL	NL	NL	NL								
NEPM (1999) HIL D - Commercial/Industrial																																															
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																				700		1000		3500		10000																					
Lab_Report	Field_ID	Location_Code	Sample_Type	Sample_Depth	Sampled_Date	Location_Type																																									
750412	AEC9_B_V19	AEC9_B_V19	Normal	1.5-1.5	14/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	22
750412	AEC9_B_V20	AEC9_B_V20	Normal	1.5-1.5	14/10/2020	Validation (base)	<0.1	<0.1	0.4	0.1	0.4	0.5	-	0.7	<20	20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	2.5	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	17
750412	AEC9_B_V27	AEC9_B_V27	Normal	1.5-1.5	14/10/2020	Validation (base)	0.4	0.5	0.5	0.8	1.5	2.2	-	<0.5	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	0.3	6.3	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	22
750412	AEC9_B_V28	AEC9_B_V28	Normal	1.5-1.5	14/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	22
751038	AEC_B_V09	AEC9_B_V09	Normal		15/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751038	D01_20201015	AEC9_B_V09	Field_D		15/10/2020	Validation (base)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	29	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
750744	AEC9_B_V10	AEC9_B_V10	Normal	1.5-1.5	15/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	19
750744	AEC9_B_V18	AEC9_B_V18	Normal	1.5-1.5	15/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	17
750744	AEC9_B_V26	AEC9_B_V26	Normal	1.5-1.5	15/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	20
750744	AEC9_W_V02	AEC9_W_V02	Normal	1-1	15/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	18
750744	AEC9_W_V03	AEC9_W_V03	Normal	1-1	15/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	18
750744	AEC9_W_V04	AEC9_W_V04	Normal	1-1	15/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	19
751038	AEC9_W_V05_1.0	AEC9_W_V05	Normal	1-1	15/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	52	89	<50	141	<20	<20	53	53	<100	<100	<100	<0.1	<10	<10	<10	38	34	70	<0.1	<1	<10	45	36	38	<50	67	<100	<100	<100	<100	<100	17
751038	AEC9_W_V06_1.0	AEC9_W_V06	Normal	1-1	15/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	120	110	<50	230	25	25	150	150	<100	150	<100	<0.1	<10	<10	15	78	32	24	<0.1	<1	<10	20	20	28	110	140	110	<100	<100	<100	<100	19
751038	AEC9_B_V01	AEC9_B_V01	Normal		16/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751038	AEC9_W_V01_1.0	AEC9_W_V01	Normal	1-1	16/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	17
751038	AEC9_W_V07_1.0	AEC9_W_V07	Normal	1-1	16/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	24	51	<50	75	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	16	10	<10	<0.1	<1	<10	30	19	<10	<50	<50	<100	<100	<100	<100	<100	9.8
751038	AEC9_W_V07_1.5	AEC9_W_V07	Normal	1.5-1.5	16/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
751374	AEC9_B_V02	AEC9_B_V02	Normal		19/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
751374	D01_20201019	AEC9_B_V02	Field_D		19/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
751374	AEC9_B_V03	AEC9_B_V03	Normal		19/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751374	AEC9_B_V11	AEC9_B_V11	Normal		19/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	16
751374	AEC9_W_V08_1.0	AEC9_W_V08	Normal	1-1	19/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751374	AEC9_W_V08_1.5	AEC9_W_V08	Normal	1.5-1.5	19/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	10
751660	AEC9_B_V04	AEC9_B_V04	Normal		20/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
751660	AEC9_B_V12	AEC9_B_V12	Normal		20/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
751660	AEC9_W_V09_1.0	AEC9_W_V09	Normal	1-1	20/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	<50	<50	<50	29	29	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
751660	AEC9_W_V09_1.5	AEC9_W_V09	Normal	1.5-1.5	20/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	16
751660	AEC9_W_V10_1.0	AEC9_W_V10	Normal	1-1	20/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	6.3	<20	310	100	<50	410	110	110	310	303.7	<100	310	<100	<0.1	<10	25	92	89	24	87	<0.1	<1	29	57	13	37	280	280	280	<100	110	<100	<100	8.4
751987	AEC9_B_V05	AEC9_B_V05	Normal		21/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751987	D01_20201021	AEC9_B_V05	Field_D		21/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
751987	AEC9_B_V13	AEC9_B_V13	Normal		21/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
751987	AEC9_W_V11_1.0	AEC9_W_V11	Normal		21/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	15
752272	AEC9_B_V06	AEC9_B_V06	Normal		22/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
752272	AEC9_B_V07	AEC9_B_V07	Normal		22/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	16
752272	AEC9_B_V08	AEC9_B_V08	Normal		22/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
752272	AEC9_B_V16	AEC9_B_V16	Normal		22/10/2020	Validation (base)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	54	<50	<50	54	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	32	<10	15	<10	12	<0.1	<1	12	19	<10	<10	54	58	<100	<100	<100	<100	<100	18
752272	AEC9_B_V17	AEC9_B_V17	Normal		22/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
752272	D01_20201022	AEC9_B_V17	Field_D		22/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
752272	AEC9_W_V12_1.0	AEC9_W_V12	Normal	1-1	22/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	630	130	<50	760	46	46	790	790	120	910	<100	<0.1	<10	72	44	130	24	47	<0.1	<1	94	370	54	62	470	490	570	100	<100	<100	<100	5.3
752272	AEC9_W_V13_1.0	AEC9_W_V13	Normal	1-1	22/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
752272	AEC9_W_V14_1.0	AEC9_W_V14	Normal	1-1	22/10/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
752272	AEC9_W_V15_1.0	AEC9_W_V15	Normal	1-1	22/10/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	310	260	91	661	<20	<20	230	230	260	490	<100	<0.1	<10	<10	<10	23	29	62	<0.1	<1	<10	130	160	210	210	240	370	160	160	<100	<100	6.7
752471	AEC9_B_V14	AEC9_B_V14	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	19
752471	AEC9_B_V15	AEC9_B_V15	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	18
752471	AEC9_B_V21	AEC9_B_V21	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	11
752471	AEC9_B_V22	AEC9_B_V22	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	<1
752471	D01_20201023	AEC9_B_V22	Field_D		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	17
752471	AEC9_B_V29	AEC9_B_V29	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	21
752471	AEC9_B_V30	AEC9_B_V30	Normal		23/10/2020	Validation (base)	0.1	<0.1	0.4	<0.1	0.5	0.6	-	1.1	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	17
752471	AEC9_B_V31	AEC9_B_V31	Normal		23/10/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	18
752471	AEC9_W_V16_1.0	AEC9_W_V16	Normal		23/10/2020	Validation (wall)	<0.1	<0.1	0.1	<0.1	<0.2	<0.3	-	1.3	<20	60	<50	<50	60	<20	<20	55	53.7	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	1.3	15	25	<10	<10	70	67	<100	<100	<100	<100	<100	13
752471	AEC9_W_V17_1.0	AEC9_W_V17	Normal		23/10/2020	Validation (wall)	<0.1	<0.1	0.5	0.6	1.4	2	-	5.9	25	190	<50	<50	190	58	56	200	194.1	<100	200	<100	<0.1	<10	<10	<10	30	<10	<10	<0.1	<1	33	110	19	23	210	210	210	<100	<100	<100	<100	17
754806	AEC9_B_V23	AEC9_B_V23	Normal		4/11/2020	Validation (base)	<0.1	<0.1	0.6	<0.1	1.1	1.1	-	0.6	<20	45	<50	<50	<50	<20	<20	54	53.4	<100	<100	<100	<0.1	<10	<10	<10	15	<10	<10	<0.1	<1	14	29	<10	<10	<50	<50	<100	<100	<100	<100	<100	22
754806	AEC9_B_V24	AEC9_B_V24	Normal		4/11/2020	Validation (base)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	55	<50	<50	55	<20	<20	52	52	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	17	16	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
754806	AEC9_B_V25	AEC9_B_V25	Normal		4/11/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
754806	AEC9_B_V32	AEC9_B_V32	Normal		4/11/2020	Validation (base)	<0.1	<0.1	0.5	<0.1	0.4	0.5	-	1	<20	<20	<50	<50	<50	32	31	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	19
754806	AEC9_B_V33	AEC9_B_V33	Normal		4/11/2020	Validation (base)	<0.1	<0.1	0.2	<0.1	0.4	0.4	-	<0.5	<20	20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
754806	AEC9_B_V34	AEC9_B_V34	Normal		4/11/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
754806	AEC9_W_V18_1.0	AEC9_W_V18	Normal	1	4/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
754806	D01_20201104	AEC9_W_V18	Field_D	1	4/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	21
754806	AEC9_W_V19_1.0	AEC9_W_V19	Normal	1	4/11/2020	Validation (wall)	<0.1	<0.1	1.2	<0.1	1	1	-	2	65	180	<50	<50	180	97	95	170	168	<100	170	<100	<0.1	<10	13	34	33	14	39	<0.1	<1	31	29	10	29	220	180	220	<100	<100	<100	<100	19
754806	AEC9_W_V20_1.0	AEC9_W_V20	Normal	1	4/11/2020	Validation (wall)	<0.1	<0.1	1.3	0.1	1.3	1.4	-	1.6	79	<20	<50	<50	<50	110	110	<50	<50	<100	<100	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	18
755840	AEC9_B_V35	AEC9_B_V35	Normal		10/11/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	19
755840	AEC9_B_V36	AEC9_B_V36	Normal		10/11/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	19
755840	AEC9_W_V21_1.0	AEC9_W_V21	Normal	1	10/11/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	83	91	<50	174	<20	<20	91	91	120	211	<100	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	-	-	-	-	-	-	-	14
ES2039828	T01_20201110	AEC9_W_V21_1.0	Interlab_D		10/11/2020		<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<50	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.9
756099	AEC9_B_V37	AEC9_B_V37	Normal		11/11/2020	Validation (base)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	16
756099	AEC9_W_V22_1.0	AEC9_W_V22	Normal	1-1	11/11/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	100	2900	8000	830	11,730	220	220	5100	5100	6400	11,500	<1000	<0.1	25	290	210	1300	1400	1000	<0.1	2.7	270	3500	3500	1400	3100	5700	13,200	8900	7500	1200	550	15
756099	AEC9_W_V22_1.5	AEC9_W_V22	Normal	1.5-1.5	11/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	17
756099	AEC9_W_V23_1.0	AEC9_W_V23	Normal	1-1	11/11/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	26	120	70	216	<20	<20	<50	<50	160	160	<100	<0.1	<10	<10	<10	<10	<10	41	<0.1	<1	<10	<10	45	120	<50	<50	110	110	150	<100	<100	17
756099	AEC9_W_V24_1.5	AEC9_W_V24	Normal	1.5-1.5	11/11/2020	Validation (wall)	<0.1	<0.1	<0.1	<0.1	0.3	0.3	-	6.4	72	3100	12,000	3400	18,500	150	150	6400	6393.6	11,000	18,800	1400	<0.1	14	75	430	2700	2400	4200	<0.1	4.5	99	2300	2900	1500	1900	4000	11,500	7100	7300	2500	1100	6.8
756099	AEC9_W_V24_2.0	AEC9_W_V24	Normal	2-2	11/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
756099	D01_20201111	AEC9_W_V24	Field_D	2-2	11/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	20
756614	AEC9_V_C7_5.5	AEC9_V_C7	Normal	5.5	12/11/2020		<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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
757069	AEC9_W_V25_1.0M	AEC9_W_V25	Normal	1	16/11/2020	Validation (wall)	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<50	<50	<100	<100	<100	<100	<100	22

Statistical Summary

Statistic	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 >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-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	TRH >C34-C40 Silica Gel Cleanup	Moisture Content (dried @ 103°C)
Number of Results	76	76	76	76	76	76	1	76	76	76	76	76	76	76	76	76	76	76	76	76	74	74	74	74	74	74	74	74	74	74	74	74	74	63	63	63	63	63	63	63	76
Number of Detects	2	1	10	4	10	10	0	10	5	19	10	4	15	10	10	13	13	6	10	1	0	2	6	6	12	9	10	1	5	10	14	11	10	10	11	9	5	5	2	2	75
Minimum Concentration	<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	<0.1	<10	<10	<10	<10	<10	<10	<0.1	<1	<10	<10	<10	<10	<20	<50	<50	<50	<100	<50	<100	<1
Minimum Detect	0.1	0.5	0.1	0.1	0.3	0.3	ND	0.6	25	20	51	70	54	25	25	52	52	120	150	1400	ND	14	13	15	15	10	12	0.3	1.3	12	16	10	23	54	58	110	100	110	1200	550	5.3
Maximum Concentration	0.4	0.5	1.3	0.8	1.5	2.2	<0.2	6.4	100	3100	12000	3400	18500	220	220	6400	6393.6	11000	18800	1400	<0.1	25	290	430	2700	2400	4200	0.3	6.3	270	3500	3500	1500	3100	5700	13200	8900	7500	2500	1100	22
Maximum Detect	0.4	0.5	1.3	0.8	1.5	2.2	ND	6.4	100	3100	12000	3400	18500	220	220	6400	6393.6	11000	18800	1400	ND	25	290	430	2700	2400	4200	0.3	6.3	270	3500	3500	1500	3100	5700	13200	8900	7500	2500	1100	22
Average Concentration	0.056	0.059	0.12	0.071	0.2	0.26		0.57	14	116	298	82	460	20	20	200	200	284	476	74	0.05	5.4	11	16	65	58	80	0.053	0.7	13	94	96	51	125	202	462	303	288	105	75	17
Median Concentration	0.05	0.05	0.05	0.05	0.1	0.15	0.1	0.25	10	10	25	25	25	10	10	25	25	50	50	50	0.05	5	5	5	5	5	5	0.05	0.5	5	5	5	5	25	25	50	50	50	50	50	18.45
Standard Deviation	0.041	0.056	0.22	0.11	0.3	0.37		1.2	16	486	1639	397	2491	34	34	930	929	1443	2503	163	0	2.5	35	55	345	320	499	0.029	0.88	34	483	524	237	453	865	2177	1414	1298	339	146	4.1
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	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	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

					BTEX							Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)						
					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
					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
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			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																								
1-1.99m					3.2							NL							770		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																								
2-3.99m					3.2							NL							NL		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																								
0-0.99m					3.2							NL							600		NL			
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)					NL							NL							NL		NL			
Clyde WARP SSTL (Vapour Intrusion - IMW)					NL							NL							NL		NL			
NEPM (1999) HIL D - Commercial/Industrial																								
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																		700		1000		3500		10000
Lab_Report	Field_ID	Location_Code	Sample_Type	Sampled_Date																				
756435	SP44_01	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	25	260	230	515	<20	<20	<50	<50	430	600	170
756435	SP44_02	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	180	160	340	<20	<20	<50	<50	300	410	110
756435	SP44_03	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	28	310	280	618	<20	<20	<50	<50	530	730	200
756435	SP44_04	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	100	110	210	<20	<20	<50	<50	180	290	110
756435	SP44_05	SP44	Normal	12/11/2020	<0.1	<0.1	0.5	1	1	2	-	<0.5	<20	<20	200	190	390	<20	<20	<50	<50	350	480	130
756435	SP44_06	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	160	160	320	<20	<20	<50	<50	250	250	<100
756435	SP44_07	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	170	180	350	<20	<20	<50	<50	310	420	110
756435	SP44_08	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	280	260	540	<20	<20	<50	<50	470	640	170
ES2040246	T01_20201112	SP44_08	Interlab_D	12/11/2020	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	<50	180	200	380	<10	<10	<50	<50	330	450	120
756435	SP44_09	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	88	63	151	<20	<20	<50	<50	130	130	<100
756435	SP44_10	SP44	Normal	12/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	100	80	180	<20	<20	<50	<50	150	150	<100
755840	SP65_01	SP65	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	22	100	<50	122	<20	<20	<50	<50	130	130	<100
755840	SP65_02	SP65	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	56	<50	56	<20	<20	<50	<50	<100	<100	<100
755840	SP65_03	SP65	Normal	10/11/2020	<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
755840	D01_20201110	SP66_03	Field_D	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	44	180	<50	224	<20	<20	55	55	240	295	<100
ES2039828	T02_20201110	SP66_03	Interlab_D	10/11/2020	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	<50	160	120	280	<10	<10	<50	<50	240	240	<100
755840	SP66_01	SP66	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	290	80	370	<20	<20	<50	<50	420	530	110
755840	SP66_02	SP66	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	<20	270	70	340	<20	<20	<50	<50	400	520	120
755840	SP66_03	SP66	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	100	310	58	468	<20	<20	140	140	390	650	120
755840	SP67_01	SP67	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	170	180	<50	350	<20	<20	190	190	170	360	<100
755840	SP67_02	SP67	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	61	110	<50	171	<20	<20	77	77	120	197	<100
755840	SP67_03	SP67	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	160	220	<50	380	<20	<20	200	200	190	390	<100
755840	SP67_04	SP67	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	130	200	<50	330	<20	<20	160	160	180	340	<100
755840	SP67_05	SP67	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	0.5	<20	400	200	<50	600	<20	<20	420	419.5	150	570	<100
755840	SP68_01	SP68	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	150	230	<50	380	<20	<20	200	200	190	390	<100
755840	SP68_02	SP68	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	140	200	<50	340	<20	<20	170	170	180	350	<100
755840	SP68_03	SP68	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	47	110	<50	157	<20	<20	62	62	120	182	<100
755840	SP68_04	SP68	Normal	10/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	520	450	<50	970	75	75	620	620	330	950	<100
752475	SP73_02	SP73	Normal	23/10/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	600	260	140	1000	56	56	640	640	250	890	<100
752476	SP73_01	SP73	Normal	23/10/2020	<0.1	<0.1	0.8	<0.1	0.7	0.7	-	<0.5	32	280	110	<50	390	61	60	270	270	<100	270	<100
752476	SP73_03	SP73	Normal	23/10/2020	<0.1	<0.1	<0.1	<0.1	0.2	<0.3	-	1.9	<20	150	88	<50	238	44	44	150	148.1	<100	150	<100
757397	SP73_05	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	300	270	60	630	<20	<20	370	370	240	610	<100
757397	SP73_05D	SP73	Field_D	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	76	240	83	399	<20	<20	120	120	270	390	<100
757397	SP73_06	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	24	870	650	140	1660	120	120	960	960	570	1530	<100
757397	SP73_07	SP73	Normal	17/11/2020	<0.1	<0.1	0.2	<0.1	0.4	0.4	-	1.7	20	240	130	<50	370	67	66	270	268.3	110	380	<100
757397	SP73_08	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	0.4	0.4	-	1.1	27	350	180	60	590	90	90	380	378.9	170	550	<100
757397	SP73_09	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	45	310	200	63	573	110	110	350	350	180	530	<100
757397	SP73_10	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	23	200	150	71	421	90	90	220	220	170	390	<100
757397	SP73_11	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	31	170	100	<50	270	99	99	190	190	100	290	<100
757397	SP73_12	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	42	490	250	120	860	150	150	500	500	270	770	<100
757397	SP73_13	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	0.6	26	310	170	63	543	92	92	340	339.4	170	510	<100
757397	SP73_14	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	220	140	80	440	69	69	250	250	170	420	<100
757397	SP73_15	SP73	Normal	17/11/2020	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	<20	270	200	73	543	67	67	310	310	200	510	<100
Statistical Summary																								
Number of Results					43	43	43	43	43	43	2	43	43	43	43	43	43	43	43	43	43	43	43	43
Number of Detects					0	0	3	1	5	4	0	5	9	29	42	26	42	14	14	26	26	39	41	11
Minimum Concentration					<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	<100	<100
Minimum Detect					ND	ND	0.2	1	0.2	0.4	ND	0.5	20	22	56	58	56	44	44	55	55	100	130	110
Maximum Concentration					<0.2	<0.5	0.8	1	1	2	<0.2	1.9	45	870	650	280	1660	150	150	960	960	570	1530	200
Maximum Detect					ND	ND	0.8	1	1	2	ND	1.9	45	870	650	280	1660	150	150	960	960	570	1530	200
Average Concentration					0.052	0.059	0.091	0.081	0.16	0.22		0.37	14	163	197	84	430	34	34	187	187	231	440	71
Median Concentration					0.05	0.05	0.05	0.05	0.1	0.15	0.1	0.25	10	100	180	63	380	10	10	140	140	190	390	50
Standard Deviation					0.011	0.043	0.14	0.15	0.17	0.29		0.35	9.2	192	107	70	286	39	39	207	207	129	269	40
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

	TRH Aliphatic/Aromatic Split												
	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
	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
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	4400000	4400000		300000	300000	300000	220000	220000
Clyde WARP SSTL (Vapour Intrusion - Commercial) > 4m													
4-6m		1400	2200	1800	33000				420	1400	9800		
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m													
1-1.99m		610	980	600	8300				150	430	2800		
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m													
2-3.99m		880	1400	980	17000				230	750	5100		
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m													
0-0.99m		480	760	430	4300				110	280	430		
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) HIL D - Commercial/Industrial													
NEPM (1999) Management Limits - Commercial/Industrial (coarse)													
Field_ID													
SP44_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_02	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_03	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_04	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_05	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_06	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_07	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_08	-	-	-	-	-	-	-	-	-	-	-	-	-
T01_20201112	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_09	-	-	-	-	-	-	-	-	-	-	-	-	-
SP44_10	-	-	-	-	-	-	-	-	-	-	-	-	-
SP65_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP65_02	-	-	-	-	-	-	-	-	-	-	-	-	-
SP65_03	-	-	-	-	-	-	-	-	-	-	-	-	-
D01_20201110	-	-	-	-	-	-	-	-	-	-	-	-	-
T02_20201110	-	-	-	-	-	-	-	-	-	-	-	-	-
SP66_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP66_02	-	-	-	-	-	-	-	-	-	-	-	-	-
SP66_03	-	-	-	-	-	-	-	-	-	-	-	-	-
SP67_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP67_02	-	-	-	-	-	-	-	-	-	-	-	-	-
SP67_03	-	-	-	-	-	-	-	-	-	-	-	-	-
SP67_04	-	-	-	-	-	-	-	-	-	-	-	-	-
SP67_05	-	-	-	-	-	-	-	-	-	-	-	-	-
SP68_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP68_02	-	-	-	-	-	-	-	-	-	-	-	-	-
SP68_03	-	-	-	-	-	-	-	-	-	-	-	-	-
SP68_04	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_02	<0.1	<10	120	38	99	340	330	<0.1	<1	20	49	69	95
SP73_01	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_03	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_05	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_05D	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_06	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_07	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_08	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_09	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_10	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_11	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_12	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_13	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_14	-	-	-	-	-	-	-	-	-	-	-	-	-
SP73_15	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical Summary													
Number of Results	1	1	1	1	1	1	1	1	1	1	1	1	1
Number of Detects	0	0	1	1	1	1	1	0	0	1	1	1	1
Minimum Concentration	<0.1	<10	120	38	99	340	330	<0.1	<1	20	49	69	95
Minimum Detect	ND	ND	120	38	99	340	330	ND	ND	20	49	69	95
Maximum Concentration	<0.1	<10	120	38	99	340	330	<0.1	<1	20	49	69	95
Maximum Detect	ND	ND	120	38	99	340	330	ND	ND	20	49	69	95
Average Concentration													
Median Concentration	0.05	5	120	38	99	340	330	0.05	0.5	20	49	69	95
Standard Deviation													
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

	TRH Silica Gel Cleanup							Moisture	Metals							
	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	TRH >C34-C40 Silica Gel Cleanup	Moisture	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	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	20	50	50	50	100	50	100	1	2	0.4	5	5	5	0.1	5	5
Clyde WARP SSTL (Direct Contact - Commercial)											21000					
Clyde WARP SSTL (Direct Contact - Construction Worker)											8200					
Clyde WARP SSTL (Direct Contact - IMW)											100000					
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)																
Clyde WARP SSTL (Vapour Intrusion - IMW)																
NEPM (1999) HIL D - Commercial/Industrial									3000	900		240000	1500	730	6000	400000
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																
Field_ID																
SP44_01		-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
SP44_02	-	-	-	-	-	-	-	12	20	<0.4	260	45	66	5.5	66	860
SP44_03	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP44_04	-	-	-	-	-	-	-	13	18	<0.4	120	44	46	2.1	60	350
SP44_05	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
SP44_06	-	-	-	-	-	-	-	8.6	20	0.7	140	36	100	27	110	720
SP44_07	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-
SP44_08	-	-	-	-	-	-	-	15	44	0.8	690	53	170	6.2	1400	2000
T01_20201112	-	-	-	-	-	-	-	14.6	-	-	-	-	-	-	-	-
SP44_09	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP44_10	-	-	-	-	-	-	-	12	18	0.6	110	52	82	1.1	89	640
SP65_01	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP65_02	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
SP65_03	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-
D01_20201110	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
T02_20201110	-	-	-	-	-	-	-	8.9	-	-	-	-	-	-	-	-
SP66_01	-	-	-	-	-	-	-	9.7	-	-	-	-	-	-	-	-
SP66_02	-	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-
SP66_03	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-
SP67_01	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
SP67_02	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
SP67_03	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-
SP67_04	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP67_05	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
SP68_01	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
SP68_02	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
SP68_03	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
SP68_04	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-	-
SP73_02	720	780	1200	300	300	180	<100	18	-	-	-	-	-	-	-	-
SP73_01	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-
SP73_03	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
SP73_05	-	-	-	-	-	-	-	8.1	-	-	-	-	-	-	-	-
SP73_05D	-	-	-	-	-	-	-	8.5	-	-	-	-	-	-	-	-
SP73_06	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-
SP73_07	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
SP73_08	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP73_09	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
SP73_10	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
SP73_11	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
SP73_12	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
SP73_13	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
SP73_14	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-
SP73_15	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-
Statistical Summary																
Number of Results	1	1	1	1	1	1	1	43	5	5	5	5	5	5	5	5
Number of Detects	1	1	1	1	1	1	0	43	5	3	5	5	5	5	5	5
Minimum Concentration	720	780	1200	300	300	180	<100	6.6	18	<0.4	110	36	46	1.1	60	350
Minimum Detect	720	780	1200	300	300	180	ND	6.6	18	0.6	110	36	46	1.1	60	350
Maximum Concentration	720	780	1200	300	300	180	<100	19	44	0.8	690	53	170	27	1400	2000
Maximum Detect	720	780	1200	300	300	180	ND	19	44	0.8	690	53	170	27	1400	2000
Average Concentration								14	24	0.5	264	46	93	8.4	345	914
Median Concentration	720	780	1200	300	300	180	50	14	20	0.6	140	45	82	5.5	89	720
Standard Deviation								3.2	11	0.28	246	6.9	48	11	590	635
Number of Guideline Exceedances	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

PAH/Phenols

					2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,4-dimethylphenol	2,4-dinitrophenol	2,6-dichlorophenol	2-chlorophenol	2-methylphenol	2-nitrophenol	4-chloro-3-methylphenol	4-nitrophenol	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	Dinoseb	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Pentachlorophenol	Phenanthrene	Phenol	Pyrene	tetrachlorophenols	Total halogenated phenol	Total Non-Halogenated Phenol	PAHs (Sum of total)	4,6-Dinitro-o-cyclohexyl phenol	2-methyl-4,6-dinitrophenol	3&4-Methylphenol (m&p-Cresol)
					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	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					1	1	0.5	0.5	5	0.5	0.5	0.2	1	1	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	20	0.5	0.5	0.5	1	0.5	0.5	0.5	10	1	20	0.5	20	5	0.4
Clyde WARP SSTL (Direct Contact - Commercial)																							40																				
Clyde WARP SSTL (Direct Contact - Construction Worker)																							200																				
Clyde WARP SSTL (Direct Contact - IMW)																							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)																																											
Clyde WARP SSTL (Vapour Intrusion - IMW)																																											
NEPM (1999) HIL D - Commercial/Industrial																																		660		240000					4000			
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																																											
Lab_Report	**Field_ID**	**Location_Code**	**Sample_Type**	**Sampled_Date**																																							
756435	SP44_01	SP44	Normal	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_02	SP44	Normal	12/11/2020	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	0.7	<0.5	<0.5	<1	0.6	<0.5	0.8	<10	<1	<20	2.1	<20	<5	<0.4
756435	SP44_03	SP44	Normal	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_04	SP44	Normal	12/11/2020	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	1.3	<0.5	<0.5	<1	1.4	<0.5	1.1	<10	<1	<20	3.8	<20	<5	<0.4
756435	SP44_05	SP44	Normal	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_06	SP44	Normal	12/11/2020	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<10	<1	<20	<0.5	<20	<5	<0.4
756435	SP44_07	SP44	Normal	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_08	SP44	Normal	12/11/2020	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<10	<1	<20	<0.5	<20	<5	<0.4
ES2040246	T01_20201112	SP44_08	Interlab_D	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_09	SP44	Normal	12/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
756435	SP44_10	SP44	Normal	12/11/2020	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<10	<1	<20	<0.5	<20	<5	<0.4
755840	SP65_01	SP65	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP65_02	SP65	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP65_03	SP65	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	D01_20201110	SP66_03	Field_D	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2039828	T02_20201110	SP66_03	Interlab_D	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP66_01	SP66	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP66_02	SP66	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP66_03	SP66	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP67_01	SP67	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP67_02	SP67	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP67_03	SP67	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP67_04	SP67	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP67_05	SP67	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP68_01	SP68	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP68_02	SP68	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP68_03	SP68	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
755840	SP68_04	SP68	Normal	10/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
752475	SP73_02	SP73	Normal	23/10/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
752476	SP73_01	SP73	Normal	23/10/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
752476	SP73_03	SP73	Normal	23/10/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_05	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_05D	SP73	Field_D	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_06	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_07	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_08	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_09	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_10	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_11	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_12	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_13	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_14	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
757397	SP73_15	SP73	Normal	17/11/2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Statistical Summary

Number of Results	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	2	0	0	0	2	0	2	0	0	0	2	0	0	0
Minimum Concentration	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<10	<1	<20	<0.5	<20	<5	<0.4
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	0.6	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	0.6	ND	0.8	ND	ND	ND	2.1	ND	ND	ND
Maximum Concentration	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<1	<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	<20	1.3	<0.5	<0.5	<1	1.4	<0.5	1.1	<10	<1	<20	3.8	<20	<5	<0.4
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	0.6	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	1.4	ND	1.1	ND	ND	ND	3.8	ND	ND	ND
Average Concentration	0.5	0.5	0.25	0.25	2.5	0.25	0.25	0.1	0.5	0.5	2.5	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	10	0.55	0.25	0.25	0.5	0.55	0.25	0.53	5	0.5	10	1.3	10	2.5	0.2
Median Concentration	0.5	0.5	0.25	0.25	2.5	0.25	0.25	0.1	0.5	0.5	2.5	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	10	0.25	0.25	0.25	0.5	0.25	0.25	0.25	5	0.5	10	0.25	10	2.5	0.2
Standard Deviation	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	0.46	0	0	0	0.5	0	0.4	0	0	0	1.6	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	BTEX							Naphthalene	TRH NEPM (1999)							TRH NEPM (2013)							
	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX	Naphthalene	TRH C6-C9 Fraction	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
	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	20	50		50	50	10	10	50	50	100	50	100
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			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																						
1-1.99m	3.2							NL									770		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																						
2-3.99m	3.2							NL									NL		NL			
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																						
0-0.99m	3.2							NL									600		NL			
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)	NL							NL									NL		NL			
Clyde WARP SSTL (Vapour Intrusion - IMW)	NL							NL									NL		NL			
CCME (2008) - Acute Hazards																1400		5200				
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																700		1000		3500		10000

Field_ID	Location_Code	Sampled_Date_Time	Sample_Type	Sample_Depth_Range																				
BH12/25_0.2	BH12/25	16/03/2012	Normal	0.2-0.2	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
BH12/25_1.3	BH12/25	16/03/2012	Normal	1.3-1.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
BH12/26_0.05	BH12/26	16/03/2012	Normal	0.05-0.05	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
BH12/26_1.3	BH12/26	16/03/2012	Normal	1.3-1.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
BH12/27_0.05	BH12/27	16/03/2012	Normal	0.05-0.05	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
BH12/27_1.0	BH12/27	16/03/2012	Normal	1-1	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
HA19/01_0.1	HA19/01	2/08/2019	Normal	0-0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	<20	110	-	240	350	<20	<20	<50	<50	260	400	140
HA19/01_0.5	HA19/01	2/08/2019	Normal	0.4-0.6	<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
MW11/12_0.3	MW11/12	22/09/2011	Normal	0.3-0.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	320	-	-	-	-	-	-	-
MW11/12_3.0	MW11/12	22/09/2011	Normal	3-3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	270	-	-	-	-	-	-	-
MW11/16_0.45	MW11/16	22/09/2011	Normal	0.45-0.45	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/16_3.3	MW11/16	22/09/2011	Normal	3.3-3.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
D_051011_01	MW11/21	5/10/2011	Field_D	0.5-0.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	150	-	-	-	570	-	-	-	-	-	-	-
MW11/21_0.5	MW11/21	5/10/2011	Normal	0.5-0.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	150	-	-	-	800	-	-	-	-	-	-	-
MW11/21_3.2	MW11/21	5/10/2011	Normal	3.2-3.2	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	1.2	200	-	460	-	-	-	460	-	-	-	-	-	-	-
MW11/21_5.0	MW11/21	5/10/2011	Normal	5-5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/22_0.5	MW11/22	28/09/2011	Normal	0.5-0.5	<0.5	<0.5	-	<0.5	<1	<1.5	<1.5	<5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/22_3.3	MW11/22	29/09/2011	Normal	3.3-3.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/23_0.3	MW11/23	30/09/2011	Normal	0.3-0.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	-	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/23_3.5	MW11/23	30/09/2011	Normal	3.5-3.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	-	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/27_0.6	MW11/27	30/09/2011	Normal	0.6-0.6	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/27_1.9	MW11/27	30/09/2011	Normal	1.9-1.9	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/31_0.5	MW11/31	26/09/2011	Normal	0.5-0.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/31_2.2	MW11/31	26/09/2011	Normal	2.2-2.2	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/33_0.5	MW11/33	28/09/2011	Normal	0.5-0.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	110	-	-	-	-	-	-	-
MW11/33_0.8	MW11/33	29/09/2011	Normal	0.8-0.8	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	140	-	-	-	1600	-	-	-	-	-	-	-
MW11/33_2.0	MW11/33	29/09/2011	Normal	2-2	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
D_260911_01	MW11/38	26/09/2011	Field_D	0.45-0.45	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/38_0.45	MW11/38	26/09/2011	Normal	0.45-0.45	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/38_2.5	MW11/38	26/09/2011	Normal	2.5-2.5	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
T_260911_01	MW11/38	26/09/2011	Field_D	0.45-0.45	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
MW11/41_0.35	MW11/41	28/09/2011	Normal	0.35-0.35	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<5	<10	-	<50	-	-	-	990	-	-	-	-	-	-	-
MW11/41_2.3	MW11/41	29/09/2011	Normal	2.3-2.3	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<5	<10	-	<50	-	-	-	<50	-	-	-	-	-	-	-
D_050312_01	MW12/16	5/03/2012	Field_D	-0.5	<0.5	<0.5	3.2	<0.5	<1	<1.5	4.45	9.3	58	-	560	210	260	<100	820	79	76	690	680	<100	-	<100
MW12/16_0.5	MW12/16	5/03/2012	Normal	0.5-0.5	<0.5	<0.5	1.5	<0.5	<1	<1.5	2.75	11	15	-	530	180	230	<100	760	25	24	630	620	<100	-	<100
MW12/16_2.0	MW12/16	5/03/2012	Normal	2-2	1.2	12	5.2	9.1	25	34.1	53	6.5	120	-	400	<100	<200	<100	500	160	110	400	390	<100	-	<100
MW12/16_6.0	MW12/16	5/03/2012	Normal	6-6	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
T_050312_01	MW12/16	5/03/2012	Interlab_D	-0.5	<0.2	<0.5	4	<0.5	<0.5	<0.5	4.6	8	89	-	380	160	210	<100	590	122	118	480	-	<100	480	<100
MW12/17_0.4	MW12/17	5/03/2012	Normal	0.4-0.4	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
MW12/17_2.0	MW12/17	5/03/2012	Normal	2-2	<0.5	<0.5	<0.5	<0.5	<1	<1.5	<1.5	<0.5	<10	-	<50	<100	<200	<100	<100	<20	<20	<50	<50	<100	-	<100
MW(SB)18/06_0.3	SB18/06	7/02/2018	Normal	0.3-0.3	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
MW(SB)18/06_1.2	SB18/06	7/02/2018	Normal	1.2-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
MW(SB)18/06_3.0	SB18/06	7/02/2018	Normal	3-3	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
MW(SB)18/06_5.0	SB18/06	7/02/2018	Normal	5-5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/05_0.5	TP18/05	7/02/2018	Normal	0.5-0.5	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/05_0.5	TP18/05	7/02/2018	Normal	-0.5	-	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_1.2	TP18/05	7/02/2018	Normal	1.2-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/05_1.2	TP18/05	7/02/2018	Normal	-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_2.7	TP18/05	7/02/2018	Normal	2.7-2.7	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP06_0.3	TP18/06	6/02/2018	Normal	-0.3	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06_1.2	TP18/06	6/02/2018	Normal	-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.4_20180207	TP18/09	8/02/2018	Normal	0.4-0.4	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/09_0.6_20180207	TP18/09	7/02/2018	Normal	-0.6	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.6_20180207	TP18/09	8/02/2018	Normal	0.6-0.6	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	130	130	<100
TP18/09_0.7_20180207	TP18/09	8/02/2018	Normal	0.7-0.7	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/09_0.85_20180207	TP18/09	8/02/2018	Normal	0.85-0.85	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	100	-	<100	100	<10	<10	50	50	<100	50	<100
TP18/09_1.0_20180207	TP18/09	7/02/2018	Normal	-1	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_1.0_20180207	TP18/09	8/02/2018	Normal	1-1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	90	180	-	<100	270	13	13	140	140	150	290	<100
QC18_201	TP18/25	6/02/2018	Field_D		<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/25_0.3	TP18/25	6/02/2018	Normal	0.3-0.3	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	460	2540	-	1400	4400	<10	<10	650	650	3380	4860	830
TP18/25_1.2	TP18/25	6/02/2018	Normal	1.2-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	22	-	150	6160	-	3470	9780	19	19	270	270	8330	11,000	2380
TP18/25_1.6	TP18/25	6/02/2018	Normal	1.6-1.6	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/25_2.2	TP18/25	6/02/2018	Normal	2.2-2.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/25_3.1	TP18/25	6/02/2018	Normal	3.1-3.1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/34_0.3_20180208	TP18/34	8/02/2018	Normal	0.3-0.3	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/34_0.3_20180208	TP18/34	8/02/2018	Normal	-0.3	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_1.2_20180208	TP18/34	8/02/2018	Normal	1.2-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP18/34_1.2_20180208	TP18/34	8/02/2018	Normal	-1.2	<0.2	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_2.2_20180208	TP18/34	8/02/2018	Normal	2.2-2.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	<1	<10	-	<50	<100	-	<100	<50	<10	<10	<50	<50	<100	<50	<100
TP19/31_1.2	TP19/31	22/07/2019	Normal	1.1-1.3	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	89	440	-	120	649	21	21	180	180	410	590	<100
TP19/31_2.5	TP19/31	22/07/2019	Normal	2.4-2.6	<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
TP19/42_0.4	TP19/42	24/07/2019	Normal	0.3-0.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	2.4	-	77	2400	2300	-	220	4920	180	180	2600	2597.7	1800	4400	<100
TP19/42_2.2	TP19/42	24/07/2019	Normal	2.1-2.3	<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
TP19/47_0.2	TP19/47	29/07/2019	Normal	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/47_0.3	TP19/47	29/07/2019	Normal	0.2-0.4	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	21	-	120	4100	490	-	110	4700	300	300	4200	4182	220	4420	<100
TP19/47_2.0	TP19/47	29/07/2019	Normal	1.9-2.1	<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
TP19/53_0.3	TP19/53	29/07/2019	Normal	0.2-0.4	<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
TP19/53_1.0	TP19/53	29/07/2019	Normal	0.9-1.1	<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
TP19/58_0.2	TP19/58	1/08/2019	Normal	0.1-0.3	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	-	-	-	-	-	-	-	-	-	-	-	-
TP19/59_0.1	TP19/59	1/08/2019	Normal	0-0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	-	-	-	-	-	-	-	-	-	-	-	-
TP19/61_0.4	TP19/61	29/07/2019	Normal	0.3-0.5	<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
TP19/61_0.8	TP19/61	29/07/2019	Normal	0.7-0.9	<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
TP19/62_0.1	TP19/62	24/07/2019	Normal	0-0.2	<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
TP19/63_0.1	TP19/63	24/07/2019	Normal	0-0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	<20	1200	-	640	1840	<20	<20	<50	<50	1600	1820	220
TP19/63_0.6	TP19/63	24/07/2019	Normal	0.5-0.7	<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
TP19/72_0.2	TP19/72	29/07/2019	Normal	0.1-0.3	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	-	<0.5	-	<20	<20	62	-	120	182	<20	<20	<50	<50	150	150	<100
TP19/72_0.5	TP19/72	29/07/2019	Normal	0.4-0.6	<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
TP19/73_0.4	TP19/73	29/07/2019	Normal	0.3-0.5	<0.2	<0.2	<0.2	<0.2	<0.4	<0.6	-	1.5	-	140	380	120	-	<50	500	230	230	390	388.5	<100	390	<100
TP19/73_0.9	TP19/73	29/07/2019	Normal	0.8-1	<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

Statistical Summary

Number of Results	87	87	86	87	87	80	59	86	59	21	78	53	13	53	78	53	53	53	52	53	41	53
Number of Detects	1	1	4	1	1	1	4	8	6	3	15	14	3	8	23	10	10	12	11	10	13	4
Minimum Concentration	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.2	<0.5	<10	<20	<20	<50	<200	<50	<50	<10	<10	<50	<50	<100	<50	<100
Minimum Detect	1.2	12	1.5	9.1	25	34.1	2.75	1.2	15	77	89	62	210	110	100	13	13	50	50	130	50	140
Maximum Concentration	1.2	12	5.2	9.1	25	34.1	53	21	200	140	4100	6160	260	3470	9780	300	300	4200	4182	8330	11000	2380
Maximum Detect	1.2	12	5.2	9.1	25	34.1	53	21	200	140	4100	6160	260	3470	9780	300	300	4200	4182	8330	11000	2380
Average Concentration	0.16	0.34	0.35	0.3	0.6	0.87	1.6	1.1	13	25	151	300	131	156	475	28	27	221	215	351	731	114
Median Concentration	0.1	0.25	0.25	0.25	0.25	0.25	0.75	0.25	5	10	25	50	100	50	25	10	10	25	25	50	50	50
Standard Deviation	0.14	1.3	0.76	0.96	2.7	3.8	6.9	2.9	32	38	539	951	59	507	1418	60	58	677	680	1245	2037	336
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	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	2	0	1	0	0

										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-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
EQL										0.1	10	10	10	10	10	10	0.1	1	10	10	10	10	20	50	50	50	50	100	50	100	50
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) > 4m 4-6m											1400	2200	1800	33000				420	1400	9800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m 1-1.99m											610	980	600	8300				150	430	2800										
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m 2-3.99m											880	1400	980	17000				230	750	5100										
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m 0-0.99m											480	760	430	4300				110	280	430										
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								
CCME (2008) - Acute Hazards																								5200						
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																								1000				3500		10000	

Field_ID	Location_Code	Sampled_Date_Time	Sample_Type	Sample_Depth_Range																						
BH12/25_0.2	BH12/25	16/03/2012	Normal	0.2-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12/25_1.3	BH12/25	16/03/2012	Normal	1.3-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12/26_0.05	BH12/26	16/03/2012	Normal	0.05-0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12/26_1.3	BH12/26	16/03/2012	Normal	1.3-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12/27_0.05	BH12/27	16/03/2012	Normal	0.05-0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH12/27_1.0	BH12/27	16/03/2012	Normal	1-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA19/01_0.1	HA19/01	2/08/2019	Normal	0-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	145	-	52	120	93	<100	-
HA19/01_0.5	HA19/01	2/08/2019	Normal	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW11/12_0.3	MW11/12	22/09/2011	Normal	0.3-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	320	-	-
MW11/12_3.0	MW11/12	22/09/2011	Normal	3-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	270	-	-
MW11/16_0.45	MW11/16	22/09/2011	Normal	0.45-0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/16_3.3	MW11/16	22/09/2011	Normal	3.3-3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
D_051011_01	MW11/21	5/10/2011	Field_D	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	420	-	<100	-	-
MW11/21_0.5	MW11/21	5/10/2011	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	530	-	120	-	-
MW11/21_3.2	MW11/21	5/10/2011	Normal	3.2-3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/21_5.0	MW11/21	5/10/2011	Normal	5-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/22_0.5	MW11/22	28/09/2011	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/22_3.3	MW11/22	29/09/2011	Normal	3.3-3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/23_0.3	MW11/23	30/09/2011	Normal	0.3-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/23_3.5	MW11/23	30/09/2011	Normal	3.5-3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/27_0.6	MW11/27	30/09/2011	Normal	0.6-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/27_1.9	MW11/27	30/09/2011	Normal	1.9-1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/31_0.5	MW11/31	26/09/2011	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/31_2.2	MW11/31	26/09/2011	Normal	2.2-2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/33_0.5	MW11/33	28/09/2011	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	110	-	-
MW11/33_0.8	MW11/33	29/09/2011	Normal	0.8-0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1200	-	210	-	-
MW11/33_2.0	MW11/33	29/09/2011	Normal	2-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
D_260911_01	MW11/38	26/09/2011	Field_D	0.45-0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/38_0.45	MW11/38	26/09/2011	Normal	0.45-0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/38_2.5	MW11/38	26/09/2011	Normal	2.5-2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
T_260911_01	MW11/38	26/09/2011	Field_D	0.45-0.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
MW11/41_0.35	MW11/41	28/09/2011	Normal	0.35-0.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	310	-	680	-	-
MW11/41_2.3	MW11/41	29/09/2011	Normal	2.3-2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100	-	<100	-	-
D_050312_01	MW12/16	5/03/2012	Field_D	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/16_0.5	MW12/16	5/03/2012	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/16_2.0	MW12/16	5/03/2012	Normal	2-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/16_6.0	MW12/16	5/03/2012	Normal	6-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T_050312_01	MW12/16	5/03/2012	Interlab_D	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/17_0.4	MW12/17	5/03/2012	Normal	0.4-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12/17_2.0	MW12/17	5/03/2012	Normal	2-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW(SB)18/06_0.3	SB18/06	7/02/2018	Normal	0.3-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW(SB)18/06_1.2	SB18/06	7/02/2018	Normal	1.2-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW(SB)18/06_3.0	SB18/06	7/02/2018	Normal	3-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW(SB)18/06_5.0	SB18/06	7/02/2018	Normal	5-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_0.5	TP18/05	7/02/2018	Normal	0.5-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_0.5	TP18/05	7/02/2018	Normal	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_1.2	TP18/05	7/02/2018	Normal	1.2-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_1.2	TP18/05	7/02/2018	Normal	-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/05_2.7	TP18/05	7/02/2018	Normal	2.7-2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06_0.3	TP18/06	6/02/2018	Normal	-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP06_1.2	TP18/06	6/02/2018	Normal	-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.4_20180207	TP18/09	8/02/2018	Normal	0.4-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.6_20180207	TP18/09	7/02/2018	Normal	-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.6_20180207	TP18/09	8/02/2018	Normal	0.6-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<100	<100	<100	<100	<50
TP18/09_0.7_20180207	TP18/09	8/02/2018	Normal	0.7-0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_0.85_20180207	TP18/09	8/02/2018	Normal	0.85-0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<100	<100	<100	<100	<50
TP18/09_1.0_20180207	TP18/09	7/02/2018	Normal	-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/09_1.0_20180207	TP18/09	8/02/2018	Normal	1-1	-	-	-	-	-	-	-	-	-	-	-	-	-	<50	<50	<50	<50	<100	<100	<100	<100	<50
QC18_201	TP18/25	6/02/2018	Field_D		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/25_0.3	TP18/25	6/02/2018	Normal	0.3-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	90	200	1480	1660	880	1130	510	330	200
TP18/25_1.2	TP18/25	6/02/2018	Normal	1.2-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	60	200	2670	3010	1740	2220	870	590	200
TP18/25_1.6	TP18/25	6/02/2018	Normal	1.6-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/25_2.2	TP18/25	6/02/2018	Normal	2.2-2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/25_3.1	TP18/25	6/02/2018	Normal	3.1-3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_0.3_20180208	TP18/34	8/02/2018	Normal	0.3-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_0.3_20180208	TP18/34	8/02/2018	Normal	-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_1.2_20180208	TP18/34	8/02/2018	Normal	1.2-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_1.2_20180208	TP18/34	8/02/2018	Normal	-1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP18/34_2.2_20180208	TP18/34	8/02/2018	Normal	2.2-2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/31_1.2	TP19/31	22/07/2019	Normal	1.1-1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	37	91	237	-	200	160	<50	<100	-
TP19/31_2.5	TP19/31	22/07/2019	Normal	2.4-2.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/42_0.4	TP19/42	24/07/2019	Normal	0.3-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/42_2.2	TP19/42	24/07/2019	Normal	2.1-2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/47_0.2	TP19/47	29/07/2019	Normal	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/47_0.3	TP19/47	29/07/2019	Normal	0.2-0.4	<0.1	<10	700	2300	1300	23	230	<0.1	2.3	1900	1700	200	1100	9200	8200	9960	-	610	250	150	<100	-
TP19/47_2.0	TP19/47	29/07/2019	Normal	1.9-2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/53_0.3	TP19/53	29/07/2019	Normal	0.2-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/53_1.0	TP19/53	29/07/2019	Normal	0.9-1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/58_0.2	TP19/58	1/08/2019	Normal	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/59_0.1	TP19/59	1/08/2019	Normal	0-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/61_0.4	TP19/61	29/07/2019	Normal	0.3-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/61_0.8	TP19/61	29/07/2019	Normal	0.7-0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/62_0.1	TP19/62	24/07/2019	Normal	0-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/63_0.1	TP19/63	24/07/2019	Normal	0-0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/63_0.6	TP19/63	24/07/2019	Normal	0.5-0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/72_0.2	TP19/72	29/07/2019	Normal	0.1-0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	<20	<50	238	-	98	190	140	<100	-
TP19/72_0.5	TP19/72	29/07/2019	Normal	0.4-0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP19/73_0.4	TP19/73	29/07/2019	Normal	0.3-0.5	<0.1	<10	780	200	170	20	<10	<0.1	23	33	42	13	<10	270	330	400	-	130	<100	<50	<100	-
TP19/73_0.9	TP19/73	29/07/2019	Normal	0.8-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Statistical Summary

Number of Results	2	2	2	2	2	2	2	2	2	2	2	2	2	2	10	10	10	5	35	10	35	10	5			
Number of Detects	0	0	2	2	2	2	1	0	2	2	2	2	1	5	5	7	2	11	6	11	2	2				
Minimum Concentration	<0.1	<10	700	200	170	20	<10	<0.1	2.3	33	42	13	<10	<20	<50	<50	<50	52	<100	<50	<100	<50				
Minimum Detect	ND	ND	700	200	170	20	230	ND	2.3	33	42	13	1100	37	91	145	1660	52	120	93	330	200				
Maximum Concentration	<0.1	<10	780	2300	1300	23	230	<0.1	23	1900	1700	200	1100	9200	8200	9960	3010	1740	2220	870	590	200				
Maximum Detect	ND	ND	780	2300	1300	23	230	ND	23	1900	1700	200	1100	9200	8200	9960	3010	1740	2220	870	590	200				
Average Concentration														975	915	1521	949	211	427	132	132	95				
Median Concentration	0.05	5	740	1250	735	21.5	117.5	0.05	12.65	966.5	871	106.5	552.5	31	58	237.5	25	50	140	50	50	25				
Standard Deviation														2891	2562	3086	1352	374	710	190	183	96				
Number of Guideline Exceedances	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0				
Number of Guideline Exceedances(Detects Only)	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0				

Stockpile ID	Location on Site (Remediation Stage)	Start Date	End Date	Stage 1 Area Source Location	Material Description	Est Volume (m3)	Soil Sampling Undertaken	Existing Sample Numbers	Asbestos Present?	WARP - Suitable for re-use?	Final Destination
SP44	Stage 1	12/10/2020	30/11/2020	Soil, Brick	Soil, Brick	1080	12/11/2020	10	N	Y	Stage 1 - South of AEC_9 Excavation
SP64	Stage 1	13/10/2020	Active	Concrete from AEC9 originating from hardstand and below ground infrastructure	Hammered concrete of varying size with large quantity of reo	1500	N/A	N/A	N	N/A	Stage 1 - South of AEC_9 Excavation
SP65	Stage 1	12/10/2020	16/11/2020	Light brown AEC9 Surface Scrape	sandy/gravelly soils. Metal present	40	9/11/2020	3	N	Y	SP72 & SP73 (Material fed through the screen)
SP66	Stage 1	12/10/2020	Active	Dark brown AEC9 Surface Scrape	sandy/gravelly soils. Metal present	35	9/11/2020	3	N	Y	Stage 1 - South of AEC_9 Excavation
SP67	Stage 1	14/10/2020	Active	Impacted soils - C9/C10/D9/D10 - 1.6m BGL	Unscreened, sandy clay soils - some staining observed	326	9/11/2020	5	N	Y	Stage 1 - South of AEC_9 Excavation
SP68	Stage 1	15/10/2020	Active	Impacted soils - C11/D11/E11/F11 - 1.7m BGL	Unscreened, sandy clay soils - some staining observed	353	9/11/2020	4	N	Y	Stage 1 - South of AEC_9 Excavation
SP69	Stage 1	16/10/2020	18/11/2020	Impacted soils - E9/E10/F9/F10 - 1.7m BGL	Unscreened, sandy clay soils - some staining observed	331	N/A	N/A	N	N/A	SP72 & SP73 (Material fed through the screen)
SP70	Stage 1	19/10/2020	13/11/2020	Small excavated clay pile - E9 - less impacted	Red clay	3	N/A	N/A	N	N/A	Consolidated with SP68 after SP68 was validated
SP71	Stage 1	19/10/2020	15/11/2020	2020 Impacted soils - E7/E8/F7/F8/E5/E6/F5/F6/E4/F4/C7/C8/D7/D8/C6/D6/C5/D5 - 1.5m BGL	Dark brown clay - high moisture content present.	302	N/A	N/A	N	N/A	SP72 & SP73 (Material fed through the screen)
SP72	N/A - combined	22/10/2020	3/12/2020	Screened undersize from AEC9 (50mm -)	Grey sandy soils - Homogenous	1622	N/A	N/A	N	N	Final SP72 stockpile to be moved to bio-pad for treatment following field screening PID >100ppm (no longer on Stage 1)
SP73	Stage 1	22/10/2020	17/11/2020	Screened oversize from AEC9 (50mm +)	Clay oversize (high moisture content)	1267	16/11/2020	14	N	Y	Stage 1 - South of AEC9 - J3/J4
SP73a	N/A	17/11/2020	28/11/2020	Screened oversize from AEC9 (50mm +)	Clay oversize (odour, staining and localised LNAPL)	355	N/A	N/A	N	N	Consolidated to biopiles, SP75, SP76
SP74	Stage 1	04/11/2020	Active	Impacted Soils - B2/B3/C2/B3/D2/D3 - 2.2m BGL	Heavy staining / black material observed.	427	N/A	N/A	N	N/A	SP72 & SP73 (Material fed through the screen)
SP75	Stage 2	26/11/2020	Active	SP72, SP73a	Consolidated materials - Tarped and connected to SVME	1003	N/A	N/A	N	N	Remaining On site - Biopad/ Tankfarn A1
SP76	Stage 2	27/11/2020	Active	SP72, SP73a	Consolidated materials - Tarped and connected to SVME	944	N/A	N/A	N	N	Remaining On site - Biopad/ Tankfarn A1
SP77	Stage 2	3/112/2020	Active	SP72	Consolidated materials - Tarped and connected to SVME	427	N/A	N/A	N	N/A	Remaining On site - Biopad/ Tankfarn A1

Note: All soil not considered suitable for re-use is to be moved off the Stage 1 Area prior to close out of Stage 1 activities.

LTEMP

Table 5 – Stage 1 Area Environmental Management Requirements

Item	Requirements
All Intrusive Excavation Works Undertaken within the Stage 1 Area	
Training and Competence	The Land Custodian is to ensure that all site 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 the relevant documentation, training on the location of known residual contamination and in the identification of visual and olfactory indications of additional unexpected finds of contamination.
Health and Safety Plan	The contactor is to prepare a task specific health and safety plan that includes suitable protection measures for working with residual hydrocarbon contamination including but not limited to: ■ training requirements; ■ air / dust / odour monitoring action levels and monitoring procedures; ■ required respiratory protection; ■ minimum Personnel Protective Equipment (PPE) requirements; ■ site signage requirements; ■ site security; ■ required exposure route pathway mitigation measures (dust suppression etc.); ■ vehicle/machinery/plant safety; and ■ general site safety.
Excavation works and temporary stockpiling	To reduce and/or prevent the exposure of human receptors at the site to potential contamination within onsite soils, the following will be undertaken during any intrusive excavation works: ■ To reduce the area of disturbed material, the number of areas subject to excavation works at any one time should be minimised. ■ During excavation works, measures to reduce dust emissions such as spraying with water, addition of soil binding agents etc. should be undertaken. ■ Where works are undertaken within the vicinity of known asbestos materials, dust monitoring (as detailed below) is also to be undertaken to assess the suitability of controls for mitigating potential for fugitive airborne asbestos. ■ 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 adjacent workers / receptors.

Item	Requirements
	■ Where material requires offsite disposal, excavated material should be placed directly into a tipper truck and where possible material should not be placed into temporary stockpiles awaiting offsite disposal. ■ Where material requires stockpiling prior to offsite disposal, appropriate dust and sediment controls must be in place. Smaller volumes should be contained within an enclosed or covered skip. ■ All materials movement within the site must be recorded within an appropriate Materials Tracking Register.
Materials handling and disposal	■ **Soil** - Excavated materials are to be either re-instated within the same location (in accordance with relevant planning / DA conditions) or disposed offsite to a suitably licenced landfill / receiving facility in accordance with relevant NSW EPA waste disposal guidance at the time of works. ■ **Concrete** – Excavated concrete footings containing asbestos formwork are to be disposed offsite to a suitably licensed facility in accordance with NSW EPA waste classification requirements at the time of works. ■ **Groundwater** - Any groundwater extracted from excavation works is to be managed as per the site specific EPL or disposed in accordance with relevant NSW EPA made or endorsed waste disposal guidance at the time of works. ■ **Residual Oily Water / Sludge** – Oily water / sludge associated with redundant drainage infrastructure if encountered during excavation works should be classified and disposed offsite to a suitably licenced facility in accordance with relevant NSW EPA waste disposal guidance at the time of works.
Sediment and Stormwater Runoff Controls	During works, sediment and surface water runoff controls will be implemented to minimise generation and transport of potentially contaminated sediments and surface water within and off the Site. While ERM notes that controls will be developed based on the specific location / nature of works to be undertaken, controls may include (but not be limited to): ■ Sediment control; ■ Clean water diversions; and ■ Stormwater drain protection. Sediment control is required. Sediment control measures (i.e. silt fencing and hay bales) will be strategically placed at the following locations: ■ Down-gradient of temporary stockpiles or highly disturbed areas; ■ Up-gradient of temporary stockpiles to redirect water; and ■ Down-gradient of any surrounding stormwater channels that flow within/through the Site, as contingency against overflow into adjacent site areas. Clean water diversions are required to minimise ingress to excavations and soil erosion. Where necessary, clean water diversions (hay bales and gravel bags) will be strategically placed in the following locations: ■ Up-gradient of temporary stockpile or excavation areas to redirect water; and ■ Down-gradient of any surrounding stormwater channels that flow within/through the Site as contingency against overflow into bunded stockpile locations. Stormwater drain protection is required to prevent ingress of sediments to the stormwater infrastructure and will comprise: ■ Installation of sediment socks in any identified stormwater drains located down-gradient of any temporary stockpile areas. All sediment and surface water controls will be inspected by the Land Custodian's nominated representative during works, to inspect the controls in operation. Should any control measures be damaged or defective, the issue will be reported to the contractors project manager / representative, to arrange for repair or modification of the control systems in place.
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 a VENM certificate, sampling will not be required. The ENM / VENM certificate should at a minimum:

Item	Requirements
	■ state that the material has been classified as 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 or fill material other than VENM (i.e. 'clean fill') is imported to the site, a site visit to the source site by an environmental consultant to enable collection and analysis of soil samples may be required. Samples are to be analysed for relevant contaminants of concern for the specific conditions of the source site. All VENM / imported material classification reports are to be provided to Land Custodian or their nominated representative and included within compliance reporting upon completion of works (Section 7.3).
Unexpected Finds Management	During excavation works there is the potential of encountering additional in-ground finds. Unexpected finds may include (but not be limited to): ■ asbestos containing materials; ■ additional LNAPL / hydrocarbon impact; ■ buried building rubble; ■ unusual soil staining and discoloration; and ■ odours emanating from the ground during earthworks. 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. The environmental consultant 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 relevant regulatory / approval authority and Land Custodian for record keeping requirements. Where analysis of unexpected finds indicates a potential risk to either human health and or the environment necessary, a Task Specific Works Plan (as detailed below) may be prepared. The plan is to be developed to outline task specific procedures / processes to be adopted to minimise the risk to human health and / or the environment from any unexpected finds.
Vehicle and Equipment Cleaning and Operation	The following controls will be placed on operation and movement of equipment: ■ All equipment will be operated by suitably qualified operators. ■ Equipment working within any area containing contaminated materials will be washed inside the area. Wash water must be prevented from leaving the site / entering drains. ■ The surface of internal access roads carrying vehicular traffic will be kept clean. ■ All equipment will be maintained at optimum operating conditions and any servicing of equipment will be undertaken in areas specified by the Contractor. It is recommended that such activities be undertaken on concrete or bitumen surfaces to prevent impact to surface soils by oils, fuels or cleaning agents. ■ Any fuel stored onsite will be held in a designated area. The area will be appropriately bunded to contain any potential spillages and/or leaks. ■ Vehicles carrying spoil or rubble from the site (if required) will at all times be covered with an "enviro-tarp" or similar impervious material to prevent the escape of dust or other material.

Item	Requirements
	■ All heavy vehicle access and egress to and from the site will be via the designated heavy vehicle route. ■ The wheels and wheel arches of all vehicles having had access the site will be inspected and if required, cleaned by the use of a broom or water spray to prevent mud and sediment from being deposited on local roadways. ■ After wheel and wheel arch cleaning, vehicles will be inspected for the presence of rocks between tyres and sediment within the undercarriage of the vehicle. Any material will be removed and placed at a designated point within the site.
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.
Intrusive Excavation Works Within 20 m of Identified Residual Contamination (Figure 2)	
Engagement of Environmental Specialist	Where excavation works are undertaken within 20m of identified residual contamination (Figure 2) prior to the commencement of any intrusive works the Land Custodian or nominated representative is to engage a suitably qualified environmental specialist to undertake a review of health and safety management procedures, manage, monitor and evaluate environmental controls and demonstrate compliance with this LTEMP. ■ ERM notes that where unexpected finds of contamination are identified within other areas of the Site during excavation works, scientist suitably qualified environmental specialist should be engaged to manage, monitor and evaluate environmental controls, demonstrate compliance with this LTEMP and assess specific requirements for unexpected finds detailed above.
Environmental Monitoring	Environmental monitoring is to be undertaken for Volatile Organic Compounds in ambient air during all excavation and construction works within 20 m of identified residual hydrocarbon contamination to evaluate the effectiveness of control measures (Figure 2). Where works are to be undertaken within the vicinity of identified asbestos, dust monitoring should be undertaken to assess the effectiveness of environmental controls on preventing airborne releases of asbestos fibres. Air monitoring is to be undertaken by a suitably qualified occupational hygienist. ■ The specific monitoring methodology / regime should be developed by the environmental specialist / occupational hygienist and based on the specific tasks / construction mythology to be undertaken. ■ Action levels (vapour / dust / airbourne fibre levels where intrusive works are to cease and control measures are to be re-assessed / implemented) will be required to be developed within the health and safety plan and are to be based on relevant regulatory guidance at the time of works.
Task Specific Works Plan	Where intrusive excavation works are undertaken within 20 m of identified residual contamination illustrated on Figure 2, prior to undertaking works, 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. ■ The Works Plan should be prepared for the specific works to be undertaken. ■ The Works Plan should be prepared in accordance with industry best 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. ■ 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).

Item	Requirements
	■ Mitigation measures. ■ Air / dust monitoring action levels, including monitoring procedures for Lower Explosive Limit (LEL) and Volatile Organic Compounds (VOCs) 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 the site EPL and / or NSW EPA waste disposal guidance. ▪ Excavated soils should be placed on within a bunded area to minimise potential run off. ▪ Excavated concrete containing asbestos formwork should be covered following excavated to prevent wind-blown emissions of potential asbestos. ▪ 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 NSW EPA waste disposal regulations. ▪ ERM notes that excavated concrete materials containing asbestos formwork are not to be replaced within the Site and are to be disposed offsite in accordance with NSW waste disposal requirements at the time of works. ■ Reinstatement of the site surface. ■ Waste management including waste disposal. ■ Record Keeping, audit and review.
Biodiversity Management Measures (Green and Golden Bell Frog)	
Green and Golden Bell Frog (GGBF)	Consistent with Viva Energy's existing GGBF management measures for the Clyde Terminal, to mitigate against potential impacts to the GGBF population, the following measures are to be included in an administered by the Stage 1 Land Custodian as part of an operational Environmental Management Plan: ■ Works inductions that focus on the potential occurrence of the species; ■ Pre-clearance surveys by an environmental representative as needed for stockpiles and excavations to check for the presence of GGBF; ■ Management of the site to minimise potential for creating habitat (i.e. no ponding of water); ■ Measures to minimise indirect impacts to GGBF through spread of Chytrid fungus; and ■ An unexpected find protocol which outlines the need to engage a suitably qualified ecologist to relocate any GGBF encountered.

Stage 1 Drainage Validation

COPC	Soil										
	Direct Contact (mg/kg)			VI (mg/kg)						CCME (2008) Acute Risk	NEPM Management Limits (mg/kg)
	Commercial	IMW	Construction	Commercial (0.15mbgl)	Commercial (1 mbgl)	Commercial (>2-4mbgl)	Commercial (>4mbgl)	IMW	Construction		
Benzene	400	15000	1200	3.2	3.2	3.2	3.2	NL	NL	-	-
Naphthalene	9800	810000	67000	NL	NL	NL	NL	NL	NL	-	-
Benzo(a)pyrene TEQ	40	3000	200	-	-	-	-	-	-	-	-
Total Chromium[a]	21000	100,000	8200							-	
Chromium VI	3600	17000	1400	-	-	-	-	-	-	-	-
TRH C6-C10 (less BTEX)	28000	830000	69000	600	770	NL	NL	NL	NL	-	-
TRH C6-C10	-	-	-	-	-	-	-	-	-	1400	700
TRH C10-C16 (less N)	17000	540000	45000	NL	NL	NL	NL	NL	NL	-	-
TRH C10-C16	-	-	-	-	-	-	-	-	-	5200	1000
TRH C16-C34	27000	770000	64000	-	-	-	-	-	-	NL	3500
TRH C34-C40	27000	770000	64000	-	-	-	-	-	-	NL	10000
TPH (EC5-6) aliphatic	1200000	3700000	310000	-	-	-	-	-	-	-	-
TPH (>EC6-8) aliphatic	1200000	3700000	310000	480	610	880	1400	NL	NL	-	-
TPH (>EC8-10) aliphatic	24000	740000	62000	760	980	1400	2200	NL	NL	-	-
TPH (>EC10-12) aliphatic	24000	740000	62000	430	600	980	1800	NL	NL	-	-
TPH (>EC12-16) aliphatic	24000	740000	62000	4300	8300	17000	33000	NL	NL	-	-
TPH (>EC16-21) aliphatic	470000	4400000	370000	-	-	-	-	-	-	-	-
TPH (>EC21-34) aliphatic	470000	4400000	370000	-	-	-	-	-	-	-	-
TPH (>34) aliphatic	4700000	44000000	3700000	-	-	-	-	-	-	-	-
TPH (>EC8-10) aromatic	9500	300000	25000	110	150	230	420	NL	NL	-	-
TPH (>EC10-12) aromatic	9500	300000	25000	280	430	750	1400	NL	NL	-	-
TPH (>EC12-16) aromatic	9500	300000	25000	430	2800	5100	9800	NL	NL	-	-
TPH (>EC16-21) aromatic	7100	220000	18000	-	-	-	-	-	-	-	-
TPH (>EC21-34) aromatic	7100	220000	18000	-	-	-	-	-	-	-	-
TPH (>34) aromatic	7100	220000	18000	-	-	-	-	-	-	-	-

a - Assumes Total chromium is 17% Hexavalent chromium

	Borehole	BTEX						Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)							Inorganics		
	PID	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	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	Moisture Content (dried @ 103°C)	Acenaphthene	Acenaphthylene
	ppm	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	0.5	20	20	50	50	50	20	20	50	50	100	100	100	1	0.5	0.5
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) >1-2m																							
1-1.99m		3.2						NL							770		NL						
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																							
0-0.99m		3.2						NL							600		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	Location_Code	Sampled_Date_Time	Sample_Type	Sample_Depth_Range	Lab_Report_Number																				
TP20/19_0.3	TP20/19	8/09/2020	Normal	0.2-0.4	743229	-	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<20	<20	91	52	143	<20	<20	<50	<50	140	140	<100	13	<0.5	<0.5
TP20/19_1.0	TP20/19	8/09/2020	Normal	0.9-1.1	743229	-	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<20	66	440	<50	506	<20	<20	150	150	350	500	<100	21	<0.5	<0.5
TP20/20_0.5	TP20/20	7/09/2020	Normal	0.4-0.6	743229	-	<1	<1	<1	<1	<2	<3	8.2 - 16	<200	2900	17,000	1700	21,600	<200	<200	5400	5384	9500	15,570	670	14	7.3	2.3

Statistical Summary

Number of Results	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects	0	0	0	0	0	0	0	1	0	2	3	2	3	0	0	2	2	3	3	1	3	1	1
Minimum Concentration	99999	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	<0.5	<20	<20	91	<50	143	<20	<20	<50	<50	140	140	<100	13	<0.5	<0.5
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	8.2	ND	66	91	52	143	ND	ND	150	150	140	140	670	13	7.3	2.3
Maximum Concentration	0	<1	<1	<1	<1	<2	<3	16	<200	2900	17000	1700	21600	<200	<200	5400	5384	9500	15570	670	21	7.3	2.3
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	16	ND	2900	17000	1700	21600	ND	ND	5400	5384	9500	15570	670	21	7.3	2.3
Average Concentration		0.2	0.2	0.2	0.2	0.4	0.6	4.2	40	992	5844	592	7416	40	40	1858	1853	3330	5403	257	16	2.6	0.93
Median Concentration		0.05	0.05	0.05	0.05	0.1	0.15	0.25	10	66	440	52	506	10	10	150	150	350	500	50	14	0.25	0.25
Standard Deviation		0.26	0.26	0.26	0.26	0.52	0.78	6.8	52	1653	9663	959	12285	52	52	3068	3059	5344	8806	358	4.4	4.1	1.2
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	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	1	0	1	0	0	0	0	0

Env Stds Comments

	PAH/Phenols																
	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
EQL	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)						40											
Clyde WARP SSTL (Direct Contact - Construction Worker)						200											
Clyde WARP SSTL (Direct Contact - IMW)						3000											
Clyde WARP SSTL (Vapour Intrusion - Commercial) >1-2m																	
1-1.99m																	
Clyde WARP SSTL (Vapour Intrusion - Commercial) 0.15m																	
0-0.99m																	
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)																	
Clyde WARP SSTL (Vapour Intrusion - IMW)																	
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																	

Field_ID	Location_Code	Sampled_Date_Time	Sample_Type	Sample_Depth_Range	Lab_Report_Number														
TP20/19_0.3	TP20/19	8/09/2020	Normal	0.2-0.4	743229	<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
TP20/19_1.0	TP20/19	8/09/2020	Normal	0.9-1.1	743229	<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
TP20/20_0.5	TP20/20	7/09/2020	Normal	0.4-0.6	743229	4.2	5	2.1	2.9	3.5	3.2	1.8	<0.5	<0.5	7.2	<0.5	2.4	16	<0.5	41	13	110.5

Statistical Summary

Number of Results	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects	1	1	1	1	3	3	1	0	0	1	0	1	1	0	2	1	2
Minimum Concentration	<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	4.2	5	2.1	2.9	1.2	0.6	1.8	ND	ND	7.2	ND	2.4	16	ND	0.5	13	0.5
Maximum Concentration	4.2	5	2.1	2.9	3.5	3.2	1.8	<0.5	<0.5	7.2	<0.5	2.4	16	<0.5	41	13	110.5
Maximum Detect	4.2	5	2.1	2.9	3.5	3.2	1.8	ND	ND	7.2	ND	2.4	16	ND	41	13	110.5
Average Concentration	1.6	1.8	0.87	1.1	2	1.5	0.77	0.25	0.25	2.6	0.25	0.97	5.5	0.25	14	4.5	37
Median Concentration	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	0.5	0.25	0.5
Standard Deviation	2.3	2.7	1.1	1.5	1.3	1.5	0.89	0	0	4	0	1.2	9.1	0	23	7.4	64
Number of Guideline Exceedances	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

Env Stds Comments

ERM

						TRH Aliphatic/Aromatic Split										BTEX						Naphthalene	TRH NEPM (1999)					TRH NEPM (2013)						
						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	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	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
						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	10	10	10	10	10	10	0.1	1	10	10	10	10	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
Clyde WARP SSTL (Direct Contact - Construction Worker)							310000	62000	62000	62000	370000	370000		25000	25000	25000	18000	18000	1200						67000						69000		45000	64000		64000
Clyde WARP SSTL (Direct Contact - IMW)							3700000	740000	740000	740000	4400000	4400000		300000	300000	300000	220000	220000	15000						810000						830000		540000	770000		770000
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																																				
2-3.99m							880	1400	980	17000				230	750	5100			3.2						NL						NL		NL			
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)							NL	NL	NL	NL				NL	NL	NL			NL						NL						NL		NL			
Clyde WARP SSTL (Vapour Intrusion - IMW)							NL	NL	NL	NL				NL	NL	NL	NL	NL	NL						NL						NL		NL			
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																															700		1000		3500		10000
Field_ID	**Location_Code**	**Sampled_Date_Time**	**Sample_Type**	**Sample_Depth_Range**	**Lab_Report_Number**																															
1370 P-190	P-190	17/11/2020	Normal	> 2 - 3.5	758169	<0.1	<10	88	1000	6600	6500	4400	0.2	<1	480	4700	6000	8400	<0.1	0.2	<0.1	<0.1	<0.2	<0.3	1.3 - 4.7	39	5000	36,000	3600	44,600	70	70	15,000	14,999	30,000	47,600	2600
1370 P-197	P-197	17/11/2020	Normal	> 2 - 3.5	758169	<1	880	1100	5600	20,000	17,000	9400	<1	26	5000	35,000	25,000	11,000	<1	<1	<1	<1	<2	<3	130 - 170	1000	49,000	98,000	8800	155,800	1800	1800	81,000	80,830	73,000	158,100	4100
26P-4 26D610-2	26P-4	18/11/2020	Normal	> 2 - 3.5	758169	<0.1	<10	23	20	130	120	310	<0.1	<1	74	570	890	1700	<0.1	<0.1	0.8	0.2	0.8	1	1.9 - 2.6	32	580	2800	1000	4380	65	63	1100	1097.4	3000	4960	860
Statistical Summary																																				
Number of Results						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects						0	1	3	3	3	3	3	1	1	3	3	3	3	0	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3
Minimum Concentration						<0.1	<10	23	20	130	120	310	<0.1	<1	74	570	890	1700	<0.1	<0.1	<0.1	<0.1	<0.2	<0.3	1.3	32	580	2800	1000	4380	65	63	1100	1097.4	3000	4960	860
Minimum Detect						ND	880	23	20	130	120	310	0.2	26	74	570	890	1700	ND	0.2	0.8	0.2	0.8	1	1.3	32	580	2800	1000	4380	65	63	1100	1097.4	3000	4960	860
Maximum Concentration						<1	880	1100	5600	20000	17000	9400	<1	26	5000	35000	25000	11000	<1	<1	<1	<1	<2	<3	170	1000	49000	98000	8800	155800	1800	1800	81000	80830	73000	158100	4100
Maximum Detect						ND	880	1100	5600	20000	17000	9400	0.2	26	5000	35000	25000	11000	ND	0.2	0.8	0.2	0.8	1	170	1000	49000	98000	8800	155800	1800	1800	81000	80830	73000	158100	4100
Average Concentration						0.2	297	404	2207	8910	7873	4703	0.25	9	1851	13423	10630	7033	0.2	0.25	0.45	0.25	0.63	0.88	52	357	18193	45600	4467	68260	645	644	32367	32309	35333	70220	2520
Median Concentration						0.05	5	88	1000	6600	6500	4400	0.2	0.5	480	4700	6000	8400	0.05	0.2	0.5	0.2	0.8	1	3	39	5000	36000	3600	44600	70	70	15000	14999	30000	47600	2600
Standard Deviation						0.26	505	604	2979	10134	8523	4553	0.23	15	2734	18800	12704	4798	0.26	0.23	0.38	0.23	0.47	0.68	85	557	26771	48321	3972	78434	1000	1001	42687	42592	35303	79036	1621
Number of Guideline Exceedances						0	1	0	2	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	2	0	0
Number of Guideline Exceedances(Detects Only)						0	1	0	2	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	1	2	0	0

Env Stds Comments

		Inorganics	PAH/Phenols																																						SVOC
		Moisture Content (dried @ 103°C)	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,4-dimethylphenol	2,4-dinitrophenol	2,6-dichlorophenol	2-chlorophenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4,6-Dinitro-2-methylphenol	4-chloro-3-methylphenol	4-nitrophenol	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	Dinoseb	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Pentachlorophenol	Phenanthrene	Phenol	Pyrene	Tetrachlorophenols	Phenols (Total Halogenated)	Total Non-Halogenated Phenol	PAHs (Sum of total)	4,6-Dinitro-o-cyclohexyl phenol
		%	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	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		1	1	1	0.5	0.5	5	0.5	0.5	0.2	1	0.4	5	1	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	20	0.5	0.5	0.5	1	0.5	0.5	0.5	10	1	20	0.5	20
Clyde WARP SSTL (Direct Contact - Construction Worker)																																								
Clyde WARP SSTL (Direct Contact - IMW)																							200																	
Clyde WARP SSTL (Vapour Intrusion - Commercial) >2 - 4m																							3000																	
2-3.99m																																								
Clyde WARP SSTL (Vapour Intrusion - Construction Worker)																																								
Clyde WARP SSTL (Vapour Intrusion - IMW)																																								
NEPM (1999) Management Limits - Commercial/Industrial (coarse)																																								
Field_ID	**Location_Code**	**Sampled_Date_Time**	**Sample_Type**	**Sample_Depth_Range**	**Lab_Report_Number**																																					
1370 P-190	P-190	17/11/2020	Normal	> 2 - 3.5	758169	27	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<0.4	<5	<1	<5	2.7	0.9	4.1	5.9	3.5	5.8	5.8	5.8	1.5	4.4	1.5	16	1.1	<20	4.6	6.8	0.7	<1	12	<0.5	17	<10	<1	<20	87.4	<20
1370 P-197	P-197	17/11/2020	Normal	> 2 - 3.5	758169	42	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<0.4	<5	<1	<5	29	12	21	6.8	4.3	5.3	5.8	5.5	0.9	1.4	0.8	10	<0.5	<20	<0.5	58	<0.5	<1	140	<0.5	23	<10	<1	<20	437.2	<20
26P-4 26D610-2	26P-4	18/11/2020	Normal	> 2 - 3.5	758169	22	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.2	<1	<0.4	<5	<1	<5	1.1	<0.5	<0.5	2	1.1	1.4	2	1.7	<0.5	1.1	0.6	3.6	<0.5	<20	0.7	1.1	<0.5	<1	2.6	<0.5	4.5	<10	<1	<20	20.3	<20
Statistical Summary																																									
Number of Results			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects			3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	2	3	3	3	3	3	2	3	3	3	1	0	2	3	1	0	3	0	3	0	0	0	3	0
Minimum Concentration			22	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.5	<0.2	<1	<0.4	<5	<1	<5	1.1	<0.5	<0.5	2	1.1	1.4	2	1.7	<0.5	1.1	0.6	3.6	<0.5	<20	<0.5	1.1	<0.5	<1	2.6	<0.5	4.5	<10	<1	<20	20.3	<20
Minimum Detect			22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0.9	4.1	2	1.1	1.4	2	1.7	0.9	1.1	0.6	3.6	1.1	ND	0.7	1.1	0.7	ND	2.6	ND	4.5	ND	ND	ND	20.3	ND
Maximum Concentration			42	<1	<1	<0.5	<0.5	<5	<0.5	<0.5	<0.5	<0.2	<1	<0.4	<5	<1	<5	29	12	21	6.8	4.3	5.8	5.8	5.8	1.5	4.4	1.5	16	1.1	<20	4.6	58	0.7	<1	140	<0.5	23	<10	<1	<20	437.2	<20
Maximum Detect			42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	29	12	21	6.8	4.3	5.8	5.8	5.8	1.5	4.4	1.5	16	1.1	ND	4.6	58	0.7	ND	140	ND	23	ND	ND	ND	437.2	ND
Average Concentration			30	0.5	0.5	0.25	0.25	2.5	0.25	0.25	0.1	0.5	0.2	2.5	0.5	2.5	11	4.4	8.5	4.9	3	4.2	4.5	4.3	0.88	2.3	0.97	9.9	0.53	10	1.9	22	0.4	0.5	52	0.25	15	5	0.5	10	182	10
Median Concentration			27	0.5	0.5	0.25	0.25	2.5	0.25	0.25	0.1	0.5	0.2	2.5	0.5	2.5	2.7	0.9	4.1	5.9	3.5	5.3	5.8	5.5	0.9	1.4	0.8	10	0.25	10	0.7	6.8	0.25	0.5	12	0.25	17	5	0.5	10	87.4	10
Standard Deviation			10	0	0	0	0	0	0	0	0	0	0	0	0	0	16	6.6	11	2.6	1.7	2.4	2.2	2.3	0.63	1.8	0.47	6.2	0.49	0	2.4	31	0.26	0	77	0	9.4	0	0	0	224	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Env Stds Comments

APPENDIX A DRAINAGE DECOMMISSIONING VALIDATION REGISTER

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D150-10	P12	P12	23	151.0364989	-33.82791637	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-11, D150-9	P11	P11	23	151.0365086	-33.82790602	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-4	P8a	P8	23	151.0364671	-33.82783972	29/07/2020 2:00	steel	0	0	-	-	0	10	0	-	-	0	0	0	-	-	0	5	0	-	-	0
D150-4a	P14	P8a	23	151.0366778	-33.82786319	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-5	P15	P14	23	151.0369212	-33.82790841	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-8	P9	P11	23	151.0364777	-33.82790937	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-3a	P8	P8b	23	151.0362488	-33.82782425	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
P150-12	P13	P13	23	151.03654	-33.82790945	29/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-6	-	P24	23	151.0363601	-33.82797353	30/07/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-15	P22	P23	23	151.0363313	-33.82796586	30/07/2020 2:00		0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-16	P24	P23	23	151.0363696	-33.82797458	30/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-17	P23a	P23	23	151.0364246	-33.82801276	30/07/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D200-2	P10	P5	23	151.0360868	-33.82779835	30/07/2020 2:00		0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-3b	P8c	P6	23	151.0360608	-33.82780929	30/07/2020 2:00	steel	0	0	-	-	0	13	0	-	-	0	0	0	-	-	0	0.2	0	-	-	0
D200-4	P39	P23	23	151.0363256	-33.82805031	30/07/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D250-1	P6	P20	23	151.0359562	-33.82789873	30/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D250-5	P21a	P21	23	151.0360604	-33.82794789	30/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D250-6a	P23	P21b	23	151.036221	-33.82798648	30/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D250-6b	P21b	P8b	23	151.0362338	-33.8279885	30/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-4	P6	P3	23	151.0358703	-33.82779106	30/07/2020 2:00	steel	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-
D150-19	P48	P39	23	151.0363471	-33.82811125	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-20	P49	P48	23	151.0365402	-33.82812194	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-21	P50	P49	23	151.0366933	-33.8281325	31/07/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-28	P37	P38	23	151.0361437	-33.82819507	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-29	P39	P38	23	151.0362714	-33.82815081	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-8	P34a	P34	23	151.0359184	-33.82811561	31/07/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D250-2	P21	P20	23	151.0359869	-33.82793766	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D250-7, D250-7a, D25	P20	P34	23	151.0359367	-33.82800145	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-10	P35	P37	23	151.0361113	-33.82818086	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-9	P35	P34	23	151.0359948	-33.82815123	31/07/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
No pipe. Pit only.	P33	P33	23	151.035936	-33.82808795	31/07/2020 2:00	concrete	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
No pipe. Pit only.	P33a	P33a	23	151.0359515	-33.82801	31/07/2020 2:00	concrete	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D150-109	P100	P100	24	151.0368898	-33.82886922	3/08/2020 2:00	concrete	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-110	-	P101	24	151.0366047	-33.82891021	3/08/2020 2:00		-	-	-	-	-	0	0	-	-	0			-	-				-	-	
D150-111	-	P101	24	151.0366223	-33.82890552	3/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0			-	-				-	-	
D150-112	-	P101	24	151.0366924	-33.82895438	3/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-113	P101	P103	24	151.0366637	-33.82892501	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-11	P35	P36	23	151.0360168	-33.82821942	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-27	P95	P99	24	151.0368442	-33.82879928	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-28	P100	P103	24	151.0368947	-33.8289416	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-5	P3	P18	23	151.035781	-33.82781587	3/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D300-6	P19	P18	23	151.0357365	-33.82795342	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-6	P18	P19	23	151.0357634	-33.82795991	3/08/2020 2:00	concrete	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-7	P18	P27	23	151.0356877	-33.82807676	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-8	P36	P28	23	151.0359201	-33.82826401	3/08/2020 2:00	steel	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-
D300-9	P34	P35	23	151.0359534	-33.82815882	3/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-1	P28	P27	23	151.0356747	-33.82817172	3/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D80-1	P35a	P35	23	151.0360339	-33.82817914	3/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D100-35	-	P94	24	151.0365955	-33.82870968	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-101	P97	P95	24	151.0366272	-33.82881835	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-102	-	P92	24	151.0364403	-33.82884789	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-103	-	P92	24	151.0364136	-33.82885778	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-107	-	P97	24	151.0366331	-33.82886193	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-108	-	P97	24	151.0366005	-33.82884806	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-86	-	P89	24	151.036483	-33.82863885	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-87	-	P89	24	151.0364549	-33.82866253	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-88	-	P89	24	151.03647	-33.8286044	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-89	-	P89	24	151.0364664	-33.82860809	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-93	-	P93	24	151.0365895	-33.82864572	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-94	-	P93	24	151.0365788	-33.82862514	4/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D230-6	P90	P89	24	151.0364627	-33.82865653	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-24	P91	P96	24	151.0365856	-33.82877891	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0.8	0	-	-	0
D300-24	P91	P96	24	151.0366046	-33.82879018	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-26	P94	P95	24	151.0366174	-33.82873562	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D300-27	P99	P95	24	151.0366342	-33.82878335	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
P230-6	P93	P94	24	151.0365945	-33.8286712	4/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-7	-	P26a	23	151.0369237	-33.82810475	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D100-7a	-	P26a	23	151.0368471	-33.82810547	5/08/2020 2:00	terracotta	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-22	-	P25	23	151.0367723	-33.82805262	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-23	-	P25	23	151.0368063	-33.82806452	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-24	P25	P26	23	151.036843	-33.82808962	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-25	P26b	P26	23	151.0369136	-33.82807889	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-25a	P26b	P26c	23	151.0369434	-33.82811318	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-26	-	P26b	23	151.0369673	-33.82807726	5/08/2020 2:00	terracotta	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-26a	-	P26b	23	151.0369713	-33.82810526	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-27	P16	P17	23	151.0369265	-33.82804377	5/08/2020 2:00	other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D150-31	P26c	P57	23	151.0369301	-33.8281905	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-32	P40	P51	23	151.0364193	-33.82818522	5/08/2020 2:00	other	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-36	P54	P55	23	151.0369044	-33.82824226	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-37	P55	P56	23	151.0369073	-33.82823647	5/08/2020 2:00	other			-	-				-	-				-	-				-	-	
D150-38	P41	P40	23	151.0362701	-33.82820563	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-39	-	P40	23	151.0362734	-33.82820487	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-40	-	P40	23	151.0362901	-33.82820425	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-43	-	P52	23	151.0365282	-33.82824037	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-44	-	P52	23	151.036575	-33.82823811	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-47	P41	P56	23	151.0368754	-33.8282545	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-60	P65	P67a	23	151.0366755	-33.82841182	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-61	-	P67	23	151.0366745	-33.82836543	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-62	P66	P67	23	151.036707	-33.82837834	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-63	-	P67	23	151.0367301	-33.8283757	5/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D150-65	P56	P68	23	151.0368301	-33.82838852	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-65	P56	P68	23	151.0368534	-33.82831057	5/08/2020 2:00	other			-	-				-	-				-	-				-	-	
D200-7	P64	P67a	23	151.0366711	-33.82839246	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-8	P67a	P68	23	151.0367483	-33.82839552	5/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-15	P45	P59	23	151.0361406	-33.82826942	6/08/2020 2:00	steel			-	-		0	0	-	-	0	-	-	-	-		0	0	-	-	0
D150-48	P58	P66	23	151.036654	-33.82836799	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-49	P58	P59	23	151.0362782	-33.82833538	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-50	-	P60	23	151.0363099	-33.82833865	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-51	P60	P59	23	151.036268	-33.82834737	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-52	P58	P60	23	151.0362937	-33.82833521	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-54	P61	P62	23	151.0363507	-33.82837126	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-55	-	P62	23	151.0363789	-33.82836774	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-56	-	P62	23	151.0363738	-33.82836815	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-57	-	P62	23	151.0363747	-33.82836711	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-59	P63	P64	23	151.0365136	-33.82836945	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-60	-	P64	23	151.0365694	-33.82836815	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-64	-	P67a	23	151.0366839	-33.82843181	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	
D150-65	P56	P68	23	151.036823	-33.8283985	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-67	-	P68	23	151.0368133	-33.82844778	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D200-5	P60	P62	23	151.0363549	-33.82835977	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-6	P62	P64	23	151.0365053	-33.82838764	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-8	P67a	P68	23	151.0367795	-33.82842058	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-9	P69	P70	23	151.0365817	-33.82843345	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-9	P70	P69	23	151.0364074	-33.82839757	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-6	P46	P69	23	151.0363493	-33.82837737	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-6	P69	P46	23	151.0362106	-33.82837624	6/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-7	-	P69	23	151.0363931	-33.8284091	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
NA	-	P58	23	151.0362645	-33.82829695	6/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D100-31	-	P90	24	151.036481	-33.82871215	7/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-101	P92	P91	24	151.0364672	-33.82878453	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-90	-	P90	24	151.0364079	-33.82873641	7/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-91	-	P90	24	151.036412	-33.82868239	7/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D150-92	-	P90	24	151.0365056	-33.82870213	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-6	P89	P90	24	151.0364571	-33.82867393	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-22	P85	P91	24	151.0364191	-33.82877543	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-24	P90	P91	24	151.0364674	-33.82877463	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-24	P91	P90	24	151.0364524	-33.82873725	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-2	P28	P29	23	151.0357617	-33.8282962	7/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D360-3	P32	P29	23	151.0357607	-33.82832075	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-3	P29	P32	23	151.0358173	-33.82833023	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-4	P37	P32	23	151.0359285	-33.82833299	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-5	P46	P37	23	151.0360826	-33.82835265	7/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D510-1	P30a	P30	23	151.0357229	-33.82825668	11/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D910-1	P4	P30	23	151.0357672	-33.8281998	11/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D910-2	P31	P30	23	151.0357692	-33.82827675	11/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-27	-	P79	24	151.0360274	-33.8286572	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D100-28	-	P79	24	151.0360415	-33.82867187	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D100-29	-	P15	24	151.0360539	-33.82870783	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-79	-	P78	24	151.0360408	-33.82856492	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-79a	-	P78	24	151.0360601	-33.82856085	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-80	-	P78	24	151.0360806	-33.82857418	12/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D230-3	P78	P79	24	151.0360444	-33.8286497	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-15	P76	P80	24	151.0360042	-33.8287292	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-16	P80	P79	24	151.0360519	-33.82868214	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-17	P82	P81	24	151.0360424	-33.82869279	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-17a	P81	P80	24	151.0360318	-33.82874773	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-18	P85	P80	24	151.0360461	-33.82872698	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D360-2	P29	P28	23	151.0357422	-33.82823304	12/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-68	-	P73	24	151.0356878	-33.82851534	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-69	-	P73	24	151.0357078	-33.8285342	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-70	-	P74	24	151.0356409	-33.82861764	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-71	-	P74	24	151.0356706	-33.82864321	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-72	-	P74	24	151.0356867	-33.82864266	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D150-73	-	P74	24	151.0356881	-33.82864476	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-74	P74a	P74	24	151.0356498	-33.82864903	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-75	-	P75	24	151.0358757	-33.82856018	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-76	-	P75	24	151.0358842	-33.82857318	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-77	-	P76	24	151.0358688	-33.82866462	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-78	-	P76	24	151.0358668	-33.82867539	13/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D225-1	P114	P82	24	151.0361206	-33.82892677	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-1	P74	P73	24	151.0356799	-33.82857435	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-2	P76	P75	24	151.0358672	-33.82860042	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-2	P75	P76	24	151.0358714	-33.82864689	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-7	P104	P77	24	151.0358023	-33.82884601	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-8	P105	P104	24	151.0358313	-33.82897471	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-13	P76	P74	24	151.0356701	-33.82865125	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-14	P77	P76	24	151.035867	-33.82869425	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-15	P80	P76	24	151.0358621	-33.82870079	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-30	P108	P104	24	151.0358555	-33.82896859	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-31	P115	P114	24	151.0361283	-33.82898745	13/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-30	-	P84	24	151.0363328	-33.82869019	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-82	-	P83	24	151.0362709	-33.82858068	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-83	-	P83	24	151.0362848	-33.82858399	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-84	-	P83	24	151.0362975	-33.82862338	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-85	-	P84	24	151.0362665	-33.82866852	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D230-4	P83	P84	24	151.0363001	-33.82866517	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D230-4	P84	P83	24	151.0362785	-33.82863977	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-18	P80	P85	24	151.036252	-33.82873805	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-19	P85	P84	24	151.0362797	-33.82871332	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-20	P86	P85	24	151.036289	-33.82876562	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-21	-	P85	24	151.0363023	-33.82873025	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D300-22	P88	P85	24	151.036322	-33.82875075	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-23	P91	P88	24	151.0363911	-33.82875003	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-37	-	P102	24	151.03674	-33.8289846	14/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D360-8	P102	P128	24	151.0368095	-33.82909763	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D375-1	P96	P88	24	151.0363924	-33.8287593	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D450-5	P80	P88	24	151.0363545	-33.82874819	14/08/2020 2:00	steel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D600-2	P118	P88	24	151.0363767	-33.82879622	14/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D100-39	-	P124	24	151.0365494	-33.82900095	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-100	-	P86	24	151.0362359	-33.8288393	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-106	-	P119	24	151.036401	-33.82894667	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D150-11	P124	P125	24	151.0366345	-33.82911997	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-116	P132	P127	24	151.0366176	-33.82935626	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-1	-	P124	24	151.0365588	-33.82898883	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D200-12	P120	P119	24	151.0363954	-33.82899202	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-12	P119	P120	24	151.0364239	-33.82910233	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D200-13	-	P125	24	151.0366399	-33.82913229	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D200-14	-	P125	24	151.036653	-33.82912064	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D230-10	P116	P86	24	151.0362393	-33.8288274	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D250-10	P123	P120	24	151.0364408	-33.82915702	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-20	P85	P86	24	151.0362727	-33.82880887	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-32	P116	P115	24	151.0361882	-33.82895845	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-33	P111	P115	24	151.0361458	-33.82905744	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-34	P119	P118	24	151.036378	-33.82895954	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-35	P124	P119	24	151.0364146	-33.82896863	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-36	P126	P127	24	151.0366185	-33.82930626	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-38	P103	P131	24	151.0368372	-33.82923007	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D300-39	-	P131	24	151.0368031	-33.82927608	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D360-9	P128	P129	24	151.0367729	-33.82925207	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D380-1	-	P130	24	151.0367191	-33.82935915	17/08/2020 2:00	steel	-	-	-	-	-	0	0	-	-	0	-	-	-	-	-	0	0	-	-	0
D410-1	P130	P127	24	151.0367037	-33.82935382	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D410-2	P129	P130	24	151.036757	-33.8293058	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D600-3	P117	P118	24	151.036326	-33.82896943	17/08/2020 2:00	steel	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0	0	0	-	-	0
D150-101	-	P87	24	151.036398	-33.82881462	18/08/2020 2:00	terracotta	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-114	-	P121	24	151.0362268	-33.82925567	18/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-115	-	P122	24	151.0363117	-33.82928421	18/08/2020 2:00	steel	-	-	-	-	-	0	0	-		0	-	-	-	-	-	0	0	0	0.00	0
D150-98	P73a	P87a	24	151.0360303	-33.82879324	18/08/2020 2:00	terracotta	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-99	P87	P87a	24	151.036097	-33.82880456	18/08/2020 2:00	terracotta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D250-10	P120	P123	24	151.0364327	-33.82924767	18/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D250-12	P126	P125	24	151.0366174	-33.8291623	18/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D460-3	P122	P121	24	151.0362519	-33.82928979	18/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D460-4	P123	P122	24	151.0363188	-33.82928702	18/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D460-5	P127	P123	24	151.0364747	-33.8293335	18/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-16	P150	P151	25	151.0357945	-33.82967799	19/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-17	P151	P156	25	151.0359241	-33.82968726	19/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-18a	-	P152	25	151.0357259	-33.82985364	19/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D200-18b	-	P152	25	151.0357294	-33.82985473	19/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D200-20	P157	P156	25	151.0359804	-33.82972347	19/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D600-3	P118	P117	24	151.0361832	-33.82904726	19/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D600-4	P111	P117	24	151.0361406	-33.82906909	19/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
NA	P150	P150	25	151.0356926	-33.82969568	19/08/2020 2:00	concrete	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D150-118	-	P179a	25	151.0366626	-33.82991063	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-120	-	P155	25	151.0358163	-33.82986261	20/08/2020 2:00	steel	-	-	-		-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-120a	-	P157	25	151.0359773	-33.82981818	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-121	-	P160	25	151.0360909	-33.82980842	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-122	-	P160	25	151.0360852	-33.82978407	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-123	-	P160	25	151.0360496	-33.82984618	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-125	-	P163	25	151.036168	-33.82987329	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-125a	-	P163	25	151.0361796	-33.8298533	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-126	-	P174	25	151.0363054	-33.8298769	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-126a	-	P174	25	151.0362859	-33.82987099	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-127	-	P179	25	151.0364799	-33.82989391	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-128	-	P179	25	151.0364713	-33.82991734	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-129	-	P179	25	151.0364587	-33.82992224	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D150-130	P153	P149	25	151.0355461	-33.8299012	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-24	-	P163	25	151.0361451	-33.82987321	20/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0.00	0
D200-18	P152	P155	25	151.0357623	-33.82981734	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-19	P155	P157	25	151.0359399	-33.82980708	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-21	P143	P179a	25	151.0366881	-33.82991964	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-22	P144	P146	25	151.0367329	-33.82984995	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D200-23	P146	P179a	25	151.0366861	-33.82991747	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D250-13	P157	P160	25	151.0360074	-33.8298225	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D250-14	P160	P163	25	151.0361282	-33.82985854	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D300-42	P163	P174	25	151.0362509	-33.82987497	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D300-43	P174	P179	25	151.0364176	-33.82989706	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D360-10	P179	P179a	25	151.036648	-33.82992128	20/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0
D150-131	P158	P153	25	151.0357255	-33.82990695	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-132	NA	P154	25	151.0357212	-33.83005023	21/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-133	P159	P154	25	151.035779	-33.8300657	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-134	P159	P158	25	151.0358807	-33.82996248	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-135	P162	P159	25	151.0359018	-33.83006603	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-136	P165	P162	25	151.0360129	-33.83009722	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-141	P184	P180	25	151.0363949	-33.83001817	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-143	P182	P183	25	151.0364887	-33.83007064	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-144	P131	P183	25	151.0365069	-33.83006268	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-144a	NA	P181	25	151.0364947	-33.83001298	21/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-145	NA	P183	25	151.0365137	-33.83010484	21/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D250-15	P161	P158	25	151.0359447	-33.82994844	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-16	P161	P164	25	151.036039	-33.82996445	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-17	P165	P164	25	151.0360788	-33.82998364	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-18	P175	P164	25	151.0360844	-33.82996449	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-18a	NA	P164	25	151.0360794	-33.82994441	21/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D250-18a	NA	P175	25	151.0362136	-33.82996348	21/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D250-19	P176	P175	25	151.0362084	-33.82999994	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-44	P180	P175	25	151.0362545	-33.82996398	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-45	P181	P180	25	151.0364417	-33.82999479	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-46	P186	P181	25	151.0365228	-33.83000338	21/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
D100-46	NA	P186	25	151.0366342	-33.8300411	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0.1	0	0	0	0
D100-48	NA	P184	25	151.036396	-33.83008305	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-137	P169	P173	25	151.0360484	-33.830146	25/08/2020 2:00	steel	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-138	P178	P173	25	151.036027	-33.83013787	25/08/2020 2:00	steel	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-138	P173	P178	25	151.0361879	-33.83016054	25/08/2020 2:00	steel	1.1	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
D150-141	P180	P184	25	151.0363988	-33.8300789	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-142	NA	P182	25	151.0364318	-33.83005128	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-143	P183	P182	25	151.0364441	-33.83005753	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-143a	NA	P182	25	151.0364224	-33.83008104	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-143b	NA	P182	25	151.0364384	-33.83007584	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D250-18	P175	P176	25	151.0362296	-33.83008439	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-19	P176	P177	25	151.0361555	-33.83010736	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-19	P177	P176	25	151.0362096	-33.83009604	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-20	P177	P178	25	151.0361814	-33.8301662	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-20	P178	P177	25	151.0361562	-33.83010505	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-20a	NA	P178	25	151.0361694	-33.83017672	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D300-46	P181	P186	25	151.0366742	-33.83005585	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0	0	0	0
D410-3	P179a	P186	25	151.036631	-33.83004709	25/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
D510-1	NA	P186	25	151.0366842	-33.83003879	25/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0.1	0	0	0	0
D150-137	P173	P169	25	151.0360195	-33.83016666	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D150-139	NA	P173	25	151.0360433	-33.8301742	26/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D150-140	NA	P173	25	151.0360392	-33.83016071	26/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D230-11	NA	P147	25	151.0355457	-33.8297875	26/08/2020 2:00	other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D230-12	NA	P189	25	151.0354706	-33.83008217	26/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D250-21	NA	P191	25	151.03588	-33.83021683	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-22	P191	P192	25	151.0359614	-33.83024918	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D250-23	P193a	P192	25	151.0359594	-33.83023765	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-12a	NA	P189	25	151.0355114	-33.83013376	26/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	0	0	0	0	0
D300-44b	NA- channel	P189	25	151.0355017	-33.83011591	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-49	NA-Channel	P194	25	151.0364783	-33.83027575	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-49a	NA - channel	P192	25	151.0359393	-33.83024625	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D300-50	NA- channel	P195	25	151.0364986	-33.83027839	26/08/2020 2:00	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P193 (Pit only)	NA	P193	25	151.0361198	-33.83021771	26/08/2020 2:00	steel	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D100-16	NA	D100-16	23	151.0361407	-33.82838923	3/09/2020	steel	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D100-17	NA	D100-17	23	151.0360939	-33.8283907	3/09/2020	steel	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12D150-9	12-P9 (unable to locate)	12-P13	12	151.0351393	-33.83130228	2/10/2020 5:31	steel	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	0	0	0	0	0
26D200-1	NA	26-P5	26	151.0361008	-33.83054032	2/10/2020 5:31	other	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	0	0	0	0	0
26D150-4	NA	26-P7 (appears to be a septic tank)	26	151.0366545	-33.83052712	2/10/2020 5:31	terracotta	NA	NA	NA'	NA	NA	0	0	0	0	0	NA	NA	NA'	NA	NA	NA	NA	NA	NA	NA
12D150-8	12-P12	12-P13	12	151.035167	-33.8312421	2/10/2020 5:31	steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12D150-7	NA	12-P12	12	151.034838	-33.83137554	2/10/2020 5:31	steel	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	0	0	0	0	0
D300-40	P145 (concreted over)	P185	25	151.0362503	-33.83024109	8/10/2020	steel	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA	NA	NA	NA	0	0	0	0	0
D150-119	P134	P135	25	151.0365483	-33.82955918	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D100-45	P143	P145	25	151.0366704	-33.82980826	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D100-44	P143	P142	25	151.0365395	-33.82979022	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	N	N
D225-2	P133	P134	25	151.0363084	-33.82954809	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D100-41	NA	P136	25	151.0367393	-33.82960094	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D225-3	P137	P137	25	151.0362104	-33.82962997	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D100-42	NA	P136	25	151.0367807	-33.82958897	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Pipe Details								Gas Testing - Upstream Pit (Pre-Cleaning)					Gas Testing - Downstream Pit (Pre-Cleaning)					Gas Testing - Upstream Pit (Post-Cleaning)					Gas Testing - Downstream Pit (Post-Cleaning)				
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%	VOC (ppm) - limit 100ppm	H2S (ppm) - limit 10ppm	CH4 (%) - record only	CO2 (%)	LEL (%) - limit 0.5%
D100-43	NA	P136	25	151.0367531	-33.82969244	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D225-7	P140	P141	25	151.036436	-33.82978154	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D225-8	P141	P142	25	151.0339511	-33.83048991	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Na	Na	NA	NA	NA	NA	NA	NA	NA	NA
D225-5	P138	P139	25	151.0363796	-33.82976528	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D225-6	P139	P140	25	151.0339349	-33.83048517	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D225-4	P137	P138	25	151.0362952	-33.82974152	15/10/2020	other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
26D610-1	26-P3	26-P4	26	-	-	18/11/2020	steel	-	-	-	-	-	0.1	0	0	0	0	-	-	-	-	-	0.4	0	0	0	0
26D610-2 & 3	26-P4	31-P2	26	-	-	18/11/2020	steel	-	-	-	-	-	0	0	0	0	0	-	-	-	-	-	1.9	0	0.1	0	0
1370-5	P190	P197	25	151.0382616	-33.83009273	19/11/2020	steel	0.1	0	0	0	0	2.1	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D1370-3	P148	P190	25	151.0355984	-33.83013114	19/11/2020	steel	2.1	0	0	0	0	0.1	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D1370-4	P190	P196	25	151.0365755	-33.83021145	19/11/2020	steel	0.1	0	0	0	0	2.1	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D150-10	P12	P12	23	151.0364989	-33.82791637	29/07/2020 2:00	steel	Pit only. Pipe capped off.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		No cleaning required	No - validation criteria met			No		No
D150-11, D150-9	P11	P11	23	151.0365086	-33.82790602	29/07/2020 2:00	steel	No cleaning required.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P11	No - validation criteria met			No		No
D150-4	P8a	P8	23	151.0364671	-33.82783972	29/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D150-4a	P14	P8a	23	151.0366778	-33.82786319	29/07/2020 2:00	steel	None, previously cleaned in 2018	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P8a	No - validation criteria met			No		No
D150-5	P15	P14	23	151.0369212	-33.82790841	29/07/2020 2:00	steel	Suck out only to expose pit	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned 2018 pipe work	No - validation criteria met			No		No
D150-8	P9	P11	23	151.0364777	-33.82790937	29/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect jar of water due to access limitations	No - validation criteria met			Yes		No
D200-3a	P8	P8b	23	151.0362488	-33.82782425	29/07/2020 2:00	steel	Unlocated pit not on drawing P8b	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
P150-12	P13	P13	23	151.03654	-33.82790945	29/07/2020 2:00	steel	No cleaning required. Previously cleaned in 2018	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P13	No - validation criteria met			No		No
D100-6	-	P24	23	151.0363601	-33.82797353	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Drain not flushed. No access into pit however pit was flushed from downstream P23	No - validation criteria met			No		No
D150-15	P22	P23	23	151.0363313	-33.82796586	30/07/2020 2:00			no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P22	No - validation criteria met			No		No
D150-16	P24	P23	23	151.0363696	-33.82797458	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-17	P23a	P23	23	151.0364246	-33.82801276	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P23	No - validation criteria met			No		No
D200-2	P10	P5	23	151.0360868	-33.82779835	30/07/2020 2:00			no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Grey appearance in water. No sheen.	yes	conduct additional round of flushing	4 rounds of flushing and changed head on jet for final flush.	No		No
D200-3b	P8c	P6	23	151.0360608	-33.82780929	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		2 redundant pipes capped leading into P6. D150-7 missing from pit. 2018 pipes flushed.	No - validation criteria met			No		No
D200-4	P39	P23	23	151.0363256	-33.82805031	30/07/2020 2:00	steel	Upstream pit inaccessible	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D250-1	P6	P20	23	151.0359562	-33.82789873	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P20	No - validation criteria met			No		No
D250-5	P21a	P21	23	151.0360604	-33.82794789	30/07/2020 2:00	steel	Downstream pit cannot be flushed due to the pit being filled with large concrete boulders. See photo	other	Unable to flush. No odour,	P21	No - validation criteria met			No		No
D250-6a	P23	P21b	23	151.036221	-33.82798648	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P21a	yes	conduct additional round of flushing	Extra flushing required until water runs clear	No	Section of pipe compromised within P21b fully encapsulated by cement pit. Water running clear.	No
D250-6b	P21b	P8b	23	151.0362338	-33.8279885	30/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No	Pipe in the centre of pit P21b has a slight crack however fully encapsulated by the concrete pit. No further action required.	No
D300-4	P6	P3	23	151.0358703	-33.82779106	30/07/2020 2:00	steel	Suck out from upstream pit only. Downstream pit inaccessible. Upstream pit cannot be flushed due to safety risk.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P6	No - validation criteria met		Multiple lines of evidence required for inaccessible P3 validation.	No		No
D150-19	P48	P39	23	151.0363471	-33.82811125	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P39	No - validation criteria met			No		No
D150-20	P49	P48	23	151.0365402	-33.82812194	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe flushed. Rise disconnected from lower section. Clean water spilling out slowly.	No - validation criteria met			No		No
D150-21	P50	P49	23	151.0366933	-33.8281325	31/07/2020 2:00	steel	Pipe work may be compromised as jetter only went inside pipe 2m.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Flush water clean.	yes	Excavate and remove impacted section of pipework	No investigation of compromised status required, within remedial excavation footprint	Yes	Possible blockage	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-28	P37	P38	23	151.0361437	-33.82819507	31/07/2020 2:00	steel					No - validation criteria met			No		No
D150-29	P39	P38	23	151.0362714	-33.82815081	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P39	No - validation criteria met			No		No
D150-8	P34a	P34	23	151.0359184	-33.82811561	31/07/2020 2:00	steel	Flushed start of pipe from downstream end and hit blockage. Cannot locate or access upstream pit	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Picture of water from end of pipe.	yes	impractical to complete further flushing - Document conditions and limitations	May require test pitting	Yes	Blockage	Yes - characterise surrounding soils
D250-2	P21	P20	23	151.0359869	-33.82793766	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D250-7, D250-7a, D25	P20	P34	23	151.0359367	-33.82800145	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P20	No - validation criteria met			No		No
D300-10	P35	P37	23	151.0361113	-33.82818086	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P37	No - validation criteria met			No		No
D300-9	P35	P34	23	151.0359948	-33.82815123	31/07/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P34	No - validation criteria met			No		No
No pipe. Pit only.	P33	P33	23	151.035936	-33.82808795	31/07/2020 2:00	concrete	Flushed pit only. No pipes.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P33	No - validation criteria met			No		No
No pipe. Pit only.	P33a	P33a	23	151.0359515	-33.82801	31/07/2020 2:00	concrete	Pit only. Can see pipe passing through pit. Pit cleaned.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P33a	No - validation criteria met			No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D150-109	P100	P100	24	151.0368898	-33.82886922	3/08/2020 2:00	concrete	Pit only.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P100. Pipe appears to pass through both sides of pit.	No - validation criteria met			No		No
D150-110	-	P101	24	151.0366047	-33.82891021	3/08/2020 2:00			no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-111	-	P101	24	151.0366223	-33.82890552	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-112	-	P101	24	151.0366924	-33.82895438	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-113	P101	P103	24	151.0366637	-33.82892501	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D300-11	P35	P36	23	151.0360168	-33.82821942	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D300-27	P95	P99	24	151.0368442	-33.82879928	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect flush water due to safety issues. Too deep.	yes	conduct additional round of flushing	3x additional flushes.	No		No
D300-28	P100	P103	24	151.0368947	-33.8289416	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		5x flushes and water was not becoming any clearer. Lots of sediment in pipe creating dirty looking water.	yes	conduct additional round of flushing	5x rounds of flushing	No		No
D300-5	P3	P18	23	151.035781	-33.82781587	3/08/2020 2:00	steel	Upstream pit unable to be located. Situated under thick concrete.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P18	No - validation criteria met			No		No
D300-6	P19	P18	23	151.0357365	-33.82795342	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P18	No - validation criteria met			No		No
D300-6	P18	P19	23	151.0357634	-33.82795991	3/08/2020 2:00	concrete	Pit only. Upstream of P18. Pipe cleaned from P18.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P19	No - validation criteria met			No		No
D300-7	P18	P27	23	151.0356877	-33.82807676	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D300-8	P36	P28	23	151.0359201	-33.82826401	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D300-9	P34	P35	23	151.0359534	-33.82815882	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D360-1	P28	P27	23	151.0356747	-33.82817172	3/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P28 inaccessible under concrete. Pipe flushed from downstream P27.	No - validation criteria met			No		No
D80-1	P35a	P35	23	151.0360339	-33.82817914	3/08/2020 2:00	steel	Pipe too small to send jetter up. All water coming out of pipe is not compromised. Unable to locate or access upstream pit.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P35 end of pipe close up image	No - validation criteria met			No		No
D100-35	-	P94	24	151.0365955	-33.82870968	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P94	No - validation criteria met		Unable to access pipe end.	No		No
D150-101	P97	P95	24	151.0366272	-33.82881835	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-102	-	P92	24	151.0364403	-33.82884789	4/08/2020 2:00	steel		other	Pipe not located in pit. Pit cleaned anyway. P92 in image.		No - validation criteria met			No		No
D150-103	-	P92	24	151.0364136	-33.82885778	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-107	-	P97	24	151.0366331	-33.82886193	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-108	-	P97	24	151.0366005	-33.82884806	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-86	-	P89	24	151.036483	-33.82863885	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned 2018. Photo of pit only.	No - validation criteria met			No		No
D150-87	-	P89	24	151.0364549	-33.82866253	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. Photo of pit only.	No - validation criteria met			No		No
D150-88	-	P89	24	151.03647	-33.8286044	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-89	-	P89	24	151.0364664	-33.82860809	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-93	-	P93	24	151.0365895	-33.82864572	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-94	-	P93	24	151.0365788	-33.82862514	4/08/2020 2:00	steel	Unable to flush D150-94 water pipe as pipe cannot be accessed by jetter. Unable to flush water pipe D100-32, 33, 34 as the pipe cannot be accessed by jetter. Can not locate upstream pit of this sequence of pipes.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D230-6	P90	P89	24	151.0364627	-33.82865653	4/08/2020 2:00	steel		other		Water still looking dirty after multiple flushes.	yes	impractical to complete further flushing - Document conditions and limitations	Will attempt flush from downstream pit P89.	No		No
D300-24	P91	P96	24	151.0365856	-33.82877891	4/08/2020 2:00	steel		other	Some residual sludge in pipe. Will flush from opposite end of pipe.		yes	impractical to complete further flushing - Document conditions and limitations	Will flush pipe from P91 to see if cleaning will work.	No	Pipe successfully flushed from P91.	No
D300-24	P91	P96	24	151.0366046	-33.82879018	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		5x flushes	yes	conduct additional round of flushing	5x flushes	No		No
D300-26	P94	P95	24	151.0366174	-33.82873562	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D300-27	P99	P95	24	151.0366342	-33.82878335	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect flush water due to safety concerns. Pipe already cleaned from P99.	No - validation criteria met			No		No
P230-6	P93	P94	24	151.0365945	-33.8286712	4/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		A lot of sediment present in flush water	yes	conduct additional round of flushing		No		No
D100-7	-	P26a	23	151.0369237	-33.82810475	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D100-7a	-	P26a	23	151.0368471	-33.82810547	5/08/2020 2:00	terracotta		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe broken. Appears to be a temporary drain.	yes	impractical to complete further flushing - Document conditions and limitations		No Access	Terracotta pipe not in situ	No - Unable to be located/ Inaccessible. No residual hydrocarbons noted within pipe despite being unable to clean
D150-22	-	P25	23	151.0367723	-33.82805262	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-23	-	P25	23	151.0368063	-33.82806452	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-24	P25	P26	23	151.036843	-33.82808962	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P25 riser. Unable to locate downstream end of pipe in P26.	yes	impractical to complete further flushing - Document conditions and limitations	Pipe is a riser and cannot be cleaned due to 90 degree bend	No Access	Unable to flush pipe, cannot access downstream end of pipe.	No - Unable to be located/ Inaccessible Downstream pit removed and drained as part of ERM 2019 remediation trials excavation
D150-25	P26b	P26	23	151.0369136	-33.82807889	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-25a	P26b	P26c	23	151.0369434	-33.82811318	5/08/2020 2:00	steel	Clean pit only. Pipe sealed off.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P26c	No - validation criteria met			No		No
D150-26	-	P26b	23	151.0369673	-33.82807726	5/08/2020 2:00	terracotta		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-26a	-	P26b	23	151.0369713	-33.82810526	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-27	P16	P17	23	151.0369265	-33.82804377	5/08/2020 2:00	other		other	Unable to locate pits or pipes	P26b in image facing north. Multiple digs unsuccessful.	yes	impractical to complete further flushing - Document conditions and limitations		No Access		No - Unable to be located/ Inaccessible Pits potentially removed during demolition of 'switch house'. 4m section of pipe, low potential for hydrocarbon impact
D150-31	P26c	P57	23	151.0369301	-33.8281905	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P57. Previously cleaned in 2018.	No - validation criteria met			No		No
D150-32	P40	P51	23	151.0364193	-33.82818522	5/08/2020 2:00	other	Cannot clean. No pit located.			Swamp area where pit should be. This is valid for pipes D150-41 & D150-42.	yes	impractical to complete further flushing - Document conditions and limitations	Pipe and pit likely removed during ERM 2019 Remediation Trials excavation	No Access	Cannot locate	No - Unable to be located/ Inaccessible Infrastructure removed as part of AEC-9 remedial excavation
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel	P51 cannot be located	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel	P51 cannot be located	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018.	No - validation criteria met			No		No
D150-36	P54	P55	23	151.0369044	-33.82824226	5/08/2020 2:00	steel		other	Under water	P55	yes	excavate and remove affected pipe and surrounding soils (AEC-9)		No Access	Under water	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-37	P55	P56	23	151.0369073	-33.82823647	5/08/2020 2:00	other		other	Underwater	View of area after multiple attempts at finding pits and pipe.	yes	excavate and remove affected pipe and surrounding soils (AEC-9)		No Access	Under sludge and water	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-38	P41	P40	23	151.0362701	-33.82820563	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-39	-	P40	23	151.0362734	-33.82820487	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe. Cannot access.	No - validation criteria met			No		No
D150-40	-	P40	23	151.0362901	-33.82820425	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe. Cannot access.	No - validation criteria met			No		No
D150-43	-	P52	23	151.0365282	-33.82824037	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-44	-	P52	23	151.036575	-33.82823811	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-47	P41	P56	23	151.0368754	-33.8282545	5/08/2020 2:00	steel		other	Under water	P56	yes	excavate and remove affected pipe and surrounding soils (AEC-9)		No Access	Under water	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-60	P65	P67a	23	151.0366755	-33.82841182	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-61	-	P67	23	151.0366745	-33.82836543	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		No pipe located.	yes	impractical to complete further flushing - Document conditions and limitations		No		No
D150-62	P66	P67	23	151.036707	-33.82837834	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P67. Previously cleaned in 2018.	No - validation criteria met			No		No
D150-63	-	P67	23	151.0367301	-33.8283757	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to locate pipe.	yes	impractical to complete further flushing - Document conditions and limitations		No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D150-65	P56	P68	23	151.0368301	-33.82838852	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. Couldn't flush as water level kept rising from adjacent water hole. Water entering P68 is clear.	No - validation criteria met			No		No
D150-65	P56	P68	23	151.0368534	-33.82831057	5/08/2020 2:00	other		other	Under water	P56	yes	excavate and remove affected pipe and surrounding soils (AEC-9)		No Access	Under water	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D200-7	P64	P67a	23	151.0366711	-33.82839246	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Riser only.	No - validation criteria met			No		No
D200-8	P67a	P68	23	151.0367483	-33.82839552	5/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P68. Down pipe.	No - validation criteria met			No		No
D100-15	P45	P59	23	151.0361406	-33.82826942	6/08/2020 2:00	steel		other	8x flushes. Black sludge still present.		yes	conduct additional round of flushing	8x flushes water still impacted.	Yes		No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-48	P58	P66	23	151.036654	-33.82836799	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Only jetted 4m due to obstruction.	yes	impractical to complete further flushing - Document conditions and limitations	Only jetted 4m due to obstruction.	Yes	Possible blockage	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-49	P58	P59	23	151.0362782	-33.82833538	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-50	-	P60	23	151.0363099	-33.82833865	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe under steel. Cannot access. Pit is clean. P60	No - validation criteria met			No		No
D150-51	P60	P59	23	151.036268	-33.82834737	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only	No - validation criteria met			No		No
D150-52	P58	P60	23	151.0362937	-33.82833521	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe	No - validation criteria met			No		No
D150-54	P61	P62	23	151.0363507	-33.82837126	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-55	-	P62	23	151.0363789	-33.82836774	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-56	-	P62	23	151.0363738	-33.82836815	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations		No		No
D150-57	-	P62	23	151.0363747	-33.82836711	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-59	P63	P64	23	151.0365136	-33.82836945	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met	conduct additional round of flushing		No		No
D150-60	-	P64	23	151.0365694	-33.82836815	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations		No		No
D150-64	-	P67a	23	151.0366839	-33.82843181	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Clean water ingressing from upstream. No flush.	No - validation criteria met	conduct additional round of flushing		No		No
D150-65	P56	P68	23	151.036823	-33.8283985	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Compromised pipe	yes	excavate and remove affected pipe and surrounding soils (AEC-9)		Yes	All pipe work in this area is compromised	No - infrastructure within AEC-9 excavation footprint, to be removed as part of remediation works
D150-67	-	P68	23	151.0368133	-33.82844778	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Rise only. Cannot flush pipe	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations		No		No
D200-5	P60	P62	23	151.0363549	-33.82835977	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D200-6	P62	P64	23	151.0365053	-33.82838764	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met	conduct additional round of flushing		No		No
D200-8	P67a	P68	23	151.0367795	-33.82842058	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D200-9	P69	P70	23	151.0365817	-33.82843345	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018.	No - validation criteria met			No		No
D200-9	P70	P69	23	151.0364074	-33.82839757	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D360-6	P46	P69	23	151.0363493	-33.82837737	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Riser in P69	No - validation criteria met			No		No
D360-6	P69	P46	23	151.0362106	-33.82837624	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. Image of P46.	yes	conduct additional round of flushing		No		No
D360-7	-	P69	23	151.0363931	-33.8284091	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
NA	-	P58	23	151.0362645	-33.82829695	6/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Empty pit. Riser only.	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations	Pipe is a riser and cannot be cleaned due to 90 degree bend	No		No
D100-31	-	P90	24	151.036481	-33.82871215	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only (1m section)	No - validation criteria met			No		No
D150-101	P92	P91	24	151.0364672	-33.82878453	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-90	-	P90	24	151.0364079	-33.82873641	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-91	-	P90	24	151.036412	-33.82868239	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to penetrate pipe	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations		No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D150-92	-	P90	24	151.0365056	-33.82870213	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D230-6	P89	P90	24	151.0364571	-33.82867393	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D300-22	P85	P91	24	151.0364191	-33.82877543	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect jar due to safety concerns	yes	conduct additional round of flushing		No		No
D300-24	P90	P91	24	151.0364674	-33.82877463	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect jar due to safety concerns	yes	conduct additional round of flushing		No		No
D300-24	P91	P90	24	151.0364524	-33.82873725	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Dark coloured water.	yes	conduct additional round of flushing		No		No
D360-2	P28	P29	23	151.0357617	-33.8282962	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P29. Image of riser. Cannot access upstream pit. Can't flush pipe.	yes	conduct additional round of flushing		No		No
D360-3	P32	P29	23	151.0357607	-33.82832075	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Flush from upstream end as pipe was dirty from downstream end.	yes	conduct additional round of flushing		No		No
D360-3	P29	P32	23	151.0358173	-33.82833023	7/08/2020 2:00	steel	Riser broken on upstream pipe so we chose to flush it as well.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. Image of P32. Dark water, no solids	yes	conduct additional round of flushing	Used large nozzle to flush. 4x additional flushes.	No		No
D360-4	P37	P32	23	151.0359285	-33.82833299	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. Image of P32. Dark water, no solids observed.	yes	conduct additional round of flushing	Used larger nozzle to flush. 4x flushes.	No		No
D360-5	P46	P37	23	151.0360826	-33.82835265	7/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P37. Water colour is dark, no solids in water. Lots of sand and sediment in bottom of pit.	yes	conduct additional round of flushing	Previously cleaned in 2018.	No		No
D510-1	P30a	P30	23	151.0357229	-33.82825668	11/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P30a	yes	conduct additional round of flushing	6x additional flushes.	No		No
D910-1	P4	P30	23	151.0357672	-33.8281998	11/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. P30	yes	conduct additional round of flushing		No		No
D910-2	P31	P30	23	151.0357692	-33.82827675	11/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. P31	yes	conduct additional round of flushing		No		No
D100-27	-	P79	24	151.0360274	-33.8286572	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Jetter blocked at entrance to pipe	yes	impractical to complete further flushing - Document conditions and limitations	Jetter blocked at entrance to pipe	No		No - 11m run of 100mm pipe. Potential residual sludge volume considered insignificant source of potential impact to soil and/or groundwater
D100-28	-	P79	24	151.0360415	-33.82867187	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D100-29	-	P15	24	151.0360539	-33.82870783	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P15. End of pipe closed off.	yes	impractical to complete further flushing - Document conditions and limitations	P15. End of pipe closed off.	No		No - 11m run of 100mm pipe. Potential residual sludge volume considered insignificant source of potential impact to soil and/or groundwater
D150-79	-	P78	24	151.0360408	-33.82856492	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-79a	-	P78	24	151.0360601	-33.82856085	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-80	-	P78	24	151.0360806	-33.82857418	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D230-3	P78	P79	24	151.0360444	-33.8286497	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D300-15	P76	P80	24	151.0360042	-33.8287292	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-16	P80	P79	24	151.0360519	-33.82868214	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D300-17	P82	P81	24	151.0360424	-33.82869279	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-17a	P81	P80	24	151.0360318	-33.82874773	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe not on map.	yes	conduct additional round of flushing		No		No
D300-18	P85	P80	24	151.0360461	-33.82872698	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D360-2	P29	P28	23	151.0357422	-33.82823304	12/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. P28	yes	conduct additional round of flushing	5x additional flushes	No		No
D150-68	-	P73	24	151.0356878	-33.82851534	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-69	-	P73	24	151.0357078	-33.8285342	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-70	-	P74	24	151.0356409	-33.82861764	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-71	-	P74	24	151.0356706	-33.82864321	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-72	-	P74	24	151.0356867	-33.82864266	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D150-73	-	P74	24	151.0356881	-33.82864476	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-74	P74a	P74	24	151.0356498	-33.82864903	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-75	-	P75	24	151.0358757	-33.82856018	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-76	-	P75	24	151.0358842	-33.82857318	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-77	-	P76	24	151.0358688	-33.82866462	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment in water	yes	conduct additional round of flushing	4x additional flushes	No		No
D150-78	-	P76	24	151.0358668	-33.82867539	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D225-1	P114	P82	24	151.0361206	-33.82892677	13/08/2020 2:00	steel	Pipe sealed at P114 end. No gas or odour. Only clean water coming out even though pipe was partially blocked.	no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D230-1	P74	P73	24	151.0356799	-33.82857435	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D230-2	P76	P75	24	151.0358672	-33.82860042	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	impractical to complete further flushing - Document conditions and limitations	Will attempt flush from P76 end of pipe work. Possible compromised pipe	No	Gravels in pipe however pipe is flushed from both ends. Not considered compromised after further investigation	No
D230-2	P75	P76	24	151.0358714	-33.82864689	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. Pipe appears blocked from backfill gravels.	yes	impractical to complete further flushing - Document conditions and limitations	Flushed from opposite end of pipe. Gravels in pipe	No	Gravels in pipe however pipe is flushed from both ends. No longer considered compromised after further investigation	No
D230-7	P104	P77	24	151.0358023	-33.82884601	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D230-8	P105	P104	24	151.0358313	-33.82897471	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D300-13	P76	P74	24	151.0356701	-33.82865125	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018.	yes	conduct additional round of flushing	5x additional flushes	No		No
D300-14	P77	P76	24	151.035867	-33.82869425	13/08/2020 2:00	steel		other	Pipe is capped with concrete		yes	impractical to complete further flushing - Document conditions and limitations	Attempt flush from P77	No	Capped pipe in P76	No
D300-15	P80	P76	24	151.0358621	-33.82870079	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-30	P108	P104	24	151.0358555	-33.82896859	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Previously cleaned in 2018. No pipe located ate. Appears to be sealed.	yes	impractical to complete further flushing - Document conditions and limitations		No	No reason to assume pipe is compromised	No
D300-31	P115	P114	24	151.0361283	-33.82898745	13/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D100-30	-	P84	24	151.0363328	-33.82869019	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe doesn't exist. Image of P84 eastern wall	No - validation criteria met			No		No
D150-82	-	P83	24	151.0362709	-33.82858068	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-83	-	P83	24	151.0362848	-33.82858399	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment present from debris	yes	conduct additional round of flushing		No		No
D150-84	-	P83	24	151.0362975	-33.82862338	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing	5x additional flushes	No		No
D150-85	-	P84	24	151.0362665	-33.82866852	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D230-4	P83	P84	24	151.0363001	-33.82866517	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		P84. Cleaned from both ends.	No - validation criteria met	conduct additional round of flushing		No		No
D230-4	P84	P83	24	151.0362785	-33.82863977	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		A lot of sediment flowing in from upstream pit. Will flush from other end.	yes	conduct additional round of flushing		No		No
D300-18	P80	P85	24	151.036252	-33.82873805	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D300-19	P85	P84	24	151.0362797	-33.82871332	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment in water	yes	conduct additional round of flushing		No		No
D300-20	P86	P85	24	151.036289	-33.82876562	14/08/2020 2:00	steel		other	Sealed pipe	P85	No - validation criteria met			No		No
D300-21	-	P85	24	151.0363023	-33.82873025	14/08/2020 2:00	steel		other	Doesn't exist		No - validation criteria met			No		No
D300-22	P88	P85	24	151.036322	-33.82875075	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment in water	yes	conduct additional round of flushing		No		No
D300-23	P91	P88	24	151.0363911	-33.82875003	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D300-37	-	P102	24	151.03674	-33.8289846	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment in water, grey appearance	yes	conduct additional round of flushing		No		No
D360-8	P102	P128	24	151.0368095	-33.82909763	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D375-1	P96	P88	24	151.0363924	-33.8287593	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D450-5	P80	P88	24	151.0363545	-33.82874819	14/08/2020 2:00	steel		other	No pipe	Didn't exist in pit	No - validation criteria met			No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D600-2	P118	P88	24	151.0363767	-33.82879622	14/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D100-39	-	P124	24	151.0365494	-33.82900095	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only	No - validation criteria met			No		No
D150-100	-	P86	24	151.0362359	-33.8288393	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-106	-	P119	24	151.036401	-33.82894667	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-11	P124	P125	24	151.0366345	-33.82911997	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-116	P132	P127	24	151.0366176	-33.82935626	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Down pipe only cannot flush	yes	impractical to complete further flushing - Document conditions and limitations		No		No
D200-1	-	P124	24	151.0365588	-33.82898883	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D200-12	P120	P119	24	151.0363954	-33.82899202	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Riser only. Pipe not flushed from this end.	No - validation criteria met			No		No
D200-12	P119	P120	24	151.0364239	-33.82910233	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe sealed at both ends, unable to flush	No - validation criteria met	impractical to complete further flushing - Document conditions and limitations		No Access	Sealed pipe	No - Unable to be located/ Inaccessible. Drain identified as 'not in use on shell refining plans. Low potential for residual hydrocarbon source
D200-13	-	P125	24	151.0366399	-33.82913229	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D200-14	-	P125	24	151.036653	-33.82912064	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D230-10	P116	P86	24	151.0362393	-33.8288274	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D250-10	P123	P120	24	151.0364408	-33.82915702	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-20	P85	P86	24	151.0362727	-33.82880887	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe was sealed at P85 end	yes	conduct additional round of flushing		No		No
D300-32	P116	P115	24	151.0361882	-33.82895845	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D300-33	P111	P115	24	151.0361458	-33.82905744	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-34	P119	P118	24	151.036378	-33.82895954	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D300-35	P124	P119	24	151.0364146	-33.82896863	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-36	P126	P127	24	151.0366185	-33.82930626	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-38	P103	P131	24	151.0368372	-33.82923007	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D300-39	-	P131	24	151.0368031	-33.82927608	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to collect jar due to safety concerns	yes	conduct additional round of flushing		No		No
D360-9	P128	P129	24	151.0367729	-33.82925207	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D380-1	-	P130	24	151.0367191	-33.82935915	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Riser only in P130	yes	impractical to complete further flushing - Document conditions and limitations	Pipe is a riser and cannot be cleaned due to 90 degree bend	No		No
D410-1	P130	P127	24	151.0367037	-33.82935382	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D410-2	P129	P130	24	151.036757	-33.8293058	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D600-3	P117	P118	24	151.036326	-33.82896943	17/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. Down pipe only	No - validation criteria met			No		No
D150-101	-	P87	24	151.036398	-33.82881462	18/08/2020 2:00	terracotta		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-114	-	P121	24	151.0362268	-33.82925567	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-115	-	P122	24	151.0363117	-33.82928421	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-98	P73a	P87a	24	151.0360303	-33.82879324	18/08/2020 2:00	terracotta		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-99	P87	P87a	24	151.036097	-33.82880456	18/08/2020 2:00	terracotta		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D250-10	P120	P123	24	151.0364327	-33.82924767	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D250-12	P126	P125	24	151.0366174	-33.8291623	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pipe is capped with concrete at both ends. Image of P125. No gas detected.	No - validation criteria met			No		No
D460-3	P122	P121	24	151.0362519	-33.82928979	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D460-4	P123	P122	24	151.0363188	-33.82928702	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D460-5	P127	P123	24	151.0364747	-33.8293335	18/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D200-16	P150	P151	25	151.0357945	-33.82967799	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing	3x additional flushes	No		No
D200-17	P151	P156	25	151.0359241	-33.82968726	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Sediment present in flush water	yes	conduct additional round of flushing		No		No
D200-18a	-	P152	25	151.0357259	-33.82985364	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pit cleaned in 2018	yes	conduct additional round of flushing		No		No
D200-18b	-	P152	25	151.0357294	-33.82985473	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pit cleaned in 2018	No - validation criteria met			No		No
D200-20	P157	P156	25	151.0359804	-33.82972347	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing	3x additional flushes	No		No
D600-3	P118	P117	24	151.0361832	-33.82904726	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D600-4	P111	P117	24	151.0361406	-33.82906909	19/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. Pit stained black.	yes	conduct additional round of flushing	4x additional flushes	No		No
NA	P150	P150	25	151.0356926	-33.82969568	19/08/2020 2:00	concrete		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Pit only. Riser for pipe D200-16 present	No - validation criteria met			No		No
D150-118	-	P179a	25	151.0366626	-33.82991063	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-120	-	P155	25	151.0358163	-33.82986261	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing	4x additional flushes	No		No
D150-120a	-	P157	25	151.0359773	-33.82981818	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Black tar stuck on outside of jar from cleaning pipe. Water is clear	yes	conduct additional round of flushing		No		No
D150-121	-	P160	25	151.0360909	-33.82980842	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D150-122	-	P160	25	151.0360852	-33.82978407	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing	3x additional flushes	No		No
D150-123	-	P160	25	151.0360496	-33.82984618	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-125	-	P163	25	151.036168	-33.82987329	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Jar is stained water is clear	yes	conduct additional round of flushing		No		No
D150-125a	-	P163	25	151.0361796	-33.8298533	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Jar is stained water is clear	yes	conduct additional round of flushing		No		No
D150-126	-	P174	25	151.0363054	-33.8298769	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Water is clear. Sucked thick tar like substance out of pipe and covered sample jar	yes	conduct additional round of flushing	Flushed for 10 minutes	No		No
D150-126a	-	P174	25	151.0362859	-33.82987099	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Water from pipe is clear. Sample jar is stained from previous sample	yes	conduct additional round of flushing		No		No
D150-127	-	P179	25	151.0364799	-33.82989391	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Unable to enter pipe	yes	impractical to complete further flushing - Document conditions and limitations	No access to pipe	No Access	Cannot access pipe with jetter	No - Inaccessible for cleaning due to partial filling of pit with cement. 3m section of 150mm pipe.
D150-128	-	P179	25	151.0364713	-33.82991734	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-129	-	P179	25	151.0364587	-33.82992224	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D150-130	P153	P149	25	151.0355461	-33.8299012	20/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	No - validation criteria met			No		No
D150-24	-	P163	25	151.0361451	-33.82987321	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing	5x additional flushes	No		No
D200-18	P152	P155	25	151.0357623	-33.82981734	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D200-19	P155	P157	25	151.0359399	-33.82980708	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No
D200-21	P143	P179a	25	151.0366881	-33.82991964	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D200-22	P144	P146	25	151.0367329	-33.82984995	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D200-23	P146	P179a	25	151.0366861	-33.82991747	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			No - validation criteria met			No		No
D250-13	P157	P160	25	151.0360074	-33.8298225	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018. Pit could not be cleaned any deeper and the sediment was being stirred around during jetting.	yes	conduct additional round of flushing		No		No
D250-14	P160	P163	25	151.0361282	-33.82985854	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			yes	conduct additional round of flushing		No		No
D300-42	P163	P174	25	151.0362509	-33.82987497	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	No - validation criteria met			No		No

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D300-43	P174	P179	25	151.0364176	-33.82989706	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D360-10	P179	P179a	25	151.036648	-33.82992128	20/08/2020 2:00	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)		Cleaned in 2018	Yes	conduct additional round of flushing		No		No
D150-131	P158	P153	25	151.0357255	-33.82990695	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D150-132	NA	P154	25	151.0357212	-33.83005023	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No		No
D150-133	P159	P154	25	151.035779	-33.8300657	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	No - validation criteria met			No		No
D150-134	P159	P158	25	151.0358807	-33.82996248	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D150-135	P162	P159	25	151.0359018	-33.83006603	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	No - validation criteria met			No		No
D150-136	P165	P162	25	151.0360129	-33.83009722	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Sediment present in sample	No - validation criteria met			No		No
D150-141	P184	P180	25	151.0363949	-33.83001817	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018. Pit stained black.	yes	conduct additional round of flushing		No		No
D150-143	P182	P183	25	151.0364887	-33.83007064	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D150-144	P131	P183	25	151.0365069	-33.83006268	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D150-144a	NA	P181	25	151.0364947	-33.83001298	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Pipe not on map. Jar stained from sampling water, water is clear	yes	conduct additional round of flushing		No		No
D150-145	NA	P183	25	151.0365137	-33.83010484	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D250-15	P161	P158	25	151.0359447	-33.82994844	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing	4x additional flushes	No		No
D250-16	P161	P164	25	151.036039	-33.82996445	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	No - validation criteria met			No		No
D250-17	P165	P164	25	151.0360788	-33.82998364	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D250-18	P175	P164	25	151.0360844	-33.82996449	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing	5x additional flushes	No		No
D250-18a	NA	P164	25	151.0360794	-33.82994441	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Pipe not on map	yes	conduct additional round of flushing	6x additional flushes	No		No
D250-18a	NA	P175	25	151.0362136	-33.82996348	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Pipe not on map	yes	conduct additional round of flushing		No		No
D250-19	P176	P175	25	151.0362084	-33.82999994	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing		No		No
D300-44	P180	P175	25	151.0362545	-33.82996398	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018. Pit stained black.	yes	conduct additional round of flushing	5x additional flushes	No		No
D300-45	P181	P180	25	151.0364417	-33.82999479	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018. Pit stained black.	yes	conduct additional round of flushing		No		No
D300-46	P186	P181	25	151.0365228	-33.83000338	21/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Cleaned in 2018	yes	conduct additional round of flushing	4x additional flushes	No		No
D100-46	NA	P186	25	151.0366342	-33.8300411	25/08/2020 2:00	steel	Initially blocked with sand. Flushed to remove.	no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No		No
D100-48	NA	P184	25	151.036396	-33.83008305	25/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D150-137	P169	P173	25	151.0360484	-33.830146	25/08/2020 2:00	steel	Pit filled blank sand- attempted to flush and remove	no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No		No
D150-138	P178	P173	25	151.036027	-33.83013787	25/08/2020 2:00	steel	Pit filled with sand , attempted to flush and remove	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing		No		No
D150-138	P173	P178	25	151.0361879	-33.83016054	25/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Slightly grey water, no suspended sludge particles	yes	conduct additional round of flushing	Two rounds of flushing	No		No
D150-141	P180	P184	25	151.0363988	-33.8300789	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No		No
D150-142	NA	P182	25	151.0364318	-33.83005128	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's		Clear water, bad lighting	No - validation criteria met			No		No
D150-143	P183	P182	25	151.0364441	-33.83005753	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's		Unclear photos, water clear	No - validation criteria met			No		No
D150-143a	NA	P182	25	151.0364224	-33.83008104	25/08/2020 2:00	steel	Unidentified pipe (not on maps), 3m long	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Three rounds of flushing	No		No
D150-143b	NA	P182	25	151.0364384	-33.83007584	25/08/2020 2:00	steel	Unidentified pipe (not on maps), 1m long	no visual evidence of contamination or residual hydrocarbon sludge's		Clear water, photo not clear	No - validation criteria met			No		No
D250-18	P175	P176	25	151.0362296	-33.83008439	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No		No
D250-19	P176	P177	25	151.0361555	-33.83010736	25/08/2020 2:00	steel	Previously cleaned and flushed through previously run	no visual evidence of contamination or residual hydrocarbon sludge's		No photo taken, clear water observed	No - validation criteria met			No		No
D250-19	P177	P176	25	151.0362096	-33.83009604	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D250-20	P177	P178	25	151.0361814	-33.8301662	25/08/2020 2:00	steel	Previously cleaned pipe, flushed through from previous run	no visual evidence of contamination or residual hydrocarbon sludge's		Clean water, no suspended sludge particles, no photo taken	No - validation criteria met			No		No
D250-20	P178	P177	25	151.0361562	-33.83010505	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D250-20a	NA	P178	25	151.0361694	-33.83017672	25/08/2020 2:00	steel	Unidentified pipe (not on maps), 5m long	no visual evidence of contamination or residual hydrocarbon sludge's		Slightly grey water, no black sludge solids	yes	conduct additional round of flushing	Conducted seven rounds of flushing	No		No
D300-46	P181	P186	25	151.0366742	-33.83005585	25/08/2020 2:00	steel	Previously cleaned	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D410-3	P179a	P186	25	151.036631	-33.83004709	25/08/2020 2:00	steel	Previously cleaned pipe	no visual evidence of contamination or residual hydrocarbon sludge's		Photo of cleaned pipe	No - validation criteria met			No		No
D510-1	NA	P186	25	151.0366842	-33.83003879	25/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D150-137	P173	P169	25	151.0360195	-33.83016666	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Staining on jar from previous rounds	yes		Two rounds of flushing	No		No
D150-139	NA	P173	25	151.0360433	-33.8301742	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's			No - validation criteria met			No	Pipe does not exist	No
D150-140	NA	P173	25	151.0360392	-33.83016071	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Downward pipe- cannot flush	yes	impractical to complete further flushing - Document conditions and limitations		No Access	Unable to flush, no visible evidence of contamination	No - Inaccessible for cleaning due to 90 degree bend in pipe. 5m section of 150mm pipe.
D230-11	NA	P147	25	151.0355457	-33.8297875	26/08/2020 2:00	other	Unable to clean	no visual evidence of contamination or residual hydrocarbon sludge's		Unable to locate pit	yes	impractical to complete further flushing - Document conditions and limitations	Couldn't locate pit after excavator searched for pit.	No Access	Cannot locate pit	No - Unable to be located/ Inaccessible. Drain identified as 'not in use on shell refining plans. Low potential for residual hydrocarbon source

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
D230-12	NA	P189	25	151.0354706	-33.83008217	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Brown water due to soil	yes	conduct additional round of flushing	Two rounds of flushing	No		No
D250-21	NA	P191	25	151.03588	-33.83021683	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Photo of pit	No - validation criteria met		Pipe does not exist	No		No - pipe does not exist
D250-22	P191	P192	25	151.0359614	-33.83024918	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Grey water with sediments & sand	yes	conduct additional round of flushing	Two rounds of flushing	No		No
D250-23	P193a	P192	25	151.0359594	-33.83023765	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Slightly grey water	yes	conduct additional round of flushing	Two rounds of flushing	No		No
D300-12a	NA	P189	25	151.0355114	-33.83013376	26/08/2020 2:00	steel	Pipe not on maps	no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Two rounds of flushing	No		No
D300-44b	NA- channel	P189	25	151.0355017	-33.83011591	26/08/2020 2:00	steel	Plant material in pipe, water mixing with soil down water	no visual evidence of contamination or residual hydrocarbon sludge's		Brown water from soil	yes	conduct additional round of flushing	Two rounds of flushing	No		No
D300-49	NA-Channel	P194	25	151.0364783	-33.83027575	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's			yes	impractical to complete further flushing - Document conditions and limitations		Yes	Potential blockage- Could only enter pipe 1 m with jetter, but water coming out was clear. Pipe only 90mm wide	Yes - characterise surrounding soils
D300-49a	NA - channel	P192	25	151.0359393	-33.83024625	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Grey water, suspended sediments present	yes	conduct additional round of flushing	Three rounds of flushing	No		No
D300-50	NA- channel	P195	25	151.0364986	-33.83027839	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Slightly grey water	yes	conduct additional round of flushing	Three rounds of flushing	No		No
P193 (Pit only)	NA	P193	25	151.0361198	-33.83021771	26/08/2020 2:00	steel		no visual evidence of contamination or residual hydrocarbon sludge's		Photo of pit	yes	impractical to complete further flushing - Document conditions and limitations	Cannot uncover pit	No Access	Pit appears to be filled with concrete.	No - Unable to be located/ Inaccessible
D100-16	NA	D100-16	23	151.0361407	-33.82838923	3/09/2020	steel					yes	conduct additional round of flushing	Conducted two rounds of flushing	No		No
D100-17	NA	D100-17	23	151.0360939	-33.8283907	3/09/2020	steel					yes	conduct additional round of flushing	Conducted two rounds of flushing	No		No
12D150-9	12-P9 (unable to locate)	12-P13	12	151.0351393	-33.83130228	2/10/2020 5:31	steel	Unable to clean	other		NO PICTURE	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as jetter couldn't not be put fully through pipe (only extends 0.5m), potentially blocked, however no evidence of hydrocarbon contamination (no odours, no VOCs)	No	-	No - pipes are exposed at ground level, evidence of residual hydrocarbons
26D200-1	NA	26-P5	26	151.0361008	-33.83054032	2/10/2020 5:31	other	Unable to clean, hardened tar in pit, unable to gurney out or excavate out	other		Picture of pit	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pit as it is blocked with hardened tar, pit is too narrow to excavate out material and cannot gurney out material	No	-	No - presence of residual solidified tar is considered to pose negligible risk of impacting surrounding soil and/or groundwater due to immobility should pipe be compromised in future
26D150-4	NA	26-P7 (appears to be a septic tank)	26	151.0366545	-33.83052712	2/10/2020 5:31	terracotta	Did not clean	other		Picture of pit	yes	impractical to complete further flushing - Document conditions and limitations	Pit appears to be a septic tank, strong sewer odours, did not clean as no evidence of hydrocarbons (no odours, VOCs, staining within pit)	No	-	No
12D150-8	12-P12	12-P13	12	151.035167	-33.8312421	2/10/2020 5:31	steel		other		Picture of pipe	yes	impractical to complete further flushing - Document conditions and limitations	Unable to send jetter fully through pipe, stuck at 1m potentially blocked, jetter water coming back (not collapsed/broken)	No	-	No - pipes are exposed at ground level, evidence of residual hydrocarbons
12D150-7	NA	12-P12	12	151.034838	-33.83137554	2/10/2020 5:31	steel	Unable to put jetter through pipe	other		Picture of exposed pipe	yes	impractical to complete further flushing - Document conditions and limitations	Unable to jet pipe- potentially blocked, pipe exposed but unable to tell if it is broken, however no evidence of hydrocarbons (no odours, no VOCs)	No	-	No - pipes are exposed at ground level, evidence of residual hydrocarbons
D300-40	P145 (concreted over)	P185	25	151.0362503	-33.83024109	8/10/2020	steel		no visual evidence of contamination or residual hydrocarbon sludge's			yes	conduct additional round of flushing	Conducted seven rounds of flushing	No	-	No
D150-119	P134	P135	25	151.0365483	-33.82955918	15/10/2020	other	Unable to clean	other		PICTURE OF PIT	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D100-45	P143	P145	25	151.0366704	-33.82980826	15/10/2020	other	Unable to clean			NO PICTURE	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D100-44	P143	P142	25	151.0365395	-33.82979022	15/10/2020	other	Unable to clean pipe			No picture	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-2	P133	P134	25	151.0363084	-33.82954809	15/10/2020	other	Unable to clean	other		Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D100-41	NA	P136	25	151.0367393	-33.82960094	15/10/2020	other	Unable to clean	other	Picture of pit	Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-3	P137	P137	25	151.0362104	-33.82962997	15/10/2020	other	Unable to clean pipe	other		Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D100-42	NA	P136	25	151.0367807	-33.82958897	15/10/2020	other	Unable to clean	other		Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present

Pipe Details								Post Cleaning Conditions				Validation Outcomes					
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Cleaning Process Notes (optional)	Flush Water/ CCTV/visual Observations	Other - Flush Water/ CCTV/visual Observations	Visual Observations Comment	Contingency Actions Required? (as per SAQP)	Contingencies Implemented	Contingency additional notes	Compromised Pipework Identified?	If Yes Specify	Further Validation/ Decommissioning Action Required
											Pits received clean water from CCR (office area) - hydrocarbon impact unlikely			Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)			No - Unable to be located/ Inaccessible.
D100-43	NA	P136	25	151.0367531	-33.82969244	15/10/2020	other	Unable to clean				yes	impractical to complete further flushing - Document conditions and limitations		No	-	Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-7	P140	P141	25	151.036436	-33.82978154	15/10/2020	other	Unable to clean			Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-8	P141	P142	25	151.0339511	-33.83048991	15/10/2020	other	Unable to clean			Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-5	P138	P139	25	151.0363796	-33.82976528	15/10/2020	other	Unable to clean			Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-6	P139	P140	25	151.0339349	-33.83048517	15/10/2020	other	Unable to clean			Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
D225-4	P137	P138	25	151.0362952	-33.82974152	15/10/2020	other	Unable to clean			Pits received clean water from CCR (office area) - hydrocarbon impact unlikely	yes	impractical to complete further flushing - Document conditions and limitations	Unable to clean pipe as pits are filled with backfill and blocks of concrete- unable to remove from pit as pits are deep but narrow (potentially from liberty demo to make pits safe)	No	-	No - Unable to be located/ Inaccessible. Pits received rainwater from CCR (no hydrocarbons expected to be present
26D610-1	26-P3	26-P4	26	-	-	18/11/2020	steel		no visual evidence of contamination (hydrocarbon sludge's/ liquid free phase hydrocarbons)			no			No		No
26D610-2 & 3	26-P4	31-P2	26	-	-	18/11/2020	steel	Attempted cleaning. No improvement noted after 5 x flushes of lines	other	Thick free product still present	Sample Collected of residual sludge	yes	impractical to complete further flushing - Document conditions and limitations for management under LTEMP	Unable to practically clean due to large volume of sediment build-up in pipes. Pits were cleaned to enable proper backfill and plug between pipe sections	No		Yes - Due to large diameter and volume of residual sludge, Residual Conditions will be documented in LTEMP
1370-5	P190	P197	25	151.0382616	-33.83009273	19/11/2020	steel	Unable to clean			Sample Collected of residual sludge	yes	impractical to complete further flushing - Document conditions and limitations for management under LTEMP	Unable to practically clean due to large volume of sediment build-up in pipes. Pits were cleaned to enable proper backfill and plug between pipe sections	No		Yes - Due to large diameter and volume of residual sludge, Residual Conditions will be documented in LTEMP
D1370-3	P148	P190	25	151.0355984	-33.83013114	19/11/2020	steel	Unable to clean			Sample Collected of residual sludge	yes	impractical to complete further flushing - Document conditions and limitations for management under LTEMP	Unable to practically clean due to large volume of sediment build-up in pipes. Pits were cleaned to enable proper backfill and plug between pipe sections	No		Yes - Due to large diameter and volume of residual sludge, Residual Conditions will be documented in LTEMP
D1370-4	P190	P196	25	151.0365755	-33.83021145	19/11/2020	steel	Unable to clean			Sample Collected of residual sludge	yes	impractical to complete further flushing - Document conditions and limitations for management under LTEMP	Unable to practically clean due to large volume of sediment build-up in pipes. Pits were cleaned to enable proper backfill and plug between pipe sections	No		Yes - Due to large diameter and volume of residual sludge, Residual Conditions will be documented in LTEMP

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D150-10	P12	P12	23	151.0364989	-33.82791637	29/07/2020 2:00	steel				Yes
D150-11, D150-9	P11	P11	23	151.0365086	-33.82790602	29/07/2020 2:00	steel				Yes
D150-4	P8a	P8	23	151.0364671	-33.82783972	29/07/2020 2:00	steel				Yes
D150-4a	P14	P8a	23	151.0366778	-33.82786319	29/07/2020 2:00	steel				Yes
D150-5	P15	P14	23	151.0369212	-33.82790841	29/07/2020 2:00	steel				Yes
D150-8	P9	P11	23	151.0364777	-33.82790937	29/07/2020 2:00	steel				Yes
D200-3a	P8	P8b	23	151.0362488	-33.82782425	29/07/2020 2:00	steel				Yes
P150-12	P13	P13	23	151.03654	-33.82790945	29/07/2020 2:00	steel				Yes
D100-6	-	P24	23	151.0363601	-33.82797353	30/07/2020 2:00	steel				Yes
D150-15	P22	P23	23	151.0363313	-33.82796586	30/07/2020 2:00					Yes
D150-16	P24	P23	23	151.0363696	-33.82797458	30/07/2020 2:00	steel				Yes
D150-17	P23a	P23	23	151.0364246	-33.82801276	30/07/2020 2:00	steel				Yes
D200-2	P10	P5	23	151.0360868	-33.82779835	30/07/2020 2:00					Yes
D200-3b	P8c	P6	23	151.0360608	-33.82780929	30/07/2020 2:00	steel				Yes
D200-4	P39	P23	23	151.0363256	-33.82805031	30/07/2020 2:00	steel				Yes
D250-1	P6	P20	23	151.0359562	-33.82789873	30/07/2020 2:00	steel				Yes
D250-5	P21a	P21	23	151.0360604	-33.82794789	30/07/2020 2:00	steel				Yes
D250-6a	P23	P21b	23	151.036221	-33.82798648	30/07/2020 2:00	steel				Yes
D250-6b	P21b	P8b	23	151.0362338	-33.8279885	30/07/2020 2:00	steel				Yes
D300-4	P6	P3	23	151.0358703	-33.82779106	30/07/2020 2:00	steel				Yes
D150-19	P48	P39	23	151.0363471	-33.82811125	31/07/2020 2:00	steel				Yes
D150-20	P49	P48	23	151.0365402	-33.82812194	31/07/2020 2:00	steel				Yes
D150-21	P50	P49	23	151.0366933	-33.8281325	31/07/2020 2:00	steel				Yes
D150-28	P37	P38	23	151.0361437	-33.82819507	31/07/2020 2:00	steel				Yes
D150-29	P39	P38	23	151.0362714	-33.82815081	31/07/2020 2:00	steel				Yes
D150-8	P34a	P34	23	151.0359184	-33.82811561	31/07/2020 2:00	steel	10m	1	1 - TP20/19	Yes
D250-2	P21	P20	23	151.0359869	-33.82793766	31/07/2020 2:00	steel				Yes
D250-7, D250-7a, D25	P20	P34	23	151.0359367	-33.82800145	31/07/2020 2:00	steel				Yes
D300-10	P35	P37	23	151.0361113	-33.82818086	31/07/2020 2:00	steel				Yes
D300-9	P35	P34	23	151.0359948	-33.82815123	31/07/2020 2:00	steel				Yes
No pipe. Pit only.	P33	P33	23	151.035936	-33.82808795	31/07/2020 2:00	concrete				Yes
No pipe. Pit only.	P33a	P33a	23	151.0359515	-33.82801	31/07/2020 2:00	concrete				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D150-109	P100	P100	24	151.0368898	-33.82886922	3/08/2020 2:00	concrete				Yes
D150-110	-	P101	24	151.0366047	-33.82891021	3/08/2020 2:00					Yes
D150-111	-	P101	24	151.0366223	-33.82890552	3/08/2020 2:00	steel				Yes
D150-112	-	P101	24	151.0366924	-33.82895438	3/08/2020 2:00	steel				Yes
D150-113	P101	P103	24	151.0366637	-33.82892501	3/08/2020 2:00	steel				Yes
D300-11	P35	P36	23	151.0360168	-33.82821942	3/08/2020 2:00	steel				Yes
D300-27	P95	P99	24	151.0368442	-33.82879928	3/08/2020 2:00	steel				Yes
D300-28	P100	P103	24	151.0368947	-33.8289416	3/08/2020 2:00	steel				Yes
D300-5	P3	P18	23	151.035781	-33.82781587	3/08/2020 2:00	steel				Yes
D300-6	P19	P18	23	151.0357365	-33.82795342	3/08/2020 2:00	steel				Yes
D300-6	P18	P19	23	151.0357634	-33.82795991	3/08/2020 2:00	concrete				Yes
D300-7	P18	P27	23	151.0356877	-33.82807676	3/08/2020 2:00	steel				Yes
D300-8	P36	P28	23	151.0359201	-33.82826401	3/08/2020 2:00	steel				Yes
D300-9	P34	P35	23	151.0359534	-33.82815882	3/08/2020 2:00	steel				Yes
D360-1	P28	P27	23	151.0356747	-33.82817172	3/08/2020 2:00	steel				Yes
D80-1	P35a	P35	23	151.0360339	-33.82817914	3/08/2020 2:00	steel				Yes
D100-35	-	P94	24	151.0365955	-33.82870968	4/08/2020 2:00	steel				Yes
D150-101	P97	P95	24	151.0366272	-33.82881835	4/08/2020 2:00	steel				Yes
D150-102	-	P92	24	151.0364403	-33.82884789	4/08/2020 2:00	steel				Yes
D150-103	-	P92	24	151.0364136	-33.82885778	4/08/2020 2:00	steel				Yes
D150-107	-	P97	24	151.0366331	-33.82886193	4/08/2020 2:00	steel				Yes
D150-108	-	P97	24	151.0366005	-33.82884806	4/08/2020 2:00	steel				Yes
D150-86	-	P89	24	151.036483	-33.82863885	4/08/2020 2:00	steel				Yes
D150-87	-	P89	24	151.0364549	-33.82866253	4/08/2020 2:00	steel				Yes
D150-88	-	P89	24	151.03647	-33.8286044	4/08/2020 2:00	steel				Yes
D150-89	-	P89	24	151.0364664	-33.82860809	4/08/2020 2:00	steel				Yes
D150-93	-	P93	24	151.0365895	-33.82864572	4/08/2020 2:00	steel				Yes
D150-94	-	P93	24	151.0365788	-33.82862514	4/08/2020 2:00	steel				Yes
D230-6	P90	P89	24	151.0364627	-33.82865653	4/08/2020 2:00	steel				Yes
D300-24	P91	P96	24	151.0365856	-33.82877891	4/08/2020 2:00	steel				Yes
D300-24	P91	P96	24	151.0366046	-33.82879018	4/08/2020 2:00	steel				Yes
D300-26	P94	P95	24	151.0366174	-33.82873562	4/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D300-27	P99	P95	24	151.0366342	-33.82878335	4/08/2020 2:00	steel				Yes
P230-6	P93	P94	24	151.0365945	-33.8286712	4/08/2020 2:00	steel				Yes
D100-7	-	P26a	23	151.0369237	-33.82810475	5/08/2020 2:00	steel				Yes
D100-7a	-	P26a	23	151.0368471	-33.82810547	5/08/2020 2:00	terracotta				Yes
D150-22	-	P25	23	151.0367723	-33.82805262	5/08/2020 2:00	steel				Yes
D150-23	-	P25	23	151.0368063	-33.82806452	5/08/2020 2:00	steel				Yes
D150-24	P25	P26	23	151.036843	-33.82808962	5/08/2020 2:00	steel				Yes
D150-25	P26b	P26	23	151.0369136	-33.82807889	5/08/2020 2:00	steel				Yes
D150-25a	P26b	P26c	23	151.0369434	-33.82811318	5/08/2020 2:00	steel				Yes
D150-26	-	P26b	23	151.0369673	-33.82807726	5/08/2020 2:00	terracotta				Yes
D150-26a	-	P26b	23	151.0369713	-33.82810526	5/08/2020 2:00	steel				Yes
D150-27	P16	P17	23	151.0369265	-33.82804377	5/08/2020 2:00	other				Yes
D150-31	P26c	P57	23	151.0369301	-33.8281905	5/08/2020 2:00	steel				Yes
D150-32	P40	P51	23	151.0364193	-33.82818522	5/08/2020 2:00	other				Yes
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel				Yes
D150-33	P51	P52	23	151.036528	-33.82822709	5/08/2020 2:00	steel				Yes
D150-36	P54	P55	23	151.0369044	-33.82824226	5/08/2020 2:00	steel				Yes
D150-37	P55	P56	23	151.0369073	-33.82823647	5/08/2020 2:00	other				Yes
D150-38	P41	P40	23	151.0362701	-33.82820563	5/08/2020 2:00	steel				Yes
D150-39	-	P40	23	151.0362734	-33.82820487	5/08/2020 2:00	steel				Yes
D150-40	-	P40	23	151.0362901	-33.82820425	5/08/2020 2:00	steel				Yes
D150-43	-	P52	23	151.0365282	-33.82824037	5/08/2020 2:00	steel				Yes
D150-44	-	P52	23	151.036575	-33.82823811	5/08/2020 2:00	steel				Yes
D150-47	P41	P56	23	151.0368754	-33.8282545	5/08/2020 2:00	steel				Yes
D150-60	P65	P67a	23	151.0366755	-33.82841182	5/08/2020 2:00	steel				Yes
D150-61	-	P67	23	151.0366745	-33.82836543	5/08/2020 2:00	steel				Yes
D150-62	P66	P67	23	151.036707	-33.82837834	5/08/2020 2:00	steel				Yes
D150-63	-	P67	23	151.0367301	-33.8283757	5/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D150-65	P56	P68	23	151.0368301	-33.82838852	5/08/2020 2:00	steel				Yes
D150-65	P56	P68	23	151.0368534	-33.82831057	5/08/2020 2:00	other				Yes
D200-7	P64	P67a	23	151.0366711	-33.82839246	5/08/2020 2:00	steel				Yes
D200-8	P67a	P68	23	151.0367483	-33.82839552	5/08/2020 2:00	steel				Yes
D100-15	P45	P59	23	151.0361406	-33.82826942	6/08/2020 2:00	steel				Yes
D150-48	P58	P66	23	151.036654	-33.82836799	6/08/2020 2:00	steel				Yes
D150-49	P58	P59	23	151.0362782	-33.82833538	6/08/2020 2:00	steel				Yes
D150-50	-	P60	23	151.0363099	-33.82833865	6/08/2020 2:00	steel				Yes
D150-51	P60	P59	23	151.036268	-33.82834737	6/08/2020 2:00	steel				Yes
D150-52	P58	P60	23	151.0362937	-33.82833521	6/08/2020 2:00	steel				Yes
D150-54	P61	P62	23	151.0363507	-33.82837126	6/08/2020 2:00	steel				Yes
D150-55	-	P62	23	151.0363789	-33.82836774	6/08/2020 2:00	steel				Yes
D150-56	-	P62	23	151.0363738	-33.82836815	6/08/2020 2:00	steel				Yes
D150-57	-	P62	23	151.0363747	-33.82836711	6/08/2020 2:00	steel				Yes
D150-59	P63	P64	23	151.0365136	-33.82836945	6/08/2020 2:00	steel				Yes
D150-60	-	P64	23	151.0365694	-33.82836815	6/08/2020 2:00	steel				Yes
D150-64	-	P67a	23	151.0366839	-33.82843181	6/08/2020 2:00	steel				Yes
D150-65	P56	P68	23	151.036823	-33.8283985	6/08/2020 2:00	steel				Yes
D150-67	-	P68	23	151.0368133	-33.82844778	6/08/2020 2:00	steel				Yes
D200-5	P60	P62	23	151.0363549	-33.82835977	6/08/2020 2:00	steel				Yes
D200-6	P62	P64	23	151.0365053	-33.82838764	6/08/2020 2:00	steel				Yes
D200-8	P67a	P68	23	151.0367795	-33.82842058	6/08/2020 2:00	steel				Yes
D200-9	P69	P70	23	151.0365817	-33.82843345	6/08/2020 2:00	steel				Yes
D200-9	P70	P69	23	151.0364074	-33.82839757	6/08/2020 2:00	steel				Yes
D360-6	P46	P69	23	151.0363493	-33.82837737	6/08/2020 2:00	steel				Yes
D360-6	P69	P46	23	151.0362106	-33.82837624	6/08/2020 2:00	steel				Yes
D360-7	-	P69	23	151.0363931	-33.8284091	6/08/2020 2:00	steel				Yes
NA	-	P58	23	151.0362645	-33.82829695	6/08/2020 2:00	steel				Yes
D100-31	-	P90	24	151.036481	-33.82871215	7/08/2020 2:00	steel				Yes
D150-101	P92	P91	24	151.0364672	-33.82878453	7/08/2020 2:00	steel				Yes
D150-90	-	P90	24	151.0364079	-33.82873641	7/08/2020 2:00	steel				Yes
D150-91	-	P90	24	151.036412	-33.82868239	7/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D150-92	-	P90	24	151.0365056	-33.82870213	7/08/2020 2:00	steel				Yes
D230-6	P89	P90	24	151.0364571	-33.82867393	7/08/2020 2:00	steel				Yes
D300-22	P85	P91	24	151.0364191	-33.82877543	7/08/2020 2:00	steel				Yes
D300-24	P90	P91	24	151.0364674	-33.82877463	7/08/2020 2:00	steel				Yes
D300-24	P91	P90	24	151.0364524	-33.82873725	7/08/2020 2:00	steel				Yes
D360-2	P28	P29	23	151.0357617	-33.8282962	7/08/2020 2:00	steel				Yes
D360-3	P32	P29	23	151.0357607	-33.82832075	7/08/2020 2:00	steel				Yes
D360-3	P29	P32	23	151.0358173	-33.82833023	7/08/2020 2:00	steel				Yes
D360-4	P37	P32	23	151.0359285	-33.82833299	7/08/2020 2:00	steel				Yes
D360-5	P46	P37	23	151.0360826	-33.82835265	7/08/2020 2:00	steel				Yes
D510-1	P30a	P30	23	151.0357229	-33.82825668	11/08/2020 2:00	steel				Yes
D910-1	P4	P30	23	151.0357672	-33.8281998	11/08/2020 2:00	steel				Yes
D910-2	P31	P30	23	151.0357692	-33.82827675	11/08/2020 2:00	steel				Yes
D100-27	-	P79	24	151.0360274	-33.8286572	12/08/2020 2:00	steel				Yes
D100-28	-	P79	24	151.0360415	-33.82867187	12/08/2020 2:00	steel				Yes
D100-29	-	P15	24	151.0360539	-33.82870783	12/08/2020 2:00	steel				Yes
D150-79	-	P78	24	151.0360408	-33.82856492	12/08/2020 2:00	steel				Yes
D150-79a	-	P78	24	151.0360601	-33.82856085	12/08/2020 2:00	steel				Yes
D150-80	-	P78	24	151.0360806	-33.82857418	12/08/2020 2:00	steel				Yes
D230-3	P78	P79	24	151.0360444	-33.8286497	12/08/2020 2:00	steel				Yes
D300-15	P76	P80	24	151.0360042	-33.8287292	12/08/2020 2:00	steel				Yes
D300-16	P80	P79	24	151.0360519	-33.82868214	12/08/2020 2:00	steel				Yes
D300-17	P82	P81	24	151.0360424	-33.82869279	12/08/2020 2:00	steel				Yes
D300-17a	P81	P80	24	151.0360318	-33.82874773	12/08/2020 2:00	steel				Yes
D300-18	P85	P80	24	151.0360461	-33.82872698	12/08/2020 2:00	steel				Yes
D360-2	P29	P28	23	151.0357422	-33.82823304	12/08/2020 2:00	steel				Yes
D150-68	-	P73	24	151.0356878	-33.82851534	13/08/2020 2:00	steel				Yes
D150-69	-	P73	24	151.0357078	-33.8285342	13/08/2020 2:00	steel				Yes
D150-70	-	P74	24	151.0356409	-33.82861764	13/08/2020 2:00	steel				Yes
D150-71	-	P74	24	151.0356706	-33.82864321	13/08/2020 2:00	steel				Yes
D150-72	-	P74	24	151.0356867	-33.82864266	13/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D150-73	-	P74	24	151.0356881	-33.82864476	13/08/2020 2:00	steel				Yes
D150-74	P74a	P74	24	151.0356498	-33.82864903	13/08/2020 2:00	steel				Yes
D150-75	-	P75	24	151.0358757	-33.82856018	13/08/2020 2:00	steel				Yes
D150-76	-	P75	24	151.0358842	-33.82857318	13/08/2020 2:00	steel				Yes
D150-77	-	P76	24	151.0358688	-33.82866462	13/08/2020 2:00	steel				Yes
D150-78	-	P76	24	151.0358668	-33.82867539	13/08/2020 2:00	steel				Yes
D225-1	P114	P82	24	151.0361206	-33.82892677	13/08/2020 2:00	steel				Yes
D230-1	P74	P73	24	151.0356799	-33.82857435	13/08/2020 2:00	steel				Yes
D230-2	P76	P75	24	151.0358672	-33.82860042	13/08/2020 2:00	steel				Yes
D230-2	P75	P76	24	151.0358714	-33.82864689	13/08/2020 2:00	steel				Yes
D230-7	P104	P77	24	151.0358023	-33.82884601	13/08/2020 2:00	steel				Yes
D230-8	P105	P104	24	151.0358313	-33.82897471	13/08/2020 2:00	steel				Yes
D300-13	P76	P74	24	151.0356701	-33.82865125	13/08/2020 2:00	steel				Yes
D300-14	P77	P76	24	151.035867	-33.82869425	13/08/2020 2:00	steel				Yes
D300-15	P80	P76	24	151.0358621	-33.82870079	13/08/2020 2:00	steel				Yes
D300-30	P108	P104	24	151.0358555	-33.82896859	13/08/2020 2:00	steel				Yes
D300-31	P115	P114	24	151.0361283	-33.82898745	13/08/2020 2:00	steel				Yes
D100-30	-	P84	24	151.0363328	-33.82869019	14/08/2020 2:00	steel				Yes
D150-82	-	P83	24	151.0362709	-33.82858068	14/08/2020 2:00	steel				Yes
D150-83	-	P83	24	151.0362848	-33.82858399	14/08/2020 2:00	steel				Yes
D150-84	-	P83	24	151.0362975	-33.82862338	14/08/2020 2:00	steel				Yes
D150-85	-	P84	24	151.0362665	-33.82866852	14/08/2020 2:00	steel				Yes
D230-4	P83	P84	24	151.0363001	-33.82866517	14/08/2020 2:00	steel				Yes
D230-4	P84	P83	24	151.0362785	-33.82863977	14/08/2020 2:00	steel				Yes
D300-18	P80	P85	24	151.036252	-33.82873805	14/08/2020 2:00	steel				Yes
D300-19	P85	P84	24	151.0362797	-33.82871332	14/08/2020 2:00	steel				Yes
D300-20	P86	P85	24	151.036289	-33.82876562	14/08/2020 2:00	steel				Yes
D300-21	-	P85	24	151.0363023	-33.82873025	14/08/2020 2:00	steel				Yes
D300-22	P88	P85	24	151.036322	-33.82875075	14/08/2020 2:00	steel				Yes
D300-23	P91	P88	24	151.0363911	-33.82875003	14/08/2020 2:00	steel				Yes
D300-37	-	P102	24	151.03674	-33.8289846	14/08/2020 2:00	steel				Yes
D360-8	P102	P128	24	151.0368095	-33.82909763	14/08/2020 2:00	steel				Yes
D375-1	P96	P88	24	151.0363924	-33.8287593	14/08/2020 2:00	steel				Yes
D450-5	P80	P88	24	151.0363545	-33.82874819	14/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D600-2	P118	P88	24	151.0363767	-33.82879622	14/08/2020 2:00	steel				Yes
D100-39	-	P124	24	151.0365494	-33.82900095	17/08/2020 2:00	steel				Yes
D150-100	-	P86	24	151.0362359	-33.8288393	17/08/2020 2:00	steel				Yes
D150-106	-	P119	24	151.036401	-33.82894667	17/08/2020 2:00	steel				Yes
D150-11	P124	P125	24	151.0366345	-33.82911997	17/08/2020 2:00	steel				Yes
D150-116	P132	P127	24	151.0366176	-33.82935626	17/08/2020 2:00	steel				Yes
D200-1	-	P124	24	151.0365588	-33.82898883	17/08/2020 2:00	steel				Yes
D200-12	P120	P119	24	151.0363954	-33.82899202	17/08/2020 2:00	steel				Yes
D200-12	P119	P120	24	151.0364239	-33.82910233	17/08/2020 2:00	steel				Yes
D200-13	-	P125	24	151.0366399	-33.82913229	17/08/2020 2:00	steel				Yes
D200-14	-	P125	24	151.036653	-33.82912064	17/08/2020 2:00	steel				Yes
D230-10	P116	P86	24	151.0362393	-33.8288274	17/08/2020 2:00	steel				Yes
D250-10	P123	P120	24	151.0364408	-33.82915702	17/08/2020 2:00	steel				Yes
D300-20	P85	P86	24	151.0362727	-33.82880887	17/08/2020 2:00	steel				Yes
D300-32	P116	P115	24	151.0361882	-33.82895845	17/08/2020 2:00	steel				Yes
D300-33	P111	P115	24	151.0361458	-33.82905744	17/08/2020 2:00	steel				Yes
D300-34	P119	P118	24	151.036378	-33.82895954	17/08/2020 2:00	steel				Yes
D300-35	P124	P119	24	151.0364146	-33.82896863	17/08/2020 2:00	steel				Yes
D300-36	P126	P127	24	151.0366185	-33.82930626	17/08/2020 2:00	steel				Yes
D300-38	P103	P131	24	151.0368372	-33.82923007	17/08/2020 2:00	steel				Yes
D300-39	-	P131	24	151.0368031	-33.82927608	17/08/2020 2:00	steel				Yes
D360-9	P128	P129	24	151.0367729	-33.82925207	17/08/2020 2:00	steel				Yes
D380-1	-	P130	24	151.0367191	-33.82935915	17/08/2020 2:00	steel				Yes
D410-1	P130	P127	24	151.0367037	-33.82935382	17/08/2020 2:00	steel				Yes
D410-2	P129	P130	24	151.036757	-33.8293058	17/08/2020 2:00	steel				Yes
D600-3	P117	P118	24	151.036326	-33.82896943	17/08/2020 2:00	steel				Yes
D150-101	-	P87	24	151.036398	-33.82881462	18/08/2020 2:00	terracotta				Yes
D150-114	-	P121	24	151.0362268	-33.82925567	18/08/2020 2:00	steel				Yes
D150-115	-	P122	24	151.0363117	-33.82928421	18/08/2020 2:00	steel				Yes
D150-98	P73a	P87a	24	151.0360303	-33.82879324	18/08/2020 2:00	terracotta				Yes
D150-99	P87	P87a	24	151.036097	-33.82880456	18/08/2020 2:00	terracotta				Yes
D250-10	P120	P123	24	151.0364327	-33.82924767	18/08/2020 2:00	steel				Yes
D250-12	P126	P125	24	151.0366174	-33.8291623	18/08/2020 2:00	steel				Yes
D460-3	P122	P121	24	151.0362519	-33.82928979	18/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D460-4	P123	P122	24	151.0363188	-33.82928702	18/08/2020 2:00	steel				Yes
D460-5	P127	P123	24	151.0364747	-33.8293335	18/08/2020 2:00	steel				Yes
D200-16	P150	P151	25	151.0357945	-33.82967799	19/08/2020 2:00	steel				Yes
D200-17	P151	P156	25	151.0359241	-33.82968726	19/08/2020 2:00	steel				Yes
D200-18a	-	P152	25	151.0357259	-33.82985364	19/08/2020 2:00	steel				Yes
D200-18b	-	P152	25	151.0357294	-33.82985473	19/08/2020 2:00	steel				Yes
D200-20	P157	P156	25	151.0359804	-33.82972347	19/08/2020 2:00	steel				Yes
D600-3	P118	P117	24	151.0361832	-33.82904726	19/08/2020 2:00	steel				Yes
D600-4	P111	P117	24	151.0361406	-33.82906909	19/08/2020 2:00	steel				Yes
NA	P150	P150	25	151.0356926	-33.82969568	19/08/2020 2:00	concrete				Yes
D150-118	-	P179a	25	151.0366626	-33.82991063	20/08/2020 2:00	steel				Yes
D150-120	-	P155	25	151.0358163	-33.82986261	20/08/2020 2:00	steel				Yes
D150-120a	-	P157	25	151.0359773	-33.82981818	20/08/2020 2:00	steel				Yes
D150-121	-	P160	25	151.0360909	-33.82980842	20/08/2020 2:00	steel				Yes
D150-122	-	P160	25	151.0360852	-33.82978407	20/08/2020 2:00	steel				Yes
D150-123	-	P160	25	151.0360496	-33.82984618	20/08/2020 2:00	steel				Yes
D150-125	-	P163	25	151.036168	-33.82987329	20/08/2020 2:00	steel				Yes
D150-125a	-	P163	25	151.0361796	-33.8298533	20/08/2020 2:00	steel				Yes
D150-126	-	P174	25	151.0363054	-33.8298769	20/08/2020 2:00	steel				Yes
D150-126a	-	P174	25	151.0362859	-33.82987099	20/08/2020 2:00	steel				Yes
D150-127	-	P179	25	151.0364799	-33.82989391	20/08/2020 2:00	steel				Yes
D150-128	-	P179	25	151.0364713	-33.82991734	20/08/2020 2:00	steel				Yes
D150-129	-	P179	25	151.0364587	-33.82992224	20/08/2020 2:00	steel				Yes
D150-130	P153	P149	25	151.0355461	-33.8299012	20/08/2020 2:00	steel				Yes
D150-24	-	P163	25	151.0361451	-33.82987321	20/08/2020 2:00	steel				Yes
D200-18	P152	P155	25	151.0357623	-33.82981734	20/08/2020 2:00	steel				Yes
D200-19	P155	P157	25	151.0359399	-33.82980708	20/08/2020 2:00	steel				Yes
D200-21	P143	P179a	25	151.0366881	-33.82991964	20/08/2020 2:00	steel				Yes
D200-22	P144	P146	25	151.0367329	-33.82984995	20/08/2020 2:00	steel				Yes
D200-23	P146	P179a	25	151.0366861	-33.82991747	20/08/2020 2:00	steel				Yes
D250-13	P157	P160	25	151.0360074	-33.8298225	20/08/2020 2:00	steel				Yes
D250-14	P160	P163	25	151.0361282	-33.82985854	20/08/2020 2:00	steel				Yes
D300-42	P163	P174	25	151.0362509	-33.82987497	20/08/2020 2:00	steel				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D300-43	P174	P179	25	151.0364176	-33.82989706	20/08/2020 2:00	steel				Yes
D360-10	P179	P179a	25	151.036648	-33.82992128	20/08/2020 2:00	steel				Yes
D150-131	P158	P153	25	151.0357255	-33.82990695	21/08/2020 2:00	steel				Yes
D150-132	NA	P154	25	151.0357212	-33.83005023	21/08/2020 2:00	steel				Yes
D150-133	P159	P154	25	151.035779	-33.8300657	21/08/2020 2:00	steel				Yes
D150-134	P159	P158	25	151.0358807	-33.82996248	21/08/2020 2:00	steel				Yes
D150-135	P162	P159	25	151.0359018	-33.83006603	21/08/2020 2:00	steel				Yes
D150-136	P165	P162	25	151.0360129	-33.83009722	21/08/2020 2:00	steel				Yes
D150-141	P184	P180	25	151.0363949	-33.83001817	21/08/2020 2:00	steel				Yes
D150-143	P182	P183	25	151.0364887	-33.83007064	21/08/2020 2:00	steel				Yes
D150-144	P131	P183	25	151.0365069	-33.83006268	21/08/2020 2:00	steel				Yes
D150-144a	NA	P181	25	151.0364947	-33.83001298	21/08/2020 2:00	steel				Yes
D150-145	NA	P183	25	151.0365137	-33.83010484	21/08/2020 2:00	steel				Yes
D250-15	P161	P158	25	151.0359447	-33.82994844	21/08/2020 2:00	steel				Yes
D250-16	P161	P164	25	151.036039	-33.82996445	21/08/2020 2:00	steel				Yes
D250-17	P165	P164	25	151.0360788	-33.82998364	21/08/2020 2:00	steel				Yes
D250-18	P175	P164	25	151.0360844	-33.82996449	21/08/2020 2:00	steel				Yes
D250-18a	NA	P164	25	151.0360794	-33.82994441	21/08/2020 2:00	steel				Yes
D250-18a	NA	P175	25	151.0362136	-33.82996348	21/08/2020 2:00	steel				Yes
D250-19	P176	P175	25	151.0362084	-33.82999994	21/08/2020 2:00	steel				Yes
D300-44	P180	P175	25	151.0362545	-33.82996398	21/08/2020 2:00	steel				Yes
D300-45	P181	P180	25	151.0364417	-33.82999479	21/08/2020 2:00	steel				Yes
D300-46	P186	P181	25	151.0365228	-33.83000338	21/08/2020 2:00	steel				Yes
D100-46	NA	P186	25	151.0366342	-33.8300411	25/08/2020 2:00	steel				Yes
D100-48	NA	P184	25	151.036396	-33.83008305	25/08/2020 2:00	steel				Yes
D150-137	P169	P173	25	151.0360484	-33.830146	25/08/2020 2:00	steel				Yes
D150-138	P178	P173	25	151.036027	-33.83013787	25/08/2020 2:00	steel				Yes
D150-138	P173	P178	25	151.0361879	-33.83016054	25/08/2020 2:00	steel				Yes
D150-141	P180	P184	25	151.0363988	-33.8300789	25/08/2020 2:00	steel				Yes
D150-142	NA	P182	25	151.0364318	-33.83005128	25/08/2020 2:00	steel				Yes
D150-143	P183	P182	25	151.0364441	-33.83005753	25/08/2020 2:00	steel				Yes
D150-143a	NA	P182	25	151.0364224	-33.83008104	25/08/2020 2:00	steel				Yes
D150-143b	NA	P182	25	151.0364384	-33.83007584	25/08/2020 2:00	steel				Yes
D250-18	P175	P176	25	151.0362296	-33.83008439	25/08/2020 2:00	steel				Yes
D250-19	P176	P177	25	151.0361555	-33.83010736	25/08/2020 2:00	steel				Yes
D250-19	P177	P176	25	151.0362096	-33.83009604	25/08/2020 2:00	steel				Yes
D250-20	P177	P178	25	151.0361814	-33.8301662	25/08/2020 2:00	steel				Yes
D250-20	P178	P177	25	151.0361562	-33.83010505	25/08/2020 2:00	steel				Yes
D250-20a	NA	P178	25	151.0361694	-33.83017672	25/08/2020 2:00	steel				Yes
D300-46	P181	P186	25	151.0366742	-33.83005585	25/08/2020 2:00	steel				Yes
D410-3	P179a	P186	25	151.036631	-33.83004709	25/08/2020 2:00	steel				Yes
D510-1	NA	P186	25	151.0366842	-33.83003879	25/08/2020 2:00	steel				Yes
D150-137	P173	P169	25	151.0360195	-33.83016666	26/08/2020 2:00	steel				Yes
D150-139	NA	P173	25	151.0360433	-33.8301742	26/08/2020 2:00	steel				Yes
D150-140	NA	P173	25	151.0360392	-33.83016071	26/08/2020 2:00	steel				Yes
D230-11	NA	P147	25	151.0355457	-33.8297875	26/08/2020 2:00	other				N/A

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D230-12	NA	P189	25	151.0354706	-33.83008217	26/08/2020 2:00	steel				Yes
D250-21	NA	P191	25	151.03588	-33.83021683	26/08/2020 2:00	steel				Yes
D250-22	P191	P192	25	151.0359614	-33.83024918	26/08/2020 2:00	steel				Yes
D250-23	P193a	P192	25	151.0359594	-33.83023765	26/08/2020 2:00	steel				Yes
D300-12a	NA	P189	25	151.0355114	-33.83013376	26/08/2020 2:00	steel				Yes
D300-44b	NA- channel	P189	25	151.0355017	-33.83011591	26/08/2020 2:00	steel				Yes
D300-49	NA-Channel	P194	25	151.0364783	-33.83027575	26/08/2020 2:00	steel	8m	1	1 - TP20/20	Yes
D300-49a	NA - channel	P192	25	151.0359393	-33.83024625	26/08/2020 2:00	steel				Yes
D300-50	NA- channel	P195	25	151.0364986	-33.83027839	26/08/2020 2:00	steel				Yes
P193 (Pit only)	NA	P193	25	151.0361198	-33.83021771	26/08/2020 2:00	steel				N/A
D100-16	NA	D100-16	23	151.0361407	-33.82838923	3/09/2020	steel				Yes
D100-17	NA	D100-17	23	151.0360939	-33.8283907	3/09/2020	steel				Yes
12D150-9	12-P9 (unable to locate)	12-P13	12	151.0351393	-33.83130228	2/10/2020 5:31	steel				Yes
26D200-1	NA	26-P5	26	151.0361008	-33.83054032	2/10/2020 5:31	other				Yes
26D150-4	NA	26-P7 (appears to be a septic tank)	26	151.0366545	-33.83052712	2/10/2020 5:31	terracotta				Yes
12D150-8	12-P12	12-P13	12	151.035167	-33.8312421	2/10/2020 5:31	steel				Yes
12D150-7	NA	12-P12	12	151.034838	-33.83137554	2/10/2020 5:31	steel				Yes
D300-40	P145 (concreted over)	P185	25	151.0362503	-33.83024109	8/10/2020	steel				Yes
D150-119	P134	P135	25	151.0365483	-33.82955918	15/10/2020	other				Yes
D100-45	P143	P145	25	151.0366704	-33.82980826	15/10/2020	other				Yes
D100-44	P143	P142	25	151.0365395	-33.82979022	15/10/2020	other				Yes
D225-2	P133	P134	25	151.0363084	-33.82954809	15/10/2020	other				Yes
D100-41	NA	P136	25	151.0367393	-33.82960094	15/10/2020	other				Yes
D225-3	P137	P137	25	151.0362104	-33.82962997	15/10/2020	other				Yes
D100-42	NA	P136	25	151.0367807	-33.82958897	15/10/2020	other				Yes

Pipe Details								Compromised Pipe Validation			
Pipe ID ("CDLD Area_Pipe Number")	Upstream Pit ID	Downstream Pit ID	Key Plan Area	x Co-Ords	Y Co-Ords	Date/time completed	Pipe Type	Length of Compromised Pipe	Number of Test Pits Required as per SAQP	Number of Test Pits Completed	Pits backfilled?
D100-43	NA	P136	25	151.0367531	-33.82969244	15/10/2020	other				Yes
D225-7	P140	P141	25	151.036436	-33.82978154	15/10/2020	other				Yes
D225-8	P141	P142	25	151.0339511	-33.83048991	15/10/2020	other				Yes
D225-5	P138	P139	25	151.0363796	-33.82976528	15/10/2020	other				Yes
D225-6	P139	P140	25	151.0339349	-33.83048517	15/10/2020	other				Yes
D225-4	P137	P138	25	151.0362952	-33.82974152	15/10/2020	other				Yes
26D610-1	26-P3	26-P4	26	-	-	18/11/2020	steel				Yes
26D610-2 & 3	26-P4	31-P2	26	-	-	18/11/2020	steel				Yes
1370-5	P190	P197	25	151.0382616	-33.83009273	19/11/2020	steel				Yes
D1370-3	P148	P190	25	151.0355984	-33.83013114	19/11/2020	steel				Yes
D1370-4	P190	P196	25	151.0365755	-33.83021145	19/11/2020	steel				Yes

Appendix D Summary of Historical Assessments

Western Area

ERM reported that since 1991 investigations across the Clyde Terminal have been conducted. The outcomes from the assessments are presented in Table 1 below.

Table 1 Historical reports – WARP

Date	Activities
1992	Coffey Partners International Pty developed a geotechnical model of the site using information from 150 previous site investigations. Ten monitoring wells were installed along the south eastern boundary to determine if the migration of contaminants into Duck River was occurring. ANSTO conducted water sampling.
1993	Groundwater Monitoring Event (GME) conducted by Groundwater Technology in March 1993. GME conducted by Groundwater Technology in July 1993. Environmental Site Assessment (ESA) conducted by Coffey (16 boreholes), August 1993. ESA conducted by Golder (eight boreholes) in November 1993. ESA conducted by OTEK (three boreholes) in December 1993.
1994	ESA conducted by Coffey (six boreholes) in January 1994.
1995	ESA conducted by Groundwater Technology in March 1995 in the former chemical plant and Tank Farm E. ESA conducted by Groundwater Technology in April 1995 near the refuelling facility on the western site boundary.
1997	ESA conducted by OTEK (13 boreholes eastern site boundary).
1998	ESA (test pitting) completed by Coffey in November.
1999	Sludge pilot conducted by IT (formerly Groundwater Technology) in February 1999. ESA conducted by IT in May 1999 near the refuelling facility on the western site boundary. GME conducted by IT in October 1999. ESA conducted by Woodward Clyde (43 boreholes) in August 1999.
2000	GME conducted by IT in October in 2000.
2001	GME conducted by IT in February 2001. ESA conducted by IT in March near the sludge drying area in 2001. GME conducted by IT in August in 2001.
2002	Pollution Reduction Program and Remedial Action Plan produced by Shell Engineering Pty Ltd in July in 2002.
2003/2004	GME conducted by IT in December 2003 and January 2004.

Date	Activities
2004	Gauging event conducted by IT in February 2004. Gauging event conducted by IT in April 2004. Gauging event conducted by IT in May 2004. GME conducted by IT in July 2004. Gauging event conducted by IT in August 2004. Gauging event conducted by IT in September 2004. Limited ESA conducted by IT in September 2004. Gauging event conducted by IT in October 2004. Gauging event conducted by IT in December 2004.
2005	GME conducted by IT in March 2005. Gauging event conducted by IT in June 2005. Gauging event conducted by IT in July 2005. GME conducted by IT in August-September 2005. Gauging event conducted by IT in November 2005. Gauging event conducted by IT in December 2005.
2006	Gauging event conducted by IT in January 2006. GME conducted by IT in March 2006. Gauging event conducted by Coffey in July 2006. GME conducted by Coffey in September/October 2006. Gauging event and limited GME conducted by Coffey in December 2006.
2007	GME conducted by HLA ENSR in September 2007.
2008	Conceptual Site Model and Data Gaps Analysis completed by ERM in October 2008. GME conducted by ERM Australia in February 2008. GME conducted by ERM Australia in November 2008.
2009	ESA Phase Separated Hydrocarbon Assessment (Sub Area CSM2) - ERM April 2009. GME conducted by ERM Australia in April 2009. ESA of Tank Farm E2 September 2009. GME conducted by ERM Australia in November 2009.
2009/2010	ESA Chromium Assessment conducted by ERM November 2009 - January 2010.

Date	Activities
2010	GME (Q1.2010) conducted by ERM Australia in March 2010. GME (Q2 2010) conducted by ERM Australia in June 2010. GME (Q3 2010) conducted by ERM in September 2010. Investigation of Tank 92 release conducted by ERM Australia in October 2010. GME (Q4 2010) conducted by ERM Australia in November 2010.
2011	GME (Q1.2011) conducted by ERM Australia in March 2011. GME (Q2 2011) conducted by ERM Australia in June 2011. GME (Q3 2011) conducted by ERM in September 2011. CSM3 ESA conducted by ERM in October/November 2011. GME (Q4 2011) conducted by ERM Australia in December 2011. Investigation of Tank 30 release conducted by ERM Australia in December 2011.
2012	GME (Q1 2012) conducted by ERM Australia in March 2012. ESA (Lot 1 SPMT and Mobil Tank Farm) Phase 2 conducted in June 2012. GME (Q2 2012) conducted by ERM Australia in June 2012. GME (Q3 2012) conducted by ERM in September 2012.
	GME (Q4 2012) conducted by ERM in December 2012.
2013	GME (Q1 2013) conducted by ERM Australia in March 2013. GME (Q2 2013) conducted by ERM Australia in June 2013. GME (Q3 2013) conducted by ERM Australia in September 2013. GME (Q4 2013) conducted by ERM Australia in December 2013.
2014	GME (Q1 2014) conducted by ERM March 2014. GME (Q2 2014) conducted by ERM in May 2014. Lot 101 Detailed Site Investigation conducted by ERM in August/September 2014. GME (Q3 2014) conducted by ERM in September 2014. GME (Q4 2014) conducted by ERM in December 2014.
2015	GME (Q1 2015) conducted by ERM March 2015. GME (Q2 2015) conducted by ERM in June 2015. GME (Q4 2015) conducted by ERM in November 2015.
2016	GME (Q2 2016) conducted by ERM in August 2016. GME (Q4 2016) conducted by ERM in December 2016.

Date	Activities
2017	GME (Q2 2017) conducted by ERM in May 2017. GME (Q4 2017) conducted by ERM in December 2017.
2018	Western Area Targeted Site Investigation (TSI) completed by AECOM in January - March 2018. GME (Q2 2018) conducted by ERM in June 2018. PFAS PSI and Conceptual Site Model Fieldworks completed by ERM in August 2018. GME (Q4 2018) conducted by ERM in December 2018. Western Area Remediation Project – Environmental Impact Statement (EIS), prepared by AECOM. Western Area Remediation Project - Conceptual Remediation Action Plan, prepared by AECOM.
2019	GME (Q2 2019) conducted by ERM in May/June 2019. Remediation Site Investigation (RSI) conducted by ERM in July and August 2019. Report issued in early 2020. Human Health and Ecological Risk Assessment (HHERA) developed in late 2019. Report issued in early 2020. Remediation Options Analysis conducted by ERM in October 2019 to January 2020. Western Area Remediation Project – Response to Submissions Report, prepared by AECOM.

Stage 1 area

A summary of relevant investigation data which has informed the preparation of the Stage 1 RAP and Validation reports are provided in Error! Reference source not found.**2** below.

Table 2 Historical reports – Stage 1 area

Author	Year	Scope of works	Investigation locations completed	Comments
Coffey	1991	Boundary groundwater monitoring well installation program	One monitoring well within Stage 1 Area (W91/2)	General information on-site geology to inform CSM and the Stage 1 RAP
Groundwater Technology	1994	Groundwater monitoring well installation	One monitoring well within Stage 1 Area (MW94/6X)	General information on site geology to inform CSM and the Stage 1 RAP

Author	Year	Scope of works	Investigation locations completed	Comments
Woodward Clyde	1998	Groundwater monitoring well installation	One monitoring Well within Stage 1 Area (MW98/9)	General information on site geology to inform CSM and the Stage 1 RAP
ERM	2008 to 2019	Groundwater Monitoring Events. Monitoring of available monitoring wells for compliance purposes	Various	General information on LNAPL, dissolved phase CoPC concentrations and trends in groundwater. Hydrogeological information was used in the refinement of the CSM and in the Stage 1 RAP
ERM	2012	Stage 1 and 2 Environmental Site Assessment.	Three soil bores (Tank Farm H) 13 Groundwater monitoring wells	General information on LNAPL. The site characterisation was used in the refinement of the CSM and in the Stage 1 RAP
AECOM	2018	Targeted Site Investigation (TSI).	One monitoring well. Four test pits	General information on LNAPL. The site characterisation was used in the refinement of the CSM and in the Stage 1 RAP

Stage 1 - Remediation site investigation (RSI)

The scope of works undertaken as part of the RSI, undertaken across the WARP, including the Stage 1 Area comprised excavating an additional 80 test pits to a maximum depth of 4.8 mbgl to characterise soils in specific areas where data gaps were identified as outlined in the SAQP RSI.

ERM reported that the objective of the RSI was to collect data to assess the risk of contamination to sensitive on and off-site human and ecological receptors resulting from the AECs as presented in **Table 3**.

ERM stated that AEC-9 and portions of AEC-7, AEC-13, AEC-14 and AEC-15 are situated within the Stage 1 Area. Details regarding the extent, targeted COPC and specific objectives of investigation for each AECs was provided within the RSI report.

Table 3 Summary of AEC

Identification	Description
AEC-1	Old Administration Area
AEC-2	Buried Waste Area 8 – CDU tank farm sludge
AEC-3	Southern Contractor Area
AEC-4	Southern Buried Waste Area
AEC-5	Platformer 3
AEC-6	Buried Waste – Ex Solvents Plant
AEC-7[2]	**Pipe Track Areas**
AEC-8	Tank farm J
AEC-9	**Process West**
AEC-10	Process East
AEC-11	Tank farms A1, A2, A3
AEC-12	Tank farm C
AEC-13	**Substation Areas and Transformer Yards**
AEC-14	**Subsurface drainage network**
AEC-15/ General Site Area	**Other areas within the Western Area**

ERM's conclusions regarding the specific objectives of the RSI (for the entire WARP and not just the Stage 1 Area) are presented in **Table 4**.

Table 4 Evaluation of data gaps

Objective	Comment
Refine the nature and extent of petroleum hydrocarbon impacts and LNAPL	ERM based on the information collected as part of previous investigations and the RSI considered to have collected sufficient data to characterise the nature and extent of impacts requiring remediation within the WARP.
Potential pre-validation of low risk areas to potentially exclude from remediation and / or management	ERM stated that based on the results of the RSI and historical investigations low risk areas were limited to AEC-1 (Old Admin Area) and AEC-13 (Substation Areas). ACM were identified on or near the surface within isolated areas of these AECs. These portions of the site did not require further assessment as part of the subsequent Tier 2 HHERA. However, ERM stated that remediation or management of these identified impacts will be required.

[2] **Bold** – AECs within Stage 1 Area.

Objective	Comment
Further characterisation of buried waste areas (nature and extent of impacts)	ERM stated that test pitting within AEC-4 was terminated in fill at a depth of 4.0 mbgl in several location and as such the potential for deeper fill materials may require consideration. However, ERM based on the results of this RSI and previous investigations considered that the lateral extent of AEC-4 was suitably delineated.
Drainage and subsurface infrastructure characterisation	ERM reported that fill materials underlying pipe tacks were identified to be generally shallow, extending to a depth of approximately 0.1 to 0.2 metre. ERM stated that results of soil samples returned concentrations of CoPC less than the adopted Tier 1 screening criteria. On the basis of the extensive nature of the drainage network, ERM recommended that an unexpected finds protocol should be implemented during future excavation and removal of the subsurface drainage network, which will allow appropriate management and assessment of isolated soil impacts during remediation and sub-grade infrastructure removal.
Collect data to support HHERA and development of risk-based Site-Specific Target Levels (SSTLs) for remediation	ERM considered the RSI and historical assessments provided enough data for the purposes of developing a HHERA to refine the potential risks to human and ecological receptors, the development of SSTLs and remedial end points.
Further characterisation of non-petroleum COPC to confirm the remediation methodology/ management	ERM reported the following: Asbestos – was identified in the form of ACM fragments at isolated locations throughout the site, associated with demolished former infrastructure. ERM noted that the presence of ACM identified during investigations was limited to shallow fill materials and surface soils in localised areas. Soils within AEC-4 were identified to contain ACM fragments and fibres at variable depths and is consistent with historically documented waste burial activities within the south-western area of the Western Area. Heavy metals – laboratory analysis of collected soil samples returned concentrations of all heavy metals less than the adopted assessment criteria apart from one isolated sample located within AEC 11, which exceeded the assessment criteria for lead. Historical results have also identified the presence of total chromium results above adopted criteria associated with buried waste within AEC-4. Dioxins – were reported less than LOR and/or the adopted assessment criteria. ERM noted that dioxin concentrations discussed in the TSI (AECOM 2018) were not previously screened against Tier 1 criteria, and those were below the adopted screening criteria.

Objective	Comment
	PFAS - ASLP leachate and excavation water samples identified PFAS within localised areas of the site. Reported concentrations of PFAS were below adopted screening criteria for current and future on-site receptors. Although concentrations of PFOS were reported at some individual locations exceeding off-site ecological criteria, potential risks for these receptors was considered negligible based on previous mass flux modelling undertaken by ERM (the PFAS CSM).
Collect data from likely remediation areas to assist with technical specification development for remediation contractors.	ERM stated that the collection of additional data relating to soil properties (density, porosity, total organic carbon etc.) was enough for the development of technical specifications for remediation.

Human health and ecological risk assessment

The HHERA was developed to provide to the Western Area to evaluate the significance of potential risks where Tier 1 screening levels were exceeded. SSTLs were derived based on the updated CSM from the RSI. The specific objectives of the HHERA were as follows:

- To assess whether the on-site soil and groundwater impacts in the WARP can pose a potential risk to human or ecological receptors under the proposed future land use scenario;
- To assess whether the identified on-site impacts can pose a potential risk to off-site human or ecological receptors based on the current land use; and
- To develop SSTLs for remedial works.

ERM reported that based on the results of the Tier 1 screening and updated CSM from the RSI, the HHERA conducted further exposure assessment and derived SSTLs for:

- Direct contact or ingestion of impacted soils by future on-site intrusive maintenance workers (IMWs) or construction workers undertaking earthworks for the following AECs and CoPC:
  - AEC-3 - carcinogenic PAHs, TRH C10-C34;
  - AEC-4 - carcinogenic PAHs, TRH C10-C34 and hexavalent chromium;
  - AEC-11 – lead; and
  - **AEC-15** - TRH C10-C34.
- Inhalation of vapours by future on site workers in indoor or outdoor air for the following AECs and CoPC:
  - AEC-3 - benzene, naphthalene, and TRH C6-C10 (less BTEX);
  - AEC-4 - benzene, naphthalene, and TRH C6-C10 (less BTEX);
  - **AEC-9**[3] - benzene, and TRH C6-C10 (less BTEX);

[3] **Bold** font indicates AECs within Stage 1 Area.

– AEC-10 - TRH C6-C10 (less BTEX); and
– AEC-12 - TRH C6-C10 (less BTEX).

ERM reported that Tier 1 screening of groundwater along the boundary of the Western Area indicated that off-site migration of LNAPL or dissolved phase petroleum hydrocarbons was not occurring to a degree that could potentially cause unacceptable risks to the identified environmental / ecological receptors.

ERM stated that the exposure pathway was considered incomplete and no risk to the potential off-site receptors was identified from COPC in groundwater. Similarly, screening for PFAS and metals from soil leachate and groundwater in the Western Area were not considered to represent a risk to off-site receptors. Overall, the Tier 1 assessment of dissolved phase groundwater impacts did not identify contamination in the Western Area that warranted further assessment or management related to potential risks to on-site and off-site receptors from groundwater migration.

It was noted by ERM (2020b) that the following scenarios considered representative of potential risk were not further assessed in the HHERA, as further risk assessment was not considered to change the existing conclusions and management considerations:

- *Inhalation of dusts or potential asbestos fibres from soils containing asbestos during excavation by current and future on-site intrusive maintenance workers or construction workers undertaking earthworks; and*
- *Potential acute hazards to future on-site intrusive maintenance workers or construction workers undertaking earthworks from the pooling of hazardous ground gases associated with LNAPL and impacted soil/ groundwater.*

ERM reported that in accordance with SSD approval for the WARP, future on-site intrusive works and construction exposures should be managed via the REMP and its sub-plans, incorporating safety procedures for management of asbestos and ground gases during excavation.

ERM stated that with the exception of AEC-4, a risk categorisation of site-specific of methane in soil gas was undertaken for methane and carbon dioxide concentrations in accordance with the NSW EPA ground gas guidance (NSW EPA 2019) for potential ground gas related risks in indoor air spaces. Of the areas with ground gas measurement, only AEC-3 was identified with a risk categorisation high enough (“low risk”) which, per the guidance, requires consideration of hazardous ground gases in future management and/or remediation decisions for the development of enclosed spaces. ERM concluded that for AEC-4, consideration of hazardous ground gases in future management and/or remediation decisions for the development of enclosed spaces is necessary.

ERM reported that while on-site ecological receptors were considered to have limited value under the current and future land use, the RSI identified CoPC concentrations in site soils exceeding Ecological Investigation Levels / Ecological Screening Levels (EILs/ESLs) that were indicative of the need for consideration within future site management, particularly for design and planning of landscape areas in AEC-1, AEC-2, AEC-3, AEC-4, AEC-8, **AEC-9** and AEC-10.

ERM stated that the human health risk assessment was conducted following the ASC NEPM (NEPC 2013) to assess risks to potential future workers from direct soil contact exposure and vapour migration and to derive SSTLs.

The risk assessment concluded that potential risks to off-site adjacent receptors were unlikely. The summary of potential risks for on-site receptors is presented in Table 5.

Table 5 HHERA conclusions

Area	Soil - direct contact risk			Commercial – VI[4]	Asbestos	LNAPL[5]
	Commercial worker	Construction worker	IMW			
AEC-1	✓[6]	✓	✓	✓	×[7]	✓
AEC-2	✓	✓	✓	✓	✓	×
AEC-3	× carcinogenic PAHs	✓	✓	× benzene naphthalene TRH C6-C10 less BTEX TRH C8-12 (aliphatic)	×	×
AEC-4	× TRH C10- C34 carcinogenic PAHs	× hexavalent chromium	✓	× Benzene TRH C6-C10	×	×
AEC-5	✓	✓	✓	✓	✓	×
AEC-6	✓	✓	✓	✓	×	×
AEC-7[8]	✓	✓	✓	✓	✓	✓

[4] Potential vapour intrusion risks assume the presence of future buildings.
[5] Consideration of the management of LNAPL is warranted separately to potential health risks.
[6] Indicates potential risks are unlikely or within acceptable levels.

[7] × Indicates a potential risk or need for remediation and / or management.

[8] Dark grey Indicates AECs within Stage 1 Area.

Area	Soil - direct contact risk			Commercial – VI[4]	Asbestos	LNAPL[5]
	Commercial worker	Construction worker	IMW			
AEC-8	✓	✓	✓	✓	✓	×
AEC-9	✓	✓	✓	× Naphthalene TRH C8-C12 (aliphatic and aromatic) TRH C10 – C16 (aromatic)	✓	×
AEC-10	✓	✓	✓	✓	✓	×
AEC-11	✓	✓	✓	✓	✓	×
AEC-12	x TRH C6- C16 TRH C8- C12 Aromatic	✓	✓	× TRH C6-C12 (Aliphatic) TRH C8-C16 Aromatic TRH C6-C10 (unspecified) Benzene	✓	×
AEC-13	✓	✓	✓	✓	×	✓
AEC-14	✓	✓	✓	✓	✓	✓
AEC-15	✓	✓	✓	✓	×	×

Quarter 4 (2019) groundwater monitoring event

ERM stated that the Quarter 4 Groundwater Monitoring Event (Q4 2019 GME) represented the baseline understanding of groundwater conditions within the Western Area at the time of Stage 1 RAP preparation. The Q4 2019 GME made the following conclusions regarding groundwater conditions within the Western Area, which includes the Stage 1 Area:

- The direction of groundwater flow was consistent with previous GMEs and generally flows to the south east towards the Duck River;
- LNAPL observed within the monitoring well network was consistent in spatial extent with previous GMEs. LNAPL was identified at two locations (MW18/24, MW12/01) within the Western Area at a maximum thickness of 0.324 metre. ERM concluded that the occurrence of LNAPL within these wells was consistent with historical data and has been laterally delineated to on-site environments via monitoring of down gradient wells;
- Detected concentrations of dissolved phase CoPC were below the adopted criteria, apart from groundwater collected from MW12/03 (AEC-3), in which the recreational water quality criteria for benzene and marine water criteria for ethylbenzene and naphthalene were exceeded;
- Stable to decreasing trends were reported for benzene and TRH C6-C9 in groundwater collected at all monitoring wells sampled across the Western Area;
- The nature and extent of LNAPL and dissolved phase hydrocarbon impacts were stable, well characterised in the context of the current land use and the monitoring well network was considered suitable to assess potential changes in environmental conditions as well as source/pathway/receptor linkage;
- Decreasing concentration trends of dissolved phase petroleum hydrocarbon COPC coupled with indicators that microbially mediated natural attenuation of petroleum hydrocarbons in groundwater may be occurring, via sulphate and ferric iron reduction;
- Concentrations of heavy metals exceeded adopted ecological screening criteria for copper, lead, mercury, nickel and zinc. ERM reported that the distribution of metals exceedances did not appear to be confined to a portion of the Western Area and were considered likely to be related to regional background water quality associated with imported fill materials; and

ERM stated that based on the current dataset for PFAS in groundwater within the Western Area, ecological exceedances for PFOS were consistent with the findings of previous sampling events and were not considered to change the existing findings of the CSM and mass flux assessment previously undertaken (ERM 2018).

Historical reports - Overview

It is the auditor's opinion that the previous reports provided sufficient evidence that the primary historical use of fuel storage at the site resulted in contamination of soil and groundwater. The CoPC identified for the characterisation of the site is consistent with the documented historical use.

The auditor noted that the investigations of the Western Area over the past 11 years comprised installation and sampling of 103 monitoring wells and excavation of 83 test pits. More than 580 soil samples have been collected and analysed providing a reliable level of information to characterise the area.

SAQP comments

The auditor acknowledged that the SAQP prepared by ERM in 2019 documented DQOs, the scope of work and the methodology for the RSI and broadly addressed the previous data gaps documented by AECOM in its TSI (AECOM 2018) and Conceptual RAP (AECOM 2019).

It is the auditor's opinion that the sampling plan was prepared based on a CSM that took into consideration all historical data. The RSI SAQP had been reviewed by the auditor, the outcome of which was presented in IAA02 issued on 4 July 2019.

RSI comments

The RSI was reviewed by the auditor, the results of which were documented in IAA03, issued in February 2020.

The auditor considered that the RSI presented appropriate DQIs to assess field procedures and analytical results. The DQIs demonstrated suitable accuracy and precision of the field and laboratory program used to assess the data gaps identified in the WARP.

The validation procedure adopted in the RSI for the evaluation of field and laboratory QA/QC data indicated that the reported analytical results were representative of the soil and groundwater conditions and the quality of the analytical data produced was acceptable as reliable for characterisation of the WARP area.

It is the auditor's opinion that the RSI carried out by ERM largely followed the endorsed SAQP and the relevant guidelines made or endorsed by EPA, providing sufficient information to portray the characterisation of the WARP and assist in the preparation of the HHERA and a Detailed RAP.

The auditor acknowledged that the distribution of the sampling used to characterise the extent of contamination within the WARP was sufficient to identify and characterise the extent of the AECs. However, as noted by the auditor in IAA04 issued on 5 May 2020, given the size of the Stage 1 area and the number of soil sampling sites within Stage 1 Area, it would be prudent to include as part of the validation program, a series of sampling points in areas where data is scarce.

Q4 2019 GME comments

The Q4 2019 GME was reviewed by the auditor, the results of which were documented in IAA03, issued in February 2020.

The auditor considered that the Q4 2019 GME conducted by ERM was sufficient to characterise the quality of groundwater in the WARP. The collected data were used in the assessment of concentration trends and incorporated into the HHERA.

Overall, the auditor recognised that the data collected during the Q4 2019 GME was consistent with previous monitoring events, demonstrated that the risks of exposure to chemicals in groundwater are generally low and acceptable.

The data validation procedure adopted for the evaluation of field and laboratory QA/QC data indicated that the reported analytical results were representative of groundwater conditions and that the quality of the analytical data produced was acceptable and free of systematic bias.

The auditor noted that the findings of the 2019 GME supported AECOM's position in its Conceptual RAP (AECOM 2018) that active remediation of groundwater was not required to control or manage exposure to human health.

HHERA comments

The auditor notes that the review of the HHERA was documented in IAA03 issued in February 2020.

The auditor considered that the methodology and guidelines adopted by ERM in preparing the HHERA were appropriate and in accordance with the ASC NEPM.

It is the auditor's opinion that the information presented in the HHERA took into consideration the historical dataset as well as the most recent information presented in the RSI.

The auditor considered that ERM identified the relevant CoPC based on the findings of the Tier 1 screening, assigned appropriate screening levels, reviewed and evaluated the available data.

Relevant exposure scenarios were identified for the WARP based on the refined CSM and considered the current and proposed future land use scenarios - in relation to both on and off-site receptors.

It is the auditor's understanding that the residual LNAPL, as well as the dissolved phase plumes groundwater, do not pose an unacceptable human and ecological risk to the current and future on and off-site receptors. Exposure to these contaminant sources will be managed through a LTEMP.

The risk assessment demonstrated that the key exposure risk related to the presence of volatiles is inhalation in a future development scenario where buildings are constructed. This exposure scenario will drive the need for remediation.

Although asbestos (in the form of ACM) can pose a potential risk to IMW during the remedial activities, exposure can be managed by long management plans and in the interim via Viva Energy HSE protocols.

No unacceptable risks (for any exposure scenario, including vapour inhalation) were identified for a construction worker scenario. This scenario would be akin to remediation workers. ERM stated that as there were no unacceptable risks to on-site workers, the risk to off-site workers would be less.

Regarding potential risks within the Stage 1 Area, the auditor notes that the risk driver is vapour intrusion for future commercial works related with exceedances of naphthalene, TRH C8-C12 (aliphatic and aromatic), TRH C10 - C16 (aromatic) within AEC 9. Potential for asbestos occurrence was noted within AECs 13 and 15.

LNAPL management will also be required for AEC 15. As noted by ERM in its HHERA, asbestos occurrence and LNAPL does not pose a potential risk to future commercial receptors and will be managed through either an LTMP or Viva Energy HSE protocols.

Appendix E Data Quality Assessment

Attachement E - Quality Assurance and Quality Control Review
Client: Viva Energy
Site: Stage 1 Area
Report: **Validation Report**

Item	Addressed (Y / N / NA)	Comments
Quality Assurance Program		
Statement of pre-determined DQOs for field and laboratory procedures, including quantitative DQOs	Y	Discussed in Section 4
DQOs state the problem, identify 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	Y	Discussed in Section 4
Quality plan designed to achieve DQOs assessing accuracy, precision, comparability, representativeness and completeness of dat	Y	Discussed in Appendix G
Procedures for assessing chemical data to determine if DQOs are met, including quantitative DQOs (e.g. standard deviation, % recovery, RPDs)	Y	Detailed in Appendix G
Procedures that describe the actions if DQOs not met	N	In some cases, procedures if DQOs are not met are limited to statements such as “if any of these are exceeded then the answer is ‘No’”.
Sampling and Analytical Program		
Site investigation objectives and a brief background provided	Y	Discussed in Sections 1.3 and 1.4
Summary of CSM provided	Y	A pre-remediation CSM is provided in Appendix J. A post-remediation CSM is provided in Section 7.
Data gap analysis provided that reviews existing information	Y	Data gap in the preliminary CSM were defined, investigated and addressed as described in Section 1.1 and Section 6.
Preparation of a site specific health and safety plan and other necessary pre-mobilisation tasks	N	Quality Health Safety and Environment (QHSE) Plan and associated Safe Work Method Statements are listed in the scope of work (Section 5.4). However, no details are provided.
Assessment includes all relevant environmental media (e.g. soil, dust, surface water, groundwater, air, sediments and biota)	Y	Discussed in Section 5

Item	Addressed (Y / N / NA)	Comments
Sampling is representative of the site, based on selection of appropriate sampling points stated in sampling plan. Included are details of analytes to be monitored, sampling pattern/frequency, and number of samples, location and depth of sampling points	Y	Sampling undertaken in line with the RAP.
Acceptability of sample collection, handling and transportation in accordance with written procedures	Y	Discussed in Appendix G
Sample analyses use appropriate methodologies in NATA (or equivalent) accredited laboratories for each analyte & matrix	Y	
Appropriate sampling methods & procedures, field screening methods and analysis methods are outlined	Y	
Detection limits for each chemical of potential concern are appropriate for use in assessment of risk	Y	
For dynamic/reactive sampling, methods for analysing and interpreting field data are outlined	N/A	
Field QA/QC		
Use of standardised field sampling forms	Y	Completed field forms are provided in Appendix D
Sampling team	Y	Provided in Appendix D and Appendix K
Sampling methods including type of container used, labelling process, order and degree of filling, preservation, labelling, logging, custody	Y	General statements were provided in the report such as: • 'The methods used to collect the samples, the types of sample containers, preservation techniques and custody protocols w ere documented appropriately'; or • 'Soil samples for chemical analysis w ere collected into laboratory supplied sample containers, and stored in a chilled cooler on ice'. No attempt to chill samples was signaled by one laboratory report, Eurofins 722374-S (sample temperature at arrival 21.7°C). This batch was described to contain rocks (VENM) and was analysed for .TRH, BTEX, PAH and metals. The other batches showed evidence that sample chilling was attempted.

Item	Addressed (Y / N / NA)	Comments
		Degree of filling is not presented in text, however laboratory reports confirm it was appropriate.
Decontamination procedures between sampling	Y	Described in Appendix G.
Logs for each sample, including time, date, location, sampler, duplicate location & type, chemical analyses to be performed, sample preservation method, site observations & weather	Y	Majority of details are presented in different parts of the report, including summary tables in Section 6, the appendix called 'Tables', Appendix F, field notes (Appendix D) and COCs (Appendix K). Sample preservation method stated in Appendix G. Weather observations are not made, however it is not considered to be of material effect.
COC for each sample, including sampler, sample nature, collection date, analyses to be performed, preservation method, dispatch time, condition of samples at dispatch and courier(s)	Y	Provided in Appendix K
Sample duplication/splitting techniques	N	Technique for splitting/duplicating samples not clearly detailed.
Quality control samples, including:		
— background samples	N/A	Not taken. Not relevant for these works.
— field duplicate samples	Y	
— split samples	Y	
— rinsate blanks	N/A	Resuable sample equipment not used.
— field blanks	Y	Based on Table G1.
— trip blanks	Y	
— laboratory prepared trip spike samples	Y	
Background sample results	N/A	Not taken. Not relevant for these works.
Results of QC samples eg field blanks, background, rinsates, trip blanks	Y	Provided in Appendix G
Laboratory prepared trip spikes for volatile analytes and accompanying results	Y	
Field instrument calibrations (when used)	Y	Provided in Appendix E
Tabulate field parameter measurements	Y	Summarised in the appendix called 'Tables' and in Appendix F

Item	Addressed (Y / N / NA)	Comments
Laboratory QA/QC		
Copy of completed COC including acknowledgment of receipt, conditions of samples on receipt and identity of samples included in shipments	Y	
Record of holding times and compliance with methods	Y	
Analytical methods used		
— Laboratory accreditation for methods used	Y	
— Performance in interlaboratory trials for methods used, where available	N	Not supplied by anlaysing laboratory. Absence has no material effect.
Description & % recovery of surrogates & spikes	Y	
Instrument detection limits and MDLs	N	Not supplied by anlaysing laboratory. Absence has no material effect.
Matrix or PQLs and limit of reporting for each analyte in each media	Y	
Quality control samples:		
— duplicates	Y	
— method blanks	Y	
— surrogates	Y	
— matrix spikes	Y	
Laboratory standard charts	N	Not supplied by anlaysing 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	Y	Appendix G
Precision & accuracy of sampling & analysis for each analyte in each matrix, advising reliability, unreliability or qualitative value of data	Y	Appendix G
Data comparability including bias assessment, e.g. different personnel, methodologies, times, spatial and temporal changes etc	No	Not provided

Item	Addressed (Y / N / NA)	Comments
Results of intra and interlaboratory QC checks	Y	Appendix G
Names of laboratories and details of their accreditation	Y	Section 6
Discussion of appropriateness of non-standard test methods (incl. sample prep; method source and validation)	N/A	All analytical methods were standard methods.
PQLs and MDLs for all relevant matrices	Y	PQLs provided. Note: MDLS not provided by analytical laboratory, however absence has not material effect.
Acceptance limit(s) for each QC test (e.g. RPDs, recoveries) included	Y	
Acceptance limits for each calibration standard	N/A	Details not 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.	Y	
QC results relevant to the sample analyses	Y	
QA/QC ANALYTICAL METHODS		
Field Methods		
Applicability and appropriateness of field screening methods discussed.	Y	Appropriateness of field methodologies is discussed in general terms throughout the report, e.g. Section 3.5.1.
Adequacy of calibration of field monitoring equipment and validation of field measurements	Y	Appendix E
Laboratory screening methods		
Applicability and limitations of analytical screening techniques appropriately discussed	N/A	Not reported by laboratories
Analytical screening method performance expressed, and based on acceptable false negative rate	N/A	Not reported by laboratories
Methods specific for contaminants		
Sensitivity of analytical methods appropriate for assessment of risk	Y	
Precision and accuracy criteria in quality plan meet performance of 95% of laboratories in recognised inter-laboratory trials	N/A	Not reported by laboratories

Attachement E - Quality Assurance and Quality Control Review
Client: Viva Energy
Site: Stage 1 Area
Report: **Drainage Validation Report**

Item	Addressed (Y / N / NA)	Comments
Quality Assurance Program		
Statement of pre-determined DQOs for field and laboratory procedures, including quantitative DQOs	Y	The report provides only reference to the SAQP which is presented in Appendix J, and where DQOs are discussed.
DQOs state the problem, identify 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	Y	They are provided in the SAQP in Appendix J.
Quality plan designed to achieve DQOs assessing accuracy, precision, comparability, representativeness and completeness of dat	Y	Provided in the SAQP in Appendix J.
Procedures for assessing chemical data to determine if DQOs are met, including quantitative DQOs (e.g. standard deviation, % recovery, RPDs)	Yes	Provided in the SAQP in Appendix J and in Appendix F.
Procedures that describe the actions if DQOs not met	Y	They are provided in the SAQP in Appendix J.
Sampling and Analytical Program		
Site investigation objectives and a brief background provided	Y	Provided in Section 1.1 and 1.2
Summary of CSM provided	Y	A summary of the CSM is not provided in the report; however, the report refers to the site specific CSM provided in ERM 2020, *Clyde Western Area Remediation Project – Human Health and Ecological Risk Assessment. Final V3. February 2020*
Data gap analysis provided that reviews existing information	Y	Data gap are provided in the SAQP in Appendix J.
Preparation of a site specific health and safety plan and other necessary pre-mobilisation tasks	N	The report refers to Occupational Health & Hygiene (OHH) Plan and Health, Safety and Environmental (HSE) plan. However, no details are provided.
Assessment includes all relevant environmental media (e.g. soil, dust, surface water, groundwater, air, sediments and biota)	Y	
Sampling is representative of the site, based on selection of appropriate sampling	Y	A validation strategy is described in Section 4.4.1.

Item	Addressed (Y / N / NA)	Comments
points stated in sampling plan. Included are details of analytes to be monitored, sampling pattern/frequency, and number of samples, location and depth of sampling points		
Acceptability of sample collection, handling and transportation in accordance with written procedures	Y	Provided in the SAQP in Appendix F.
Sample analyses use appropriate methodologies in NATA (or equivalent) accredited laboratories for each analyte & matrix	Y	
Appropriate sampling methods & procedures, field screening methods and analysis methods are outlined	Y	Described in the SAQP in Appendix J.
Detection limits for each chemical of potential concern are appropriate for use in assessment of risk	Y	
For dynamic/reactive sampling, methods for analysing and interpreting field data are outlined	N/A	No dynamic/reactive sampling was undertaken.
Field QA/QC		
Use of standardised field sampling forms	Y	Appendices B and C
Sampling team	Y	In most cases, only field staff's initials are provided.
Sampling methods including type of container used, labelling process, order and degree of filling, preservation, labelling, logging, custody	Y	Section 6.2
Decontamination procedures between sampling	Y	
Logs for each sample, including time, date, location, sampler, duplicate location & type, chemical analyses to be performed, sample preservation method, site observations & weather	Y	The majority of details are presented in a combination of test pit logs, field notes and COCs. Sample preservation methods are stated in Appendix F. Weather observations are not made, however it is not considered to be of material effect.
COC for each sample, including sampler, sample nature, collection date, analyses to be performed, preservation method, dispatch time, condition of samples at dispatch and courier(s)	Y	Appendix L
Sample duplication/splitting techniques	N	No field duplicate samples were collected
Quality control samples, including:		

Item	Addressed (Y / N / NA)	Comments
— background samples	N/A	Not taken. Not relevant for these works.
— field duplicate samples	N	No field duplicate samples were collected
— split samples	N	No field duplicate samples were collected
— rinsate blanks	N/A	Resuable sample equipment not used.
— field blanks	N/A	Not collected
— trip blanks	Y	
— laboratory prepared trip spike samples	Y	
Background sample results	N/A	Not taken. Not relevant for these works.
Results of QC samples eg field blanks, background, rinsates, trip blanks	Y	Only available for trip blank and trip spike
Laboratory prepared trip spikes for volatile analytes and accompanying results	Y	
Field instrument calibrations (when used)	Y	PID bump-test and calibration record provided in Appendix G.
Tabulate field parameter measurements	Y	Presented on test pit logs (Appendix E).
Laboratory QA/QC		
Copy of completed COC including acknowledgment of receipt, conditions of samples on receipt and identity of samples included in shipments	Y	Appendix L
Record of holding times and compliance with methods	Y	
Analytical methods used	Y	
— Laboratory accreditation for methods used	Y	
— Performance in interlaboratory trials for methods used, where available	N	Not supplied by anlaysing laboratory. Absence has no material effect.
Description & % recovery of surrogates & spikes	Y	
Instrument detection limits and MDLs	N	Not supplied by anlaysing laboratory. Absence has no material effect.
Matrix or PQLs and limit of reporting for each analyte in each media	Y	

Item	Addressed (Y / N / NA)	Comments
Quality control samples:		
– duplicates	Y	
– method blanks	Y	
– surrogates	Y	
– matrix spikes	Y	
Laboratory standard charts	N	Not supplied by anlaysing 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	Y	Appendix F
Precision & accuracy of sampling & analysis for each analyte in each matrix, advising reliability, unreliability or qualitative value of data	Y	Note that duplicate samples were not analysed. A justification was provided in Appendix F.
Data comparability including bias assessment, e.g. different personnel, methodologies, times, spatial and temporal changes etc	N	
Results of intra and interlaboratory QC checks	No	Not provided
Names of laboratories and details of their accreditation	Y	
Discussion of appropriateness of non-standard test methods (incl. sample prep; method source and validation)	N/A	All analytical methods were standard methods.
PQLs and MDLs for all relevant matrices	Y	PQLs provided. Note: MDLS not provided by analytical laboratory, however absence has not material effect.
Acceptance limit(s) for each QC test (e.g. RPDs, recoveries) included	Y	
Acceptance limits for each calibration standard	N/A	Details not 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.	Y	Provided in the appendix called ‘Tables’ and in Appendix F
QC results relevant to the sample analyses	Y	

Item	Addressed (Y / N / NA)	Comments
QA/QC ANALYTICAL METHODS		
Field Methods		
Applicability and appropriateness of field screening methods discussed.	Y	Appropriateness of field methodologies is discussed in the SAQP.
Adequacy of calibration of field monitoring equipment and validation of field measurements	Y	Appendix G.
Laboratory screening methods		
Applicability and limitations of analytical screening techniques appropriately discussed	N/A	Not reported by laboratories
Analytical screening method performance expressed, and based on acceptable false negative rate	N/A	Not reported by laboratories
Methods specific for contaminants		
Sensitivity of analytical methods appropriate for assessment of risk	Y	NATA accredited methods were used
Precision and accuracy criteria in quality plan meet performance of 95% of laboratories in recognised inter-laboratory trials	N/A	Not reported by laboratories

Appendix F Updated LTEMP

Clyde Western Area Remediation Project

Stage 1 – Long Term Environmental Management Plan

29th January 2021

Project No.: 0515132

The business of sustainability

ERM

Document details	
Document title	Clyde Western Area Remediation Project
Document subtitle	Stage 1 – Long Term Environmental Management Plan
Project No.	0515132
Date	29th January 2021
Version	Final
Author	Ian Batterley
Client Name	Viva Energy Australia Pty Ltd

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Preliminary Draft	00	Ian Batterley	Peter Lavelle	Michael Gaggin	05.05.2020	Preliminary Draft for Viva Energy Review
Draft	01	Ian Batterley	Peter Lavelle	Michael Gaggin	12.05.2020	Draft
Draft	02	Ian Batterley	Peter Lavelle	Michael Gaggin	25.11.2020	Draft – incorporating residual conditions following remediation
Draft	03	Ian Batterley	Peter Lavelle	Michael Gaggin	1.12.2020	Draft – for Site Auditor Review
Draft	04	Ian Batterley	Stephen Mulligan	Michael Gaggin	2.12.2020	Amended Draft – for Site Auditor Review
Revised Draft	05	Ian Batterley	Stephen Mulligan	Michael Gaggin	7.12.2020	Revised Draft – based on Site Auditor Review
Final Draft	06	Ian Batterley	Stephen Mulligan	Michael Gaggin	16.12.2020	Final Draft
Final	00	Ian Batterley	Stephen Mulligan	Michael Gaggin	17.12.2020	Final
Final	01	Stephen Mulligan	Michael Gaggin	Michael Gaggin	29.01.2020	Final – Updated based on DPIE Review

Signature Page

29th January 2021

Clyde Western Area Remediation Project

Stage 1 – Long Term Environmental Management Plan

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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 intrusive works within the 'Stage 1' portion of the Clyde Western Area Remediation Project (WARP), herein referred to as 'The Stage 1 Area'

Background Information

The Stage 1 Area contained former refinery processing units, aboveground pipework for the transfer of product, electrical sub stations, the refinery Central Control Room (CCR), underground drainage pipe system and oil-water separator unit.

Remediation works completed within the Stage 1 Area were undertaken to reduce contaminant concentrations to enable future commercial / industrial land uses and mitigate potential risks to human health / ecological receptors.

Upon completion of remediation and validation works, ERM considered the site was suitable for commercial / industrial land uses including the proposed bitumen manufacturing plant with no basement structures or beneficial re-use of groundwater on site.

Application of this LTEMP

This LTEMP will be applied immediately upon the initiation of any works which involve intrusive excavation from the Site surface.

All works are to be undertaken in accordance with relevant licensing / permitting and regulatory requirements is outlined within **Section 2.0** and **Section 3.0**.

This LTEMP and the associated ERM (2020) Groundwater Monitoring Plan (GMP) are considered to be 'passive' in the sense that there are no mechanical components incorporated into the plans and that the primary purpose of the plan is to document the residual contamination on-site and outline mechanisms for managing potential risk into the future.

Residual Contamination Following Remediation Works

Following completion of remediation works within the Stage 1 Area, the following residual contamination may be present within the Site:

- Oily water / sludge associated with former underground drainage infrastructure;
- Asbestos associated with former underground building structures
- Hydrocarbon impacted soils; and
- Residual hydrocarbon impacted groundwater.

A description of residual contamination and the associated risks where intrusive excavation works are undertaken is presented within **Section 4.0** and **Section 5.0**. The location and extent of residual contamination within the Site is illustrated on **Figure 2** and **Figure 3** (Appendix A).

Required Environmental Management Controls

Based on the nature and extent of residual contamination identified within the Site the following management controls are required under various operational scenarios:

- No Intrusive Excavation (i.e. normal site operations) – No Management Controls Required
- Intrusive Excavation Works Required – Implementation of environmental management controls as detailed within **Section 7** and **Section 8** of this LTEMP.

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 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 Stage 1 Area	Stage 1 Area is situated within the eastern portion of the former Process West area and extends from Devon Street to the North to the Duck River at the southern boundary of the Western Area, the extent of which is shown on Figure 1.
The Land Custodian	The legal owner of the site identified as the Stage 1 Area

1. INTRODUCTION AND PURPOSE

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 intrusive works within the 'Stage 1' portion of the Clyde Western Area Remediation Project (WARP), herein referred to as 'The Stage 1 Area'.

- The site layout of the Stage 1 Area and portions of the Stage 1 Area, subject to this LTEMP identified to contain residual contamination, is illustrated within **Figure 1**.

ERM notes that this LTEMP is to be implemented following completion of remediation and validation works. All specific environmental management requirements during site development / construction should also be outlined within a Construction Environmental Management Plan (CEMP).

Prior to the commencement of any intrusive works, all site personnel / contractors are to be inducted into the requirements of this LTEMP and provide the Land Custodian with written confirmation that they acknowledge and understand the requirements and obligations outlined within the LTEMP.

Site specific biodiversity management measures for the Green and Golden Bell Frog, will be detailed within subsequent operational site management plans. Such plans are to be consistent with the *Revised Plan of Management: Restoration of Green and Gold Bell Frog Habitat, Clyde Terminal, January 2019 (where applicable), or its latest version*.

1.1 Purpose of the LTEMP

The specific objectives of this LTEMP are to:

- summarise background environmental information, known and likely conditions at the site, and provide a mechanism 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 that will avoid and / or mitigate adverse effects on human health and / or the environment;
- provide a recommended methodology for the appropriate environmental management of excavation works that may encounter residual contaminated soil and / or groundwater;
- provide environmental requirements for the sourcing and placement of backfill material;
- discuss safety measures / considerations for dealing with potentially contaminated soil / groundwater; and
- outline restrictions to potential future land uses as detailed within Table 3.

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 detailed within **Section 2.0**.

- The requirements outlined within this LTEMP relating to residual soil / asbestos contamination will remain in place until residual contamination is appropriately removed and validated with no remaining potential risks to identified human health / ecological receptors. Any changes to the requirements outlined within this LTEMP will require review / endorsement by a NSW EPA accredited Site Auditor.

ERM notes that future beneficial re-uses of groundwater have not been considered within this LTEMP and that all requirements relating to the ongoing monitoring of residual groundwater contamination (including monitoring end-points) are provided within the ERM (2020) Groundwater Monitoring Program (Appendix D).

- All groundwater monitoring requirements outlined within the ERM (2020) GMP are the responsibility of Viva Energy.
- Where beneficial re-uses of groundwater are proposed, further assessment of the suitability of groundwater is to be completed by a suitably qualified environmental specialist with findings reviewed / endorsed by a NSW EPA accredited site auditor.

This LTEMP and the associated GMP are considered to be 'passive' in the sense that there are no mechanical components incorporated into the plans and that the primary purpose of the plan is to document the residual contamination on-site and outline mechanisms for managing potential risk into the future.

1.2 LTEMP Revision

The Land Custodian of the Stage 1 Area are responsible for ensuring that all required stakeholders are provided with the current revision of this LTEMP.

The current revision of this LTEMP is detailed within the table below. Updates to this document must be undertaken in accordance with the requirements detailed within **Section 2.4**.

- Any subsequent revisions of this LTEMP must include a clear date / revision identifier to ensure the most current version of the LTEMP is implemented.

Table 1 – LTEMP Revision

Document Name	Document Revision Number	Date
Clyde Western Area Remediation Project: Stage 1 – Long Term Environmental Management Plan	■ Draft 02	■ 25/11/2020

1.3 Limitations to this LTEMP

This LTEMP may not be applicable to potential future redevelopment that is not consistent with the current proposed use of the Stage 1 Area.

Where future land uses differ from the commercial / industrial land uses assumed within the ERM (2020) Human Health and Ecological Risk Assessment (HHERA), a review of the HHERA should be undertaken to assess the requirements for potential additional / modified site management provisions.

As the HHERA was based on a slab on grade commercial/ industrial land use, basement construction was not contemplated and is currently not permitted. Further specific assessment and review by a NSW EPA Accredited Site Auditor will be required prior to any such construction.

1.4 Related Documentation

The following documentation provides a summary of site conditions prior to the completion of remediation works within the Site and may be made available to the responsible entity upon request.

- ERM 2020a. Clyde Western Area Remediation Project – Remediation Site Investigation. Final V3. February 2020.
- ERM 2020b. Clyde Western Area Remediation Project – Human Health and Ecological Risk Assessment. Final V3. February 2020.

The following documentation relating to the environmental condition of the Stage 1 Area prior to and following the completion of remediation / validation works within the Site should be made available to the responsible entity for ongoing environmental management.

- ERM 2020c Clyde Western Area Remediation Project – Stage 1 – Detailed Remediation Action Plan V2. May 2020.

- ERM 2020d Clyde Western Area Remediation Project – Groundwater Monitoring Program V3. June 2020.
- ERM 2020e Clyde Western Area Remediation Project – Stage 1 - Validation Report. December 2020.
- ERM 2020f Clyde Western Area Remediation Project – Drainage Decommissioning Validation Report (Stage 1). December 2020.

2. STATUTORY REQUIREMENTS

2.1 Legal Enforceability and Public Notification of this EMP

Upon Site Auditor endorsement of this LTEMP all requirements are legally enforceable via existing Development Consent Condition B10(a) and (b) of the State Significant Development 9302, as issued under Section 4.38 of the Environmental Planning and Assessment Act 1979 (the 'EP&A Act'). This condition is 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***

As per condition B10 (b), Parramatta Council will be requested to add a notation under section 10.7(5) of the *EP&A Act* that the property is subject to this LTEMP.

2.2 Licence and Approval Requirements

The Land Custodian or its designated representative is responsible for obtaining all necessary / required environmental, safety and occupational hygiene approvals and licences prior to the commencement of any works that may impact underlying residual contamination.

- All required permits, approvals and notifications (e.g. SafeWork NSW notifications) required at the time of works must be complete, finalised and (where necessary) approved prior to works commencing;
- All site personnel, contractors, sub-contractors etc. must comply with the terms and conditions of all approvals and licences obtained; and
- Upon commencement of any intrusive works, all processes and procedures outlined in the LTEMP must be implemented immediately.

2.3 Regulatory Framework

During the course of any intrusive works within the Stage 1 Area, all operational personnel working within the site shall comply with the applicable environmental regulatory requirements in New South Wales (NSW) at the time of works.

Any works that require the handling, movement or disposal of contaminated soils / groundwater are to be undertaken in accordance with the operational site specific Environmental Protection Licence (EPL) and all relevant made / approved NSW EPA guidelines at the time of works.

2.4 Document Revision

This LTEMP may be reviewed and updated as necessary. Therefore, it is the responsibility of the reader of this document to ensure they have the current version of the LTEMP.

Where onsite works or inspections / audits identify that the LTEMP requires updating, the LTEMP should be updated as required. ERM notes that any updates to this LTEMP will require review and endorsement from 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.

3. APPLICATION AND RESPONSIBILITIES

3.1 Implementation of this LTEMP

To ensure all site personnel / contractors are aware of the requirements detailed within this LTEMP, this LTEMP will be recorded on the Land Custodians site management / induction database (or any subsequent iterations / versions of the database).

Prior to the commencement of any intrusive woks, site personnel / contractors will be required to complete all necessary access induction and works permitting which will include induction into the requirements of this LTEMP.

No works are to be undertaken until all relevant induction documentation has been received by the Land Custodian from onsite personnel / contractors including acknowledgement that they are aware and understand all requirements detailed within this LTEMP.

- ERM notes that this LTEMP is to be implemented following completion of remediation and validation works. All specific environmental management requirements during site development / construction should also be outlined within a Construction Environmental Management Plan (CEMP)).

3.2 Area to which this LTEMP applies

The site is identified as Part Lot 100 in DP 1168951 and is located within the Stage 1 portion of the Clyde WARP.

- This LTEMP applies to the entire site, however specific management is required for areas within a 20 m buffer of where residual contamination (residual hydrocarbon impacted soil, residual asbestos formwork and residual site infrastructure) will remain in-situ following completion of remediation works. These locations requiring specific management are illustrated on Figure 1 and described within Section 5 of this LTEMP; and
- ERM notes that due to the historical land uses within the Site (i.e. former Refinery), all works must be undertaken in consideration of potential unexpected finds of contamination. Where unexpected finds are encountered during works, they too are to be managed in accordance with the requirements outlined within Section 7.1 of this LTEMP.

3.3 Application of LTEMP

This LTEMP will be applied immediately upon the initiation of any works which involve intrusive excavation from the Site surface, which may involve the following activities:

- excavation of fill and natural soil materials to facilitate removal, realignment or construction of any subsurface infrastructure;
- maintenance and / or upgrade of site utility services;
- temporary stockpiling of excavated material resulting from onsite intrusive works; and
- offsite disposal of any waste contaminated soil / groundwater (if required).

Controls outlined within this LTEMP are to be implemented where intrusive works / excavation works are undertaken. ERM further notes that additional controls including engagement of an environmental specialist, environmental monitoring and development of a task specific works plan (detailed within **Section 7.1**) are required for any works undertaken within 20 m of identified residual contamination (**Figure 2**).

- ERM notes that provided the site surface is not disturbed, including groundwater extraction, none of the controls in this LTEMP are necessary

Ongoing requirements for groundwater monitoring post-remediation will be established and documented within the ERM (2020) Groundwater Monitoring Program. This will collect data to confirm stability of conditions and that attenuation of residual groundwater impacts is occurring.

- Where groundwater is proposed for future beneficial re-uses, an assessment of suitability must be undertaken by a suitably qualified environmental professional. The assessment and any recommendations for re-use etc. must be reviewed and endorsed by a NSW EPA Accredited Site Auditor.

3.4 Roles and Responsibilities

The following table summarises potential requirements to be implemented within the Stage 1 Area.

Table 2 – LTEMP Roles and Responsibilities

Position / Company	Responsibility
Stage 1 Area Land Custodian , Viva Energy and Site Auditor	■ Approve the LTEMP
Viva Energy	■ Undertake all groundwater monitoring as per the requirements detailed within the ERM (2020) Groundwater Monitoring Program and Development Consent SSD 9302.
Stage 1 Area Land Custodian (Downer)	■ Ensure all workers and contractors understand the nature and extent of residual contamination. ■ Require all contractors and sub-contractors comply with statutory and license requirements. ■ Maintain records of all works undertaken within the site as required within this LTEMP. ■ Provide safe access to the site for completion of tasks associated with the Groundwater Monitoring Program, and make all reasonable efforts to maintain the integrity of the existing groundwater monitoring well network.
Stage 1 Area - Site Operational Staff, Contractors and Subcontractors	■ Implement the LTEMP at site level. ■ Provide adequate training for all employees and contractors during site induction, and as required on an ongoing basis during the works. ■ Comply with the relevant conditions of the consents and licenses (i.e. comply with all regulatory requirements). ■ Require any sub-contractors to comply with statutory and license requirements and conditions of the LTEMP. ■ Conduct monitoring as required in the LTEMP. ■ Complete all necessary registers, databases and records required in the LTEMP. ■ Meet all OH&S regulatory requirements. ■ Ensure that all environmental protection measures are in place and are functioning correctly. ■ During excavation works, assess any potentially contaminating unexpected finds in consideration of the sites use. ■ During intrusive excavation works, as required, undertake site inspections and monitoring of the site operations to ensure they are carried out in an environmentally responsible manner and meet the requirements of this LTEMP. ■ Complete, audits, non-conformance, incident, complaint and corrective action reports and follow up as required. ■ Ensure all non-conformance and/or complaints are reported to the appropriate responsible agent / authority. ■ Undertake corrective actions in response to requests made by the responsible agent regarding specific environmental or safety issues. ■ Notify the Land Custodian / nominated representative of any significant environmental issues.

Position / Company	Responsibility
	■ Assess the requirement and (where necessary) engage an environmental specialist / scientist to undertake additional monitoring of excavations / unexpected finds.
Qualified Environmental Specialist	■ Where required, a suitably qualified environmental specialist is to be engaged to manage, monitor and evaluate environmental controls (including the Groundwater Monitoring Program), demonstrate compliance with this LTEMP and assess specific requirements associated with excavation works within areas of known residual contamination and / or unexpected finds.

4. BACKGROUND INFORMATION

4.1 Site Details

The Western Area is an approximately 40 hectare (ha) parcel of land currently owned by Viva Energy 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.

The Stage 1 Area extends from Devon Street to the North to the Duck River at the southern boundary of the Western Area. A Site Survey showing the Extent of the Stage 1 Area is provided as *Appendix C*.

The Stage 1 Area contained former refinery processing units, aboveground pipework for the transfer of product, electrical sub stations, the refinery Central Control Room (CCR), underground drainage pipe system and oil-water separator units.

Specific site identification details are summarised in *Table 3*, below.

Table 3 – Site Identification

Item	Description
Site Owner	■ Viva Energy Australia Pty Ltd (Viva)
Site Occupier	■ Downer EDI Works Pty Ltd (Downer) – anticipated early 2020
Site Address	■ Devon Street, Rosehill NSW
Legal Description	■ Part Lot 100 in DP 1168951
Local Government Authority	■ City of Parramatta Council
Current Zoning	■ IN3 – Heavy Industrial under the Parramatta Council Local Environmental Plan 2011
Current Land Uses	■ Vacant site
Future Proposed Land Use	■ Bitumen manufacturing plant (slab on grade commercial/ industrial) ■ Upon completion of remediation and validation works, the site is suitable for commercial / industrial land uses with no basement structures or beneficial re-use of groundwater.
Permissible Land Use(s)	Any permissible use allowed under the sites zoning (with consent), which 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[1]	■ 7 hectares
Elevation	■ Between 3 and 4 metres Australian Height Datum (m AHD)

Source:

1. City of Parramatta Council LEP (2011)

5. RESIDUAL CONTAMINATION REQUIRING MANAGEMENT

Remediation works completed within the Stage 1 Area were undertaken to reduce contaminant concentrations to enable future commercial / industrial land uses and mitigate potential risks to human health / ecological receptors.

Based on field observations and results of validation sampling undertaken during completion of remediation and validation works, residual contamination is present within locations illustrated (including X and Y co-ordinates) on **Figure 2** and **Figure 3**.

A detailed description of residual contamination within the Stage 1 Area is provided below.

Table 4 – Stage 1 Area Residual Contamination

Potential Residual Contamination	Descriptions
Oily water / sludge associated with former underground drainage infrastructure	■ Due to the former operational history of the Site, there are 11 redundant underground pipes/drains throughout the Site that may require consideration during future potential intrusive excavation works which were decommissioned and decontaminated in-situ during site remediation works (to the extent practical due to access / structural considerations) (**see Figure 2**). ■ ERM notes that underground drainage lines were subject to cleaning, decontamination and were decommissioned in-situ via permanent disconnection from operational portions of Viva Energy's Clyde Terminal drainage network and backfilling pits and junctions with stabilised sand. ■ While drainage infrastructure within the Site is not considered to pose a risk to future site operations, residual hydrocarbon impacted sludge and sediment within pipes and pits shown on Figure 3 should be managed to avoid inadvertent release of LNAPL during future construction works and manage potential safety risks for workers (via dermal contact/inhalation) during and future excavation works undertaken to remove this infrastructure. Residual conditions are discussed in detail within the Drainage Decommissioning Validation Report (ERM 2020f). The location of drainage infrastructure is provided on Figure 3.
Asbestos associated with former underground building structures	■ Due to former site infrastructure located within the Site, there are three (3) redundant structures associated with former buildings located within the subsurface (redundant concrete footings etc.). During remedial works, asbestos formwork was noted to be present within a limited number of underground structures, which, due to structural reasons were not removed during site remediation. ■ Following completion of remedial works, several concrete structures containing asbestos formwork remain in-situ as illustrated on **Figure 2.** ■ ERM notes that based on site observations made during remedial works, asbestos is considered to be limited to isolated use as formwork for concrete footings and was not identified to be present within residual fill / soil material located within the Site. ■ While ERM notes that asbestos formwork within subsurface structures do not pose a risk to identified receptors under normal site operations/conditions, where intrusive excavation works are planned, additional controls such as health and safety planning, air / dust monitoring, spoil management and unexpected finds management may be required.
Hydrocarbon impacted soil	■ Remediation works were focussed on the selective excavation and removal of contaminated soils. Following completion of remediation works within the Stage 1 Area, the potential exists for hydrocarbon impacted soils to be present within the Site boundary at known and unknown locations. ■ Following completion of remedial works, residual LNAPL or soil contamination exceeding TRH Management limits are present in a limited number of locations within the walls and base of the remediation excavation and within fill materials surrounding subsurface drainage infrastructure that has been decommissioned in-situ.

Potential Residual Contamination	Descriptions
	■ While ERM notes that results from the HHERA indicate that the presence of residual hydrocarbon impacted soils does not pose a risk to identified receptors under normal site operations and are limited to aesthetic considerations (presence of hydrocarbon staining and/or odours). Where intrusive excavation works are planned in identified areas, additional controls such as health and safety monitoring, gas testing, spoil management and unexpected finds management may be required.
Residual hydrocarbon impacted groundwater	■ Based on information obtained as part of previous investigations, groundwater is present within the Stage 1 Area at a depth of approximately 1 – 1.5 m bgl. ■ Remediation works within the site have removed the primary sources of impact (hydrocarbon impacted soils exceeding site suitability criteria). Previous investigations within the Stage 1 Area and broader Clyde Terminal site have identified degraded and non-volatile LNAPL within soil and groundwater at concentrations which do not pose a risk to human health or the environment. ■ ERM notes that results from previous investigations indicate that dissolved phase groundwater concentrations are stable or decreasing and do not pose a risk to identified receptors where intrusive excavation and / or contact with groundwater does not occur. ■ Where intrusive works are planned within the Site, additional controls such as health and safety monitoring, gas testing, excavation dewatering management and unexpected finds management may be required. ■ ERM further notes that ongoing requirements for groundwater monitoring post-remediation (as per remediation Development Consent) have been established and documented within the ERM (2020) Groundwater Monitoring Program to confirm that natural attenuation of residual groundwater impacts is occurring.

5.1 Location and Extent of Residual Contamination

As outlined in Section 3.2, this LTEMP applies to the whole site but more specifically to areas of the site where residual contaminated materials are retained under the site surface, as indicated in **Figure 2** and **Figure 3**. Following completion of remediation works, the following residual sources of contamination are known to exist within the Stage 1 Area:

- Residual soil impacts – limited to presence of LNAPL or hydrocarbon impacts exceeding TRH management limits:
  - Northern portion - AEC9_W_V24, TP19/42
  - Southern Portion - TP20/17, TP20/20 and TP18/09
- Asbestos associated with sub-grade footings and infrastructure (detailed within Appendix B):
  - AEC9_ACM_1
  - AEC9_ACM_2
  - AEC9_ACM_3
- Residual hydrocarbon sludge remaining within the decommissioned drainage pipes/pits (as per Figure 3).

ERM notes that due to the historical land uses within the Site, all future ground disturbance works or site redevelopment activity must be undertaken in consideration of potential unexpected finds of contamination.

Where unexpected finds are encountered during works, they too are to be managed in accordance with the requirements outlined within this LTEMP.

It should be noted the presence of stained or odorous material may be identified beneath the site during future intrusive works outside of those locations outlined in this LTEMP, however these conditions may not be representative of unacceptable exposure scenarios. Advice should be sought from an Environmental Consultant as per the roles and responsibility outlined in **Table 2**.

6. POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT

6.1 Risks Where No Intrusive Excavation Works Are Undertaken

The following table outlines the potential risk to human health and the environment if residual contamination as illustrated within Figure 2 remains undisturbed (i.e no intrusive excavation works). As outlined previously, it is noted that ongoing assessment / management of groundwater will be undertaken in accordance with the ERM (2020) Groundwater Monitoring Program (Appendix D).

Contaminant	Source	Management Controls	Human Health Risks	Environmental Risks	Exposure Pathways
Total Recoverable Hydrocarbons (C10-C16, C16-C34) and Light Non Aqueous Phase Liquids	Residual contamination within soils, groundwater and oily water / sludge	NA – no controls required	Negligible	Negligible	Negligible
Asbestos	Asbestos located within concrete formwork	NA – no controls required	Negligible	Negligible	Negligible

6.2 Potential Risks Where Intrusive Excavation Works Are Undertaken

The following table outlines the potential risk to human health and the environment if the material is disturbed without proper management controls. These risks may result from excavation works, installation of services, stockpiling of excavated materials and works that encounter residual contamination identified within Figure 2 or additional unexpected finds.

Contaminant	Source	Disturbed	Human Health Risks	Environmental Risks	Exposure Pathways
Total Recoverable Hydrocarbons (C10-C16, C16-C34) and Light Non Aqueous Phase Liquids	Residual contamination within soils, groundwater and oily water / sludge	Intrusive works such as excavation works, stockpiling of materials etc.	The effects on human health depend on a number of factors such as how long exposure occurs, concentrations in air, soil or water, and the health and age of the affected individual. ■ Potential for generation of odours during subsurface intrusive works resulting from degraded hydrocarbons within open excavations.	Risks associated with contamination transported to potentially sensitive receptors	**Human Exposure Pathways:** Limited to aesthetic considerations including potential for generation of odours during subsurface intrusive works **Environmental Exposure pathways**: Surface water / sediment run off to adjacent stormwater drains. Uncontrolled release of dust/ odours

Contaminant	Source	Disturbed	Human Health Risks	Environmental Risks	Exposure Pathways
					generated during excavation works.
Asbestos	Asbestos located within concrete formwork	Asbestos fibres can cause asbestosis, lung cancer and mesothelioma	■ 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 could occur through breathing in fibres in dust generated during soil disturbance activities. **Environmental Exposure pathways**: Nil

7. ENVIRONMENTAL MANAGEMENT

As outlined above the primary targets / goals of this LTEMP are to ensure that:

- the assessed risks to human health and the environment arising from contact with residual contamination is understood by all site workers and managers;
- prior to the commencement of any intrusive excavation works, appropriate systems and controls are put in place; and
- ensuring all ongoing operational, monitoring and maintenance requirements are adhered to by Site owners and/or managers.

7.1 Environmental Management Requirements

Prior to the commencement of works, it is the responsibility of Stage 1 Area Land Custodian and / or their nominated representative to determine if works within the Stage 1 Area will require intrusive excavation.

- Where any intrusive excavation works are undertaken within the Site the following controls must be implemented.

Table 5 – Stage 1 Area Environmental Management Requirements

Item	Requirements
All Intrusive Excavation Works Undertaken within the Stage 1 Area	
Training and Competence	The Land Custodian is to ensure that all site 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 the relevant documentation, training on the location of known residual contamination and in the identification of visual and olfactory indications of additional unexpected finds of contamination.
Health and Safety Plan	The contactor is to prepare a task specific health and safety plan that includes suitable protection measures for working with residual hydrocarbon contamination including but not limited to: ■ training requirements; ■ air / dust / odour monitoring action levels and monitoring procedures; ■ required respiratory protection; ■ minimum Personnel Protective Equipment (PPE) requirements; ■ site signage requirements; ■ site security; ■ required exposure route pathway mitigation measures (dust suppression etc.); ■ vehicle/machinery/plant safety; and ■ general site safety.
Excavation works and temporary stockpiling	To reduce and/or prevent the exposure of human receptors at the site to potential contamination within onsite soils, the following will be undertaken during any intrusive excavation works: ■ To reduce the area of disturbed material, the number of areas subject to excavation works at any one time should be minimised. ■ During excavation works, measures to reduce dust emissions such as spraying with water, addition of soil binding agents etc. should be undertaken. ■ Where works are undertaken within the vicinity of known asbestos materials, dust monitoring (as detailed below) is also to be undertaken to assess the suitability of controls for mitigating potential for fugitive airborne asbestos. ■ 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 adjacent workers / receptors.

Item	Requirements
	■ Where material requires offsite disposal, excavated material should be placed directly into a tipper truck and where possible material should not be placed into temporary stockpiles awaiting offsite disposal. ■ Where material requires stockpiling prior to offsite disposal, appropriate dust and sediment controls must be in place. Smaller volumes should be contained within an enclosed or covered skip. ■ All materials movement within the site must be recorded within an appropriate Materials Tracking Register.
Materials handling and disposal	■ **Soil** - Excavated materials are to be either re-instated within the same location (in accordance with relevant planning / DA conditions) or disposed offsite to a suitably licenced landfill / receiving facility in accordance with relevant NSW EPA waste disposal guidance at the time of works. ■ **Concrete** – Excavated concrete footings containing asbestos formwork are to be disposed offsite to a suitably licensed facility in accordance with NSW EPA waste classification requirements at the time of works. ■ **Groundwater** - Any groundwater extracted from excavation works is to be managed as per the site specific EPL or disposed in accordance with relevant NSW EPA made or endorsed waste disposal guidance at the time of works. ■ **Residual Oily Water / Sludge** – Oily water / sludge associated with redundant drainage infrastructure if encountered during excavation works should be classified and disposed offsite to a suitably licenced facility in accordance with relevant NSW EPA waste disposal guidance at the time of works.
Sediment and Stormwater Runoff Controls	During works, sediment and surface water runoff controls will be implemented to minimise generation and transport of potentially contaminated sediments and surface water within and off the Site. While ERM notes that controls will be developed based on the specific location / nature of works to be undertaken, controls may include (but not be limited to): ■ Sediment control; ■ Clean water diversions; and ■ Stormwater drain protection. Sediment control is required. Sediment control measures (i.e. silt fencing and hay bales) will be strategically placed at the following locations: ■ Down-gradient of temporary stockpiles or highly disturbed areas; ■ Up-gradient of temporary stockpiles to redirect water; and ■ Down-gradient of any surrounding stormwater channels that flow within/through the Site, as contingency against overflow into adjacent site areas. Clean water diversions are required to minimise ingress to excavations and soil erosion. Where necessary, clean water diversions (hay bales and gravel bags) will be strategically placed in the following locations: ■ Up-gradient of temporary stockpile or excavation areas to redirect water; and ■ Down-gradient of any surrounding stormwater channels that flow within/through the Site as contingency against overflow into bunded stockpile locations. Stormwater drain protection is required to prevent ingress of sediments to the stormwater infrastructure and will comprise: ■ Installation of sediment socks in any identified stormwater drains located down-gradient of any temporary stockpile areas. All sediment and surface water controls will be inspected by the Land Custodian's nominated representative during works, to inspect the controls in operation. Should any control measures be damaged or defective, the issue will be reported to the contractors project manager / representative, to arrange for repair or modification of the control systems in place.
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 a VENM certificate, sampling will not be required. The ENM / VENM certificate should at a minimum:

Item	Requirements
	■ state that the material has been classified as 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 or fill material other than VENM (i.e. 'clean fill') is imported to the site, a site visit to the source site by an environmental consultant to enable collection and analysis of soil samples may be required. Samples are to be analysed for relevant contaminants of concern for the specific conditions of the source site. All VENM / imported material classification reports are to be provided to Land Custodian or their nominated representative and included within compliance reporting upon completion of works (Section 7.3).
Unexpected Finds Management	During excavation works there is the potential of encountering additional in-ground finds. Unexpected finds may include (but not be limited to): ■ asbestos containing materials; ■ additional LNAPL / hydrocarbon impact; ■ buried building rubble; ■ unusual soil staining and discoloration; and ■ odours emanating from the ground during earthworks. 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. The environmental consultant 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 relevant regulatory / approval authority and Land Custodian for record keeping requirements. Where analysis of unexpected finds indicates a potential risk to either human health and or the environment necessary, a Task Specific Works Plan (as detailed below) may be prepared. The plan is to be developed to outline task specific procedures / processes to be adopted to minimise the risk to human health and / or the environment from any unexpected finds.
Vehicle and Equipment Cleaning and Operation	The following controls will be placed on operation and movement of equipment: ■ All equipment will be operated by suitably qualified operators. ■ Equipment working within any area containing contaminated materials will be washed inside the area. Wash water must be prevented from leaving the site / entering drains. ■ The surface of internal access roads carrying vehicular traffic will be kept clean. ■ All equipment will be maintained at optimum operating conditions and any servicing of equipment will be undertaken in areas specified by the Contractor. It is recommended that such activities be undertaken on concrete or bitumen surfaces to prevent impact to surface soils by oils, fuels or cleaning agents. ■ Any fuel stored onsite will be held in a designated area. The area will be appropriately bunded to contain any potential spillages and/or leaks. ■ Vehicles carrying spoil or rubble from the site (if required) will at all times be covered with an "enviro-tarp" or similar impervious material to prevent the escape of dust or other material.

Item	Requirements
	■ All heavy vehicle access and egress to and from the site will be via the designated heavy vehicle route. ■ The wheels and wheel arches of all vehicles having had access the site will be inspected and if required, cleaned by the use of a broom or water spray to prevent mud and sediment from being deposited on local roadways. ■ After wheel and wheel arch cleaning, vehicles will be inspected for the presence of rocks between tyres and sediment within the undercarriage of the vehicle. Any material will be removed and placed at a designated point within the site.
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.
Intrusive Excavation Works Within 20 m of Identified Residual Contamination (Figure 2)	
Engagement of Environmental Specialist	Where excavation works are undertaken within 20m of identified residual contamination (Figure 2) prior to the commencement of any intrusive works the Land Custodian or nominated representative is to engage a suitably qualified environmental specialist to undertake a review of health and safety management procedures, manage, monitor and evaluate environmental controls and demonstrate compliance with this LTEMP. ■ ERM notes that where unexpected finds of contamination are identified within other areas of the Site during excavation works, scientist suitably qualified environmental specialist should be engaged to manage, monitor and evaluate environmental controls, demonstrate compliance with this LTEMP and assess specific requirements for unexpected finds detailed above.
Environmental Monitoring	Environmental monitoring is to be undertaken for Volatile Organic Compounds in ambient air during all excavation and construction works within 20 m of identified residual hydrocarbon contamination to evaluate the effectiveness of control measures (Figure 2). Where works are to be undertaken within the vicinity of identified asbestos, dust monitoring should be undertaken to assess the effectiveness of environmental controls on preventing airborne releases of asbestos fibres. Air monitoring is to be undertaken by a suitably qualified occupational hygienist. ■ The specific monitoring methodology / regime should be developed by the environmental specialist / occupational hygienist and based on the specific tasks / construction mythology to be undertaken. ■ Action levels (vapour / dust / airbourne fibre levels where intrusive works are to cease and control measures are to be re-assessed / implemented) will be required to be developed within the health and safety plan and are to be based on relevant regulatory guidance at the time of works.
Task Specific Works Plan	Where intrusive excavation works are undertaken within 20 m of identified residual contamination illustrated on Figure 2, prior to undertaking works, 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. ■ The Works Plan should be prepared for the specific works to be undertaken. ■ The Works Plan should be prepared in accordance with industry best 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. ■ 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).

Item	Requirements
	■ Mitigation measures. ■ Air / dust monitoring action levels, including monitoring procedures for Lower Explosive Limit (LEL) and Volatile Organic Compounds (VOCs) 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 the site EPL and / or NSW EPA waste disposal guidance. ▪ Excavated soils should be placed on within a bunded area to minimise potential run off. ▪ Excavated concrete containing asbestos formwork should be covered following excavated to prevent wind-blown emissions of potential asbestos. ▪ 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 NSW EPA waste disposal regulations. ▪ ERM notes that excavated concrete materials containing asbestos formwork are not to be replaced within the Site and are to be disposed offsite in accordance with NSW waste disposal requirements at the time of works. ■ Reinstatement of the site surface. ■ Waste management including waste disposal. ■ Record Keeping, audit and review.
Biodiversity Management Measures (Green and Golden Bell Frog)	
Green and Golden Bell Frog (GGBF)	Consistent with Viva Energy's existing GGBF management measures for the Clyde Terminal, to mitigate against potential impacts to the GGBF population, the following measures are to be included in an administered by the Stage 1 Land Custodian as part of an operational Environmental Management Plan: ■ Works inductions that focus on the potential occurrence of the species; ■ Pre-clearance surveys by an environmental representative as needed for stockpiles and excavations to check for the presence of GGBF; ■ Management of the site to minimise potential for creating habitat (i.e. no ponding of water); ■ Measures to minimise indirect impacts to GGBF through spread of Chytrid fungus; and ■ An unexpected find protocol which outlines the need to engage a suitably qualified ecologist to relocate any GGBF encountered.

7.2 Stage 1 Area Emergency Response

In the event of any incident, the first priority shall be the safety of all personnel and the community in the immediate vicinity.

In the event of a serious emergency at the site, the following procedure will be followed:

- Stop work;
- All personnel shall leave the work zone via established entry/exit routes;
- Leave the site and assemble at the emergency assembly area (as designated by the Site manager); and

- Await further instructions from the designated site manager. No project personnel or visitors are to leave the assembly area unless advised to do so by the site manager or their onsite representative to be nominated at a later stage.

The Site manager or their designated entity will notify the relevant service as to the details regarding any emergency.

Following emergency response, all practical steps should be taken to minimise the risk of further environmental damage as soon as possible after the event. The situation should be stabilised by following the appropriate incident management or contingency plan procedures. The appropriate staff should be notified and emergency procedures enacted.

Typical first response actions may include:

- Assessment of vapour concentrations / asbestos fibre counts from air monitoring in excavation areas and associated risk to human health;
- Temporary repair or isolation of failed plant / equipment component; and
- Sampling of impacted site media, be it soil, groundwater and / or surface water.

Follow-up action will include the development of a work plan to remediate or manage the impacted site media. The work plan would detail any sampling and analysis requirements to define the nature and extent of impact, methods for the recovery, handling, storage and treatment of impacted material, disposal and/or reuse options for impacted material and personal protective equipment requirements.

Records will be kept of any incidents, accidents, hazardous situations, unusual events and unsafe health exposures and the corrective action taken. Where necessary, the LTEMP should be updated based on findings of corrective actions / improvements etc.

7.3 Communication, Reporting and LTEMP Auditing Requirements

The table below outlines the reporting and auditing requirements to communicate information related to the Stage 1 Area LTEMP,

Table 6 –Stage 1 Area LTEMP Reporting and Auditing

Report	Requirement
Material Classification Reports	■ All reports relating to unexpected finds, offsite 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 laboratory analysis and subsequent classification information and materials tracking information detailing the total volume and final placement / disposal location.
Non-Conformance Reporting	■ Non-conformances 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 operational staff. ■ It is the responsibility of the site manager to immediately initiate corrective actions, if required. Once completed, the site foreman will provide details of the actions undertaken on the Non-Conformance Report and sign, date and file the report.
Incident Reporting	■ Records will be kept of any environmental incidents, accidents, hazardous situations, unusual events and unsafe health exposures and the corrective action taken. ■ The contractor / site superintendent will adequately investigate the cause of any incident so that necessary changes in work practices can be made to prevent the incident recurring.
Complaints Reporting	During intrusive works undertaken the Site, the contractor will maintain a register of complaints, which will include a record of any action taken with respect to the complaints. ■ If a complaint identifies a non-conformance, a Non-Conformance and Corrective Action Report must be initiated. ■ A copy of all complaint reports and subsequent investigations are to be provided to the Land Custodian or their nominated representative for filing and included within compliance reporting (detailed below).
LTEMP Compliance Reporting	Upon completion of any intrusive works, the contractor is to provide the Land Custodian or their nominated representative an Environmental Compliance Report detailing the following: ■ Details of the works undertaken including relevant photographs. ■ Details of management provisions in place to ensure compliance with this LTEMP, the HASP and SMP during the works. ■ Details of any non-conformances, complaints and corrective actions. ■ Details of any unexpected finds (nature, extent and results of testing / analysis undertaken, photographs). ■ Details of the appropriate classification, volume and disposal location of any material disposed offsite. ■ Details (including photographs) of any imported fill materials including volumes and confirmation of the suitability for use within the Site The report is to be provided to Land Custodian or their nominated representative **within 21 days** of completion of works.
LTEMP Performance Monitoring	This LTEMP should be reviewed by the Land Custodian or their nominated representative upon completion of all intrusive excavation activities 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, licence and approval conditions are identified and complied with. The assessment should take into account all changes such as (but not limited to): ■ changes to site conditions; ■ work requirements; ■ legislation; and ■ environmental condition.

Report	Requirement
	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); ■ a suitable qualified environmental consultant; and ■ a NSW EPA accredited Site Auditor.
Ongoing Groundwater Monitoring Reporting	The mechanism for reporting results of groundwater monitoring, as outlined in Section 3.6 of the Groundwater Monitoring Program (refer appendix B). A Groundwater Monitoring Report and Annual Summary will be produced including the following information: ■ 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 amendment as necessary, including any proposed changes to monitoring (as appropriate) ■ Completion of interpretive QA/QC assessment As groundwater monitoring pertains to the development consent for the Western Area Remediation Project, these reporting requirements will be managed by Viva Energy (as proponent).
Record Keeping	All records related to implementation and ongoing auditing of the LTEMP should be maintained by the Land Custodian or their nominated representative in a consolidated and easily accessible location.

8. CONTINGENCY ACTIONS

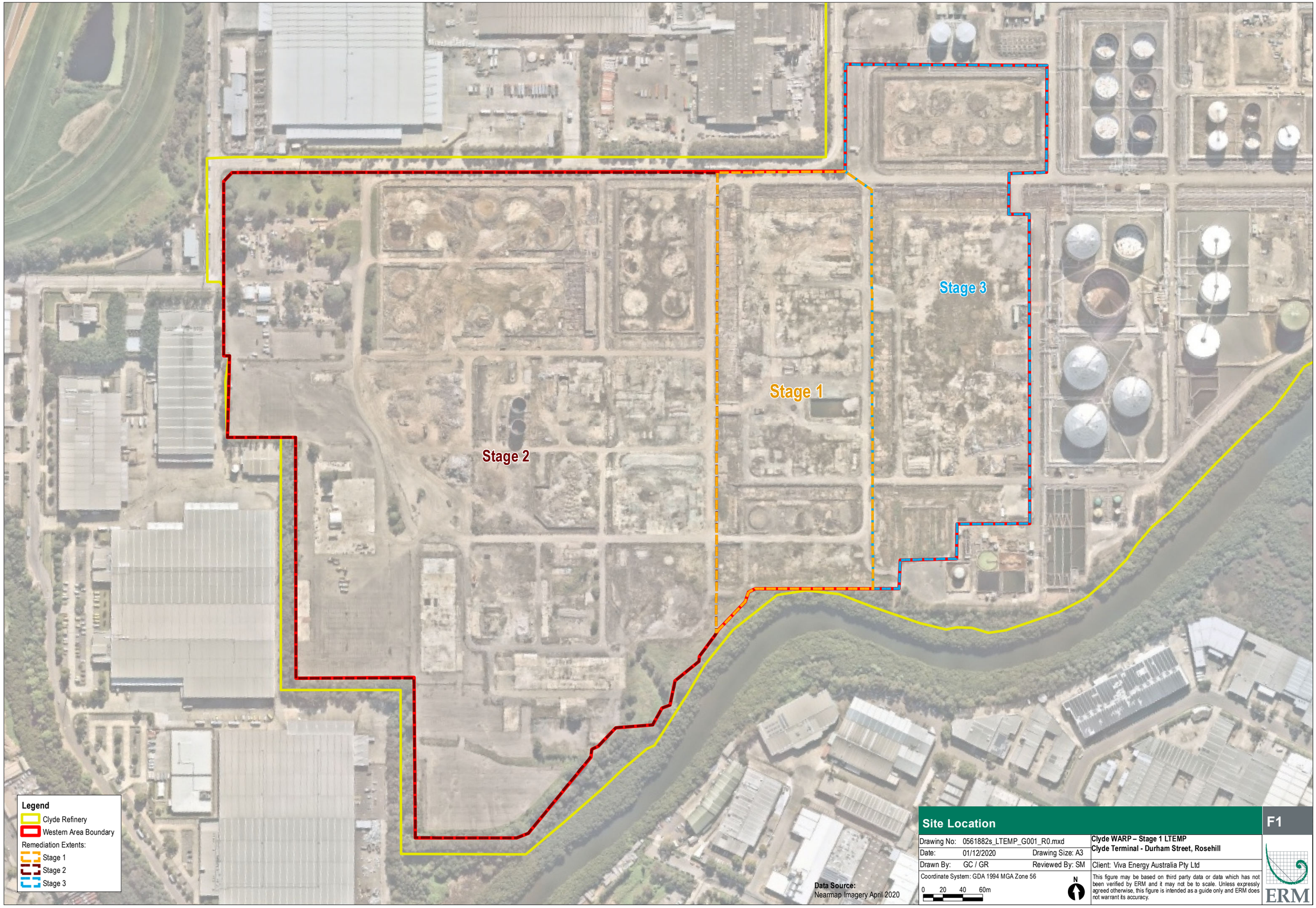
The purpose of the contingency plan is to identify unexpected situations that could occur, and specify procedures that can be implemented to manage such situations and prevent or minimise adverse impacts to the environment and human health.

Details of the procedures are defined in the table below:

Table 7 –Stage 1 Area Contingency Actions

Item	Contingency Action
Additional / unexpected groundwater contamination	■ Contingency responses to groundwater monitoring are described in the ERM (2020) Groundwater Management Plan.
Asbestos Contamination	■ While asbestos has been identified within formworks associated with former site infrastructure, asbestos (fragments and / or fibres) in soils have not been identified within the Stage 1 Area. ■ While it is the opinion of ERM that the risk of significant and / or widespread asbestos contamination within the Stage 1 Area is unlikely, where asbestos contaminated soil is identified during development works, any finds should be investigated as per the unexpected finds methodology detailed within Section 7.1. ■ Identified asbestos remaining on site should be included on an updated version of the Asbestos Register (provided as Appendix B).
Additional/ unexpected LNAPL / Hydrocarbon Contamination resulting in Potential Vapour Risk	■ While it is the opinion of ERM that the likelihood of vapour risk from additional / unexpected finds of LNAPL / hydrocarbon impacted soil and / or groundwater is unlikely, during future development works, where a potential indicators of vapour risk is identified, the Land Custodian should engage an environmental specialist to undertake further assessment.

APPENDIX A FIGURES



Site Location

F1

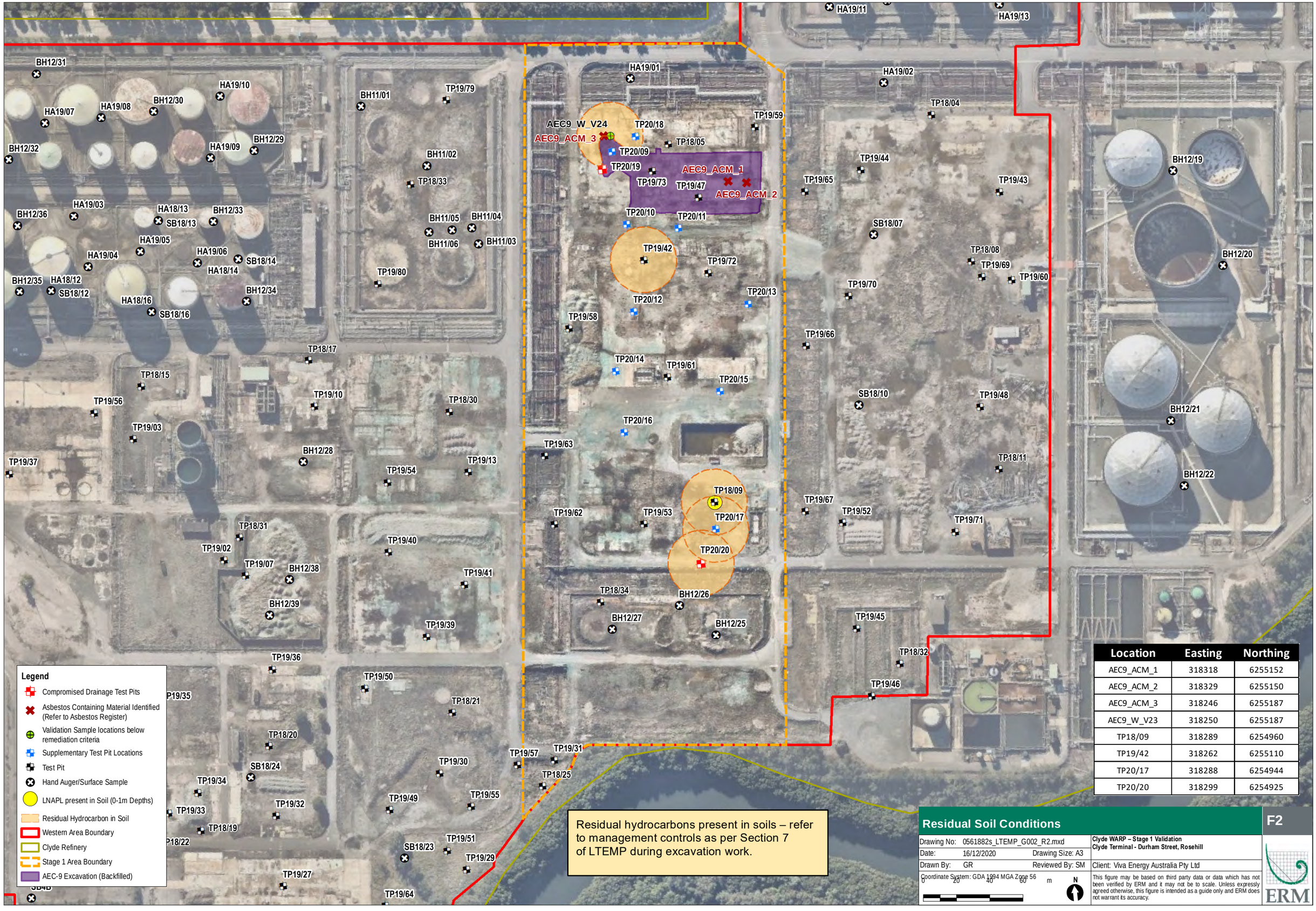
Drawing No:	0561882s_LTEMP_G001_R0.mxd		**Clyde WARP – Stage 1 LTEMP** **Clyde Terminal - Durham Street, Rosehill**
Date:	01/12/2020	Drawing Size: A3	
Drawn By:	GC / GR	Reviewed By: SM	Client: Viva Energy Australia Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60m

N

ERM



Legend

- Compromised Drainage Test Pits
- Asbestos Containing Material Identified (Refer to Asbestos Register)
- Validation Sample locations below remediation criteria
- Supplementary Test Pit Locations
- Test Pit
- Hand Auger/Surface Sample
- LNAPL present in Soil (0-1m Depths)
- Residual Hydrocarbon in Soil
- Western Area Boundary
- Clyde Refinery
- Stage 1 Area Boundary
- AEC-9 Excavation (Backfilled)

Location	Easting	Northing
AEC9_ACM_1	318318	6255152
AEC9_ACM_2	318329	6255150
AEC9_ACM_3	318246	6255187
AEC9_W_V23	318250	6255187
TP18/09	318289	6254960
TP19/42	318262	6255110
TP20/17	318288	6254944
TP20/20	318299	6254925

Residual hydrocarbons present in soils – refer to management controls as per Section 7 of LTEMP during excavation work.

Residual Soil Conditions

F2

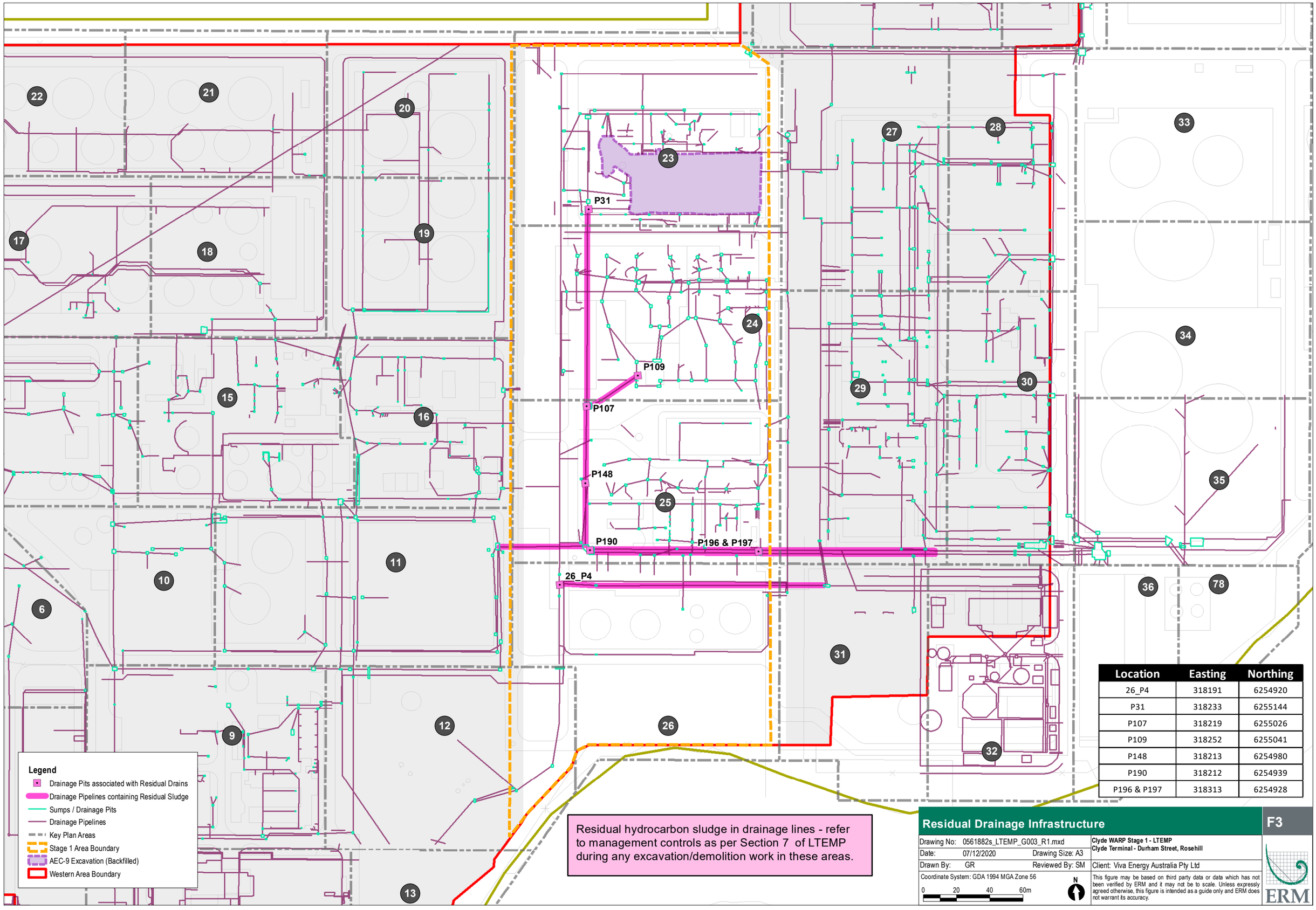
Drawing No:	0561882s_LTEMP_G002_R2.mxd	Clyde WARP – Stage 1 Validation Clyde Terminal - Durham Street, Rosehill
Date:	16/12/2020	Drawing Size: A3
Drawn By:	GR	Reviewed By: SM
Client:	Viva Energy Australia Pty Ltd	

Coordinate System: GDA 1994 MGA Zone 56

0 20 40 60 m

N

ERM



Location	Easting	Northing
26_P4	318191	6254920
P31	318233	6255144
P107	318219	6255026
P109	318252	6255041
P148	318213	6254980
P190	318212	6254939
P196 & P197	318313	6254928

Residual Drainage Infrastructure

F3

Drawing No: 0561882s_LTEMP_G003_R1.mxd
Date: 07/12/2020 Drawing Size: A3
Drawn By: GR Reviewed By: SM
Coordinate System: GDA 1994 MGA Zone 56
0 20 40 60m
N

Clyde WARP Stage 1 - LTEMP
Clyde Terminal - Durham Street, Rosehill

Client: Viva Energy Australia Pty Ltd

ERM

APPENDIX B ASBESTOS REGISTER

Asbestos Register

As outlined within Section 5.0, residual asbestos formwork is present within subsurface redundant historical site infrastructure (footings etc). ERM notes that while no asbestos in soil has been identified, where works are to be undertaken within 20m of the below locations, asbestos management controls s outlined within Section 7.0 are to be implemented.

Date identified	ID	Eastings	Northings	Approximate Depth (m BGL)	Description	Friable or non-friable	Observed condition	Accessibility
19 October 2020	AEC9_ACM_1	318318	6255152	1.0m	■ Suspected ACM formwork (corrugated sheeting) attached to concrete foundation	Non-friable	■ Good – bonded corrugated sheeting attached to concrete foundation	Inaccessible under normal site conditions – only accessed via excavation
19 October 2020	AEC9_ACM_2	318329	6255150	1.3m	■ Suspected ACM formwork (corrugated sheeting) attached to concrete foundation	Non-friable	■ Good – bonded corrugated sheeting attached to concrete foundation	Inaccessible under normal site conditions – only accessed via excavation
11 November 2020	AEC9_ACM_3	318246	6255187	Approximately 2.5m	■ Suspected ACM formwork (corrugated sheeting) located on the northern excavation extent	Non-friable	■ Good – bonded corrugated sheeting attached to concrete foundation	Inaccessible under normal site conditions – only accessed via excavation

APPENDIX C SITE SURVEY

STAGE 1B

M.G.A

GRAND PARADE

238.42

101
DP 1168951

465.765

101
DP 809340

2
DP 224288

458.43

1 DP 383675

1 DP 1190873

642.985

DURHAM STREET

COLQUHOUN STREET

DEVON STREET

493.715

139.21

21.455

120.76

152.4

60.96

259.08

T21.08

171.59

130.09

511.03

429.82

(A) (B) (C) (G) (H) (J) (K) (L) (M)

6
6.998ha
(INCLUDING RIPARIAN SETBACK)

5
28.07ha
(INCLUDING RIPARIAN SETBACK)

21
60.04ha
BY DED'N

2
DP 864567

RIPARIAN SETBACK IS 40m BOUNDARY

MEAN HIGH WATER

RIVER

DUCK

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) PIPELINE EASEMENT (V540637 & V540638)
(J) PIPELINE EASEMENT (V22813)
(K) PIPELINE EASEMENT WHOLE OF LOT (R297864)
(L) EASEMENT FOR OVERLAND FLOW 5 WIDE
(M) EASEMENT FOR PEDESTRIAN ACCESS 40 WIDE & VARIABLE WIDTH

30 0 60 150 330m

SCALE 1:3000

CLIENT

VE PROPERTY PTY LTD

PROJECT

PLAN OF PROPOSED SUBDIVISION OF LOT 100 IN DP 1168951 STAGE 1B

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.

6	GKO	11/11/2020	AMEND RIPARIAN SETBACK
5B	GKO	02/11/2020	LANDSCAPE SETBACK REMOVED
4B	GKO	13/10/2020	SY074707.11.4 VER B
4	GKO	06/08/2020	APPROX AUSGRID LINE ADDED
3	GKO	23/07/2020	EASEMENTS ADDED
2	GKO	16/07/2020	LOT 6 DIMENSION AND AREA 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

Sydney Office
Level 2, 23-29 South Street
Rydalmere NSW 2116
PO Box 1144
Dundas NSW 2117

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e info@landpartners.com.au
w www.landpartners.com.au

ISO 9001:2008 FS 535063

HEIGHT DATUM: AHD	LOCAL AUTHORITY: CITY OF PARRAMATTA
HEIGHT ORIGIN: N/A	SCALE: 1:3000(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: 11/11/2020
AUTOCAD FILE: SY074707.000.11B.6	CHECKED: GKO — DATE: 11/11/2020
ARCHIVE FILE: SY074707.000.11.5B	APPROVED: GKO — DATE: 11/11/2020
PLAN NUMBER: SY074707.000.11B.6	SHEET 1 OF 1

PD:GKO

APPENDIX D GROUNDWATER MONITORING PROGRAM

Clyde Western Area Remediation Project

Groundwater Monitoring Program

29th January 2021

Project No.: 0515132

The business of sustainability

ERM

Document details	
Document title	Clyde Western Area Remediation Project
Document subtitle	Groundwater Monitoring Program
Project No.	0515132
Date	29th January 2021
Version	Final
Author	Stephen Mulligan
Client Name	Viva Energy Australia

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	01	Stephen Mulligan	Peter Lavelle	Peter Lavelle	7.05.2020	Preliminary Draft Report for Viva Energy Review
Revised Draft	02	Stephen Mulligan	Peter Lavelle	Peter Lavelle	15.05.2020	Draft Report incorporating Viva Energy Comments
Final	03	Stephen Mulligan	Peter Lavelle	Michael Gaggin	9.06.2020	Final Report Incorporating Site Auditor Review
Final	04	Stephen Mulligan	Michael Gaggin	Michael Gaggin	29.01.2021	Final – Update to Reporting Conditions

Signature Page

29th January 2021

Clyde Western Area Remediation Project

Groundwater Monitoring Program

Stephen Mulligan
Senior Environmental Scientist

Michael Gaggin
Partner

ERM
Level 15, 309 Kent Street
Sydney NSW 2000

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.

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').

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 the contaminated soils 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 all stages of the Project.

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. Particular focus is to be placed on ensuring the drainage system is designed to adequately support both the remediation period and post-remediation period."*

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 shallow Light Non-Aqueous Phase Liquid (LNAPL) to the extent practicable; 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 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 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 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) 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.

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 Areas as having a high probability of ASS in estuarine sediments adjacent to the Duck River. The nominated remediation areas shown on Figure 1 Appendix A are classified predominantly as Class 4. No estuarine sediments have been identified within soils during previous investigations.

Given the absence of such sediments across the Western Area, the probability of encountering Actual ASS (AASS) or Potential Acid Sulphate Soils (PASS) during remediation works is considered low. Despite this, the collection of field parameters (including pH) during groundwater sampling have been incorporated to the scope of this GWMP (provided in Section 3) to monitor for adverse effects associated with excavation of ASS.

2.3 Hydrogeology

Groundwater is represented as a shallow unconfined water bearing zone within the fill material and alluvial sediments at depths between 1-3 m bgl. Preferential pathways for groundwater flow have been identified as existing within sandy lenses within the fill and estuarine units along with anthropogenic structures, such as the on-site storm water drainage network.

Previous investigations undertaken by Groundwater Technology Pty Ltd in 1994 and 1995 included the installation of seven groundwater monitoring wells screened between depths of 12 m bgl and 6 m bgl throughout the Site to characterise deeper water bearing units.

Subsequent groundwater monitoring undertaken by ERM recorded standing water levels within these wells at approximately 1.0 m bgl indicating the presence of semi-confined conditions in silts and sands at depths of 4 – 8.5 m bgl across the Site area.

Given the nature of soil and groundwater sources within the Western Area (buried waste and fill, aboveground storage and pipework and near surface drainage), the presence of impermeable clay lithology underlying fill has limited vertical migration of impacts in soil and groundwater to within the surficial shallow water bearing unit. As such, the focus of investigation activities and the resultant CSM has been on assessment of the shallow water bearing unit. The presence of a deeper water bearing unit is therefore not considered to warrant further assessment.

ERM has undertaken assessment of hydraulic conductivity / gradients in the Western Area. Results of this assessment are as summarised below.

- Hydrogeological data obtained from wells installed as part of historical investigations indicate there are semi-confined conditions in silts and sands at depths of 4 – 8.5 m bgl. The hydraulic connectivity between the geological units is not fully understood, and ERM have found no evidence of a deeper discrete aquifer during recent investigations;
- The hydraulic gradients calculated indicate that the direction of groundwater flow may be subject to rainfall events and localised groundwater mounding, but has generally been established to the north-east, east and south-east towards the bounding Duck and Parramatta Rivers. Inferred groundwater flow direction from recent gauging activities since demolition activities in 2016 is towards the Duck River, to the south and south-east;
- Average hydraulic gradients calculated parallel to groundwater flow direction indicated the hydraulic gradient to range between 0.003 m/m along the upgradient portion of the Western Area to 0.011 m/m across the southern portions of the Western Area. Hydraulic gradients increased with proximity to the Duck River;
- Hydraulic conductivity has been established to be low across the large majority of the Site and Western Area, 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 6×10^{-3} m/day. Higher hydraulic conductivity values were reported for wells screened across coarser grained sandy clay soils within the southern portion of the Western Area and are consistent with the more transmissive nature of these geologies. Generally, hydraulic conductivity values increased from a minimum 5×10^{-5} m/day at the upgradient site boundary to up to 4×10^{-2} m/day closer to the southern site boundary due to the presence of sand/silt estuarine deposits closer to the Duck River;
- Previous investigations indicate that there is no influence on the shallow groundwater at the Site by tidal fluctuation within the adjacent rivers (Woodward-Clyde, 1999). The potential for tidal influences were measured within boundary monitoring wells during recent investigations in 2019. Results of this investigation indicated no significant tidal interactions with groundwater;
- Based upon the understanding of geology and hydrogeology at the Site and Western Area, 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
- Based on the hydrogeological information, the low permeability clay layer appears to limit vertical migration of contaminants. This is supported by the soil analytical results indicating that COPCs analysed for in soil samples collected from within the clay layer (or at depths greater than 2 m bgl) do not exceeded their applicable screening criteria, with only a few exceptions (i.e., the Southern Buried Waste Area)). This is further supported by soil data obtained in 2018 from depths greater than 2 m.

2.4 Site Contamination 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.

Based on the results of previous investigations and Site Specific Target Levels derived via tier 2 risk assessment within the Human Health and Ecological Risk Assessment (HHERA), the following CoPCs within each AEC were considered to present a potential risk to identified receptors and warranted consideration for remediation or management. The extent of remediation required within each of these AECs is shown on Figure 1, Appendix A.

Table 1 - Tier 2 Risk Assessment Summary

Area	Soil Direct Contact Risk			Commercial Vapour Intrusion[1]	Asbestos	LNAPL Management[2]
	Commercial Worker	Construction Worker	IMW			
AEC-1	✓	✓	✓	✓	×	✓
AEC-2	✓	✓	✓	✓	✓	×
AEC-3	× ■ carcinogenic PAHs	✓	✓	× ■ benzene ■ naphthalene ■ TRH C6-C10 less BTEX ■ TRH C8-12	×	×
AEC-4	× ■ TRH C10-C34 ■ carcinogenic PAHs	× ■ hexavalent chromium	✓	× ■ Benzene ■ TRH C6-C10	×	×
AEC-5	✓	✓	✓	✓	✓	×
AEC-6	✓	✓	✓	✓	×	×
AEC-7	✓	✓	✓	✓	✓	✓
AEC-8	✓	✓	✓	✓	✓	×
AEC-9	✓	✓	✓	× ■ Naphthalene ■ TRH C8-C12 (aliphatic and aromatic) ■ TRH C10 – C16 (aromatic)	✓	×
AEC-10	✓	✓	✓	✓	✓	×
AEC-11	✓	✓	✓	✓	✓	×
AEC-12	x ■ TRH C6-C16	✓	✓	× ■ TRH C6-C12 (Aliphatic)	✓	×

Area	Soil Direct Contact Risk			Commercial Vapour Intrusion[1]	Asbestos	LNAPL Management[2]
	Commercial Worker	Construction Worker	IMW			
	■ TRH C8-C12 Aromatic			■ TRH C8-C16 Aromatic ■ TRH C6-C10 less BTEX ■ Benzene		
AEC-13	✓	✓	✓	✓	×	✓
AEC-14	✓	✓	✓	✓	✓	✓
AEC-15	✓	✓	✓	✓	×	×

✓ - Indicates potential risks are unlikely or within acceptable levels

× - Indicates a potential risk or need for remediation or management

1 – Potential vapour intrusion risks assume the presence of future buildings.

2 – Consideration of the management of LNAPL (i.e. acute hazards, aesthetics) is warranted separately to potential health risks.

2.4.1 Groundwater Impacts

LNAPL

LNAPL has been identified in isolated sections of the Western Area within shallow groundwater and within the soil profile. The migration potential of LNAPL is considered negligible based on the following lines of evidence:

- Ongoing primary sources of LNAPL impact which provide a source of driving head for LNAPL bodies have been removed. This, in combination with flat hydraulic gradient and low hydraulic conductivity limit the migration potential of LNAPL in the subsurface;
- While the configuration of LNAPL impacted areas has been modified over time through the addition of monitoring wells, LNAPL has not been identified in monitoring wells down-gradient of residual impacts over the course of monitoring since 2008;
- LNAPL is generally noted to be present within fill material or discontinuous sandy lenses at the level of groundwater. Vertical migration of constituents of concern does not appear to be significant based on analytical results of soil samples collected from within the low permeability clay layer and of groundwater samples collected from deeper monitoring wells; and
- Dissolved phase groundwater impacts associated with LNAPL appear to be generally stable (in nature and extent) and limited to on-site areas, with no indication of off-site migration based on the available soil and groundwater analytical data. Additionally, site-specific geological and hydrogeological conditions limit the migration of LNAPL and associated groundwater impacts.

Based on the Quarter 4 2019 GME results, the following was concluded relating to LNAPL:

- LNAPL observed within the monitoring well network was considered to be consistent in spatial extent with previous GMEs. LNAPL was identified at two locations (MW18/24, MW12/01) within the western area at a maximum thickness of 0.324 m. The occurrence of LNAPL within these wells was consistent with historical data and has been laterally delineated to on-site environments via monitoring of down gradient wells.

- The nature and extent of LNAPL and dissolved phase hydrocarbon impacts are considered to be stable, well characterised in the context of the current land use and the monitoring well network was considered suitable to assess potential changes in environmental conditions as well as source/pathway/receptor linkages.

Dissolved Phase

The Quarter 4 2019 Groundwater Monitoring Event represents the baseline understanding of groundwater conditions within the Western Area prior to remediation commencement. The following has been noted relating to the nature and extent of dissolved phase COPCs in groundwater:

- Reported concentrations of dissolved phase COPCs were below the adopted screening criteria, with the exception of MW12/03 (AEC-3) which exceeded recreational water quality criteria for benzene and marine water criteria for ethylbenzene and naphthalene.
- Stable to decreasing trends were reported for benzene and TRH C6-C9 for all monitoring wells sampled across the Western Area.
- The nature and extent of LNAPL and dissolved phase hydrocarbon impacts were considered to be stable, well characterised in the context of the current land use and the monitoring well network was considered suitable to assess potential changes in environmental conditions as well as source/pathway/receptor linkages.
- decreasing concentration trends of dissolved phase petroleum hydrocarbon COPCs coupled with indicators that microbially mediated natural attenuation of petroleum hydrocarbons in groundwater may be occurring (via sulphate and ferric iron reduction).
- 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.

Based on the current dataset for PFAS in groundwater in the Western Area, ecological exceedances for PFAS (specifically PFOS) 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 boundary (AEC-1) and within AEC-3; and
  - MW12/23 on the southern 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 that stable to decreasing groundwater concentrations continue to be observed as a result of natural attenuation processes and removal of key source areas.

3.1 Monitoring During Remediation

Potential risks to groundwater associated with remediation activities have been identified within the EIS for the Project as follows:

- *"Increased infiltration of surface water (and therefore potential for mobilisation of COPCs or altered groundwater flow regimes) via the removal of existing infrastructure during remediation works, including hardstand material within the Project Area.*
- *There is a risk of potential impacts to the nearby Duck River should:*
  - *surface water or groundwater come into contact with Acid Sulfate Soils and migrate into the river*
  - *dewatering result in mobilisation of LNAPL or contaminated groundwater across the Site or to Duck River and associated riparian areas*

Other potential groundwater impacts include contamination of groundwater from contaminated soils, equipment, existing infrastructure, or leaks and spills."

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 4 m bgl in AEC-4 and will be less than 2m bgl in other excavations completed across the Western Area.

Excavations proposed to extend beyond the impermeable silty clay layer and intercept groundwater requiring dewatering and management of groundwater will be limited to excavations of depths greater than 1 m bgl. These excavations represent highest potential for altered groundwater flow regimes leading to mobilisation of contaminants in the subsurface. As such, groundwater monitoring during remediation works will focus on the following excavations:

- AEC-3a (Former Laboratory Area) – proposed depth of 2 m bgl;
- AEC-4 (Southern Buried Waste Area) – proposed depth of up to 4 m bgl;
- AEC-9 (Former Process West) – proposed depth of 1.5 m bgl; and
- AEC-12 (Tankfarm C) – proposed depth of 1.8 m bgl.

The proposed extent of these excavations is shown on Figure 1, Appendix A.

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)

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) have either already been cleaned and decommissioned or are proposed to be;
- Shallow and Light Non-Aqueous Phase Liquid (LNAPL) impacts 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 would be removed via pumping. LNAPL impacted water would be managed and treated by being sent to the to the Site's existing wastewater treatment plant for treatment and discharged in accordance with Environmental Protection License (EPL) 570; 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 and ecological 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.

Where a more conservative guideline values are recommended within the ASC NEPM Marine Groundwater Investigation Levels (GILs), this value has been adopted for ecological screening (i.e, benzene and naphthalene).

ERM used 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.

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 not proposed to be undertaken to meet the objectives of this GWMP.

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
- 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 Clyde Western Area boundary. The Western Area Boundary 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 4m. 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 annually.

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 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 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 verify that concentrations of contaminants of concern continue to pose no unacceptable risks to future on-site receptors or the Duck River following completion of remediation activities and that groundwater management via natural attenuation remains an appropriate approach. The monitoring program during following remediation is presented as Table B2, Appendix B.

A total of 24 existing monitoring wells have been selected for the proposed groundwater monitoring. Should these monitoring wells be damaged, or unable to be located on site, an assessment of the adequacy of the 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 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; ■ Monitor potential for LNAPL mobilisation	■ Gauging weekly during excavation and/or dewatering	■ Gauging Data (water levels, LNAPL presence/ thickness);

Monitoring Area	Rationale	Frequency	Data Collected
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 within the Stage 1 monitoring network will be monitored throughout the duration of Stage 1 remediation works.

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 - Groundwater Monitoring Requirements - Post remediation

Monitoring Area	Rationale	Frequency	Data collected
Excavation Areas (nearby wells)	■ demonstrate that stable to decreasing groundwater concentrations continue to be observed as a result of natural attenuation processes and removal of key source areas. ■ Gauging to monitor potential for alteration to groundwater levels/ flow regime or LNAPL mobilisation	■ 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 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 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)

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)
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

Report	Timing	Description
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 to the NSW EPA and Local Council (Parramatta City Council)	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 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 TRH 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 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 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

AECOM 2019a. Clyde Western Area Remediation Project, Environmental Impact Statement.

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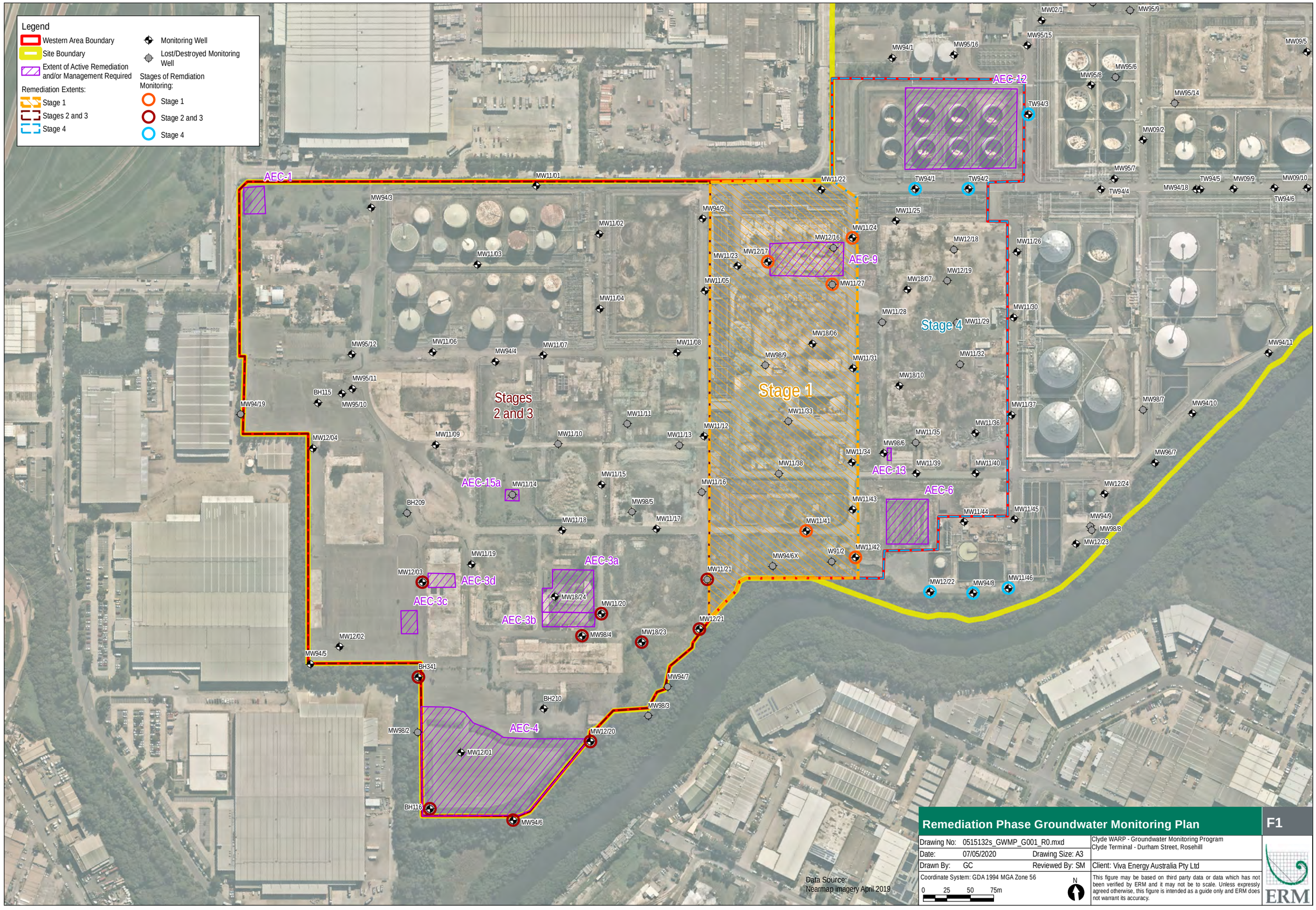
APPENDIX A FIGURES


Legend
Western Area Boundary
Site Boundary
Extent of Active Remediation and/or Management Required
Remediation Extents:
Stage 1
Stages 2 and 3
Stage 4
Monitoring Well
Lost/Destroyed Monitoring Well
Stages of Remdiation Monitoring:
Stage 1
Stage 2 and 3
Stage 4
AEC-1
AEC-12
AEC-9
AEC-15a
AEC-3a
AEC-3d
AEC-3c
AEC-3b
AEC-4
AEC-13
AEC-6
Stages 2 and 3
Stage 1
Stage 4
MW02/1
MW95/9
MW95/15
MW94/1
MW95/16
MW95/6
MW95/8
MW09/5
MW95/14
TW94/3
MW09/2
MW95/7
TW94/1
TW94/2
MW11/22
TW94/4
MW94/18
TW94/5
MW09/9
MW09/10
TW94/6
MW11/01
MW94/3
MW94/2
MW11/25
MW11/24
MW12/16
MW12/18
MW11/26
MW11/02
MW11/03
MW11/23
MW12/17
MW11/05
MW11/27
MW18/07
MW12/19
MW11/04
MW11/28
MW11/30
MW11/29
MW18/06
MW95/12
MW11/06
MW94/4
MW11/07
MW11/08
MW98/9
MW11/31
MW11/32
MW94/11
MW95/11
BH115
MW95/10
MW94/19
MW18/10
MW98/7
MW94/10
MW11/11
MW11/33
MW11/37
MW11/36
MW12/04
MW11/09
MW11/10
MW11/13
MW11/12
MW11/35
MW98/6
MW11/34
MW96/7
MW11/38
MW11/39
MW11/40
MW11/15
MW11/14
MW11/16
MW12/24
BH209
MW98/5
MW11/43
MW11/44
MW11/45
MW11/18
MW11/17
MW11/41
MW94/9
MW98/8
MW12/23
MW11/19
MW11/42
W91/2
MW94/6X
MW12/03
MW11/21
MW12/22
MW94/8
MW11/46
MW18/24
MW11/20
MW12/21
MW98/4
MW18/23
MW12/02
MW94/5
BH341
MW94/7
BH210
MW98/3
MW98/2
MW12/20
MW12/01
BH116
MW94/6
Data Source:
Nearmap imagery April 2019
Remediation Phase Groundwater Monitoring Plan
F1
Drawing No: 0515132s_GWMP_G001_R0.mxd
Clyde WARP - Groundwater Monitoring Program
Clyde Terminal - Durham Street, Rosehill
Date: 07/05/2020
Drawing Size: A3
Drawn By: GC
Reviewed By: SM
Client: Viva Energy Australia Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
0 25 50 75m
N
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Legend
- Western Area Boundary
- Site Boundary
- Extent of Active Remediation and/or Management Required
- Monitoring Well
- Lost/Destroyed Monitoring Well
- Ongoing Monitoring Location

AEC-1
AEC-3a
AEC-3b
AEC-3c
AEC-3d
AEC-4
AEC-6
AEC-9
AEC-12
AEC-13
AEC-15a

MW02/1
MW95/9
MW95/15
MW94/1
MW95/16
MW09/5
MW95/6
MW95/8
MW95/14
TW94/3
MW09/2
MW95/7
TW94/4
MW94/18
TW94/5
MW09/9
MW09/10
TW94/6
TW94/1
TW94/2
MW11/22
MW11/01
MW94/3
MW11/02
MW11/03
MW94/2
MW11/25
MW11/24
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MW18/06
MW95/12
MW11/06
MW94/4
MW11/07
MW11/08
MW98/9
MW11/31
MW11/32
MW94/11
MW18/10
MW95/11
BH115
MW95/10
MW94/19
MW11/37
MW98/7
MW94/10
MW11/11
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MW11/36
MW12/04
MW11/09
MW11/10
MW11/13
MW11/12
MW98/6
MW11/35
MW96/7
MW11/34
MW11/38
MW11/39
MW11/40
MW11/15
MW11/16
MW12/24
MW11/14
BH209
MW98/5
MW11/43
MW11/44
MW11/45
MW94/9
MW98/8
MW11/18
MW11/17
MW11/41
MW12/23
MW11/42
W91/2
MW94/6X
MW11/19
MW12/03
MW11/21
MW12/22
MW94/8
MW11/46
MW18/24
MW11/20
MW12/21
MW12/02
MW98/4
MW18/23
MW94/5
BH341
MW94/7
BH210
MW98/3
MW98/2
MW12/20
MW12/01
BH116
MW94/6

Data Source:
Nearmap imagery April 2019

Post-remediation Groundwater Monitoring Plan | F2

Drawing No:	0515132s_GWMP_G002_R0.mxd		Clyde WARP - Groundwater Monitoring Program Clyde Terminal - Durham Street, Rosehill
Date:	07/05/2020	Drawing Size: A3	
Drawn By:	GC	Reviewed By: SM	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.

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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]**
MW11/41	Stage 1	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW11/42	Stage 1	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW11/24	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN	Y	Monthly During active remediation conducted up-gradient	Y	Y
MW11/27	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN	Y	Monthly During active remediation conducted up-gradient	Y	Y
MW12/17	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN	Y	Monthly During active remediation conducted up-gradient	Y	Y
BH116	Stage 2 and 3	Excavation Area Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, PAH, Speciated Cr	Y	Monthly During active remediation conducted up-gradient	Y	Y
MW11/21	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW12/20	Stage 2 and 3	Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, PAH, Speciated Cr	Y	Monthly During active remediation conducted up-gradient	Y	Y
MW12/21	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW94/6	Stage 2 and 3	Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, PAH, Speciated Cr	Y	Weekly during excavation and dewatering	Y	Y
MW18/23	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW11/20	Stage 2 and 3	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW98/4	Stage 2 and 3	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
MW12/03	Stage 2 and 3	Excavation Area Monitoring	AEC-3d	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
BH341	Stage 2 and 3	Excavation Area Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, PAH, Speciated Cr	Y	Weekly during excavation and dewatering	Y	Y
MW11/46	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW12/22	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
MW94/8	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN	Y	Monthly during active remediation conducted up-gradient	Y	Y
TW94/1	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
TW94/2	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	Y	Y
TW94/3	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN	Y	Weekly during excavation and dewatering	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

				Ongoing monitoring (biannual)			
Sample ID	**Remediation Stage**	**Purpose/ Rationale**	**Remediation Excavation Area**	**Gauging**	**Sampling**	**Analysis [2]**	**Field Parameters[1]**
MW11/41	Stage 1	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/42	Stage 1	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/24	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/27	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW12/17	Stage 1	Excavation Area Monitoring	AEC-9	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
BH116	Stage 2 and 3	Excavation Area Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/21	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW12/20	Stage 2 and 3	Excavation Area Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW12/21	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW94/6	Stage 2 and 3	Excavation Area Monitoring, Boundary Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW18/23	Stage 2 and 3	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/20	Stage 2 and 3	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW98/4	Stage 2 and 3	Excavation Area Monitoring	AEC-3a	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW12/03	Stage 2 and 3	Excavation Area Monitoring	AEC-3d	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
BH341	Stage 2 and 3	Excavation Area Monitoring	AEC-4	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW11/46	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW12/22	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
MW94/8	Stage 4	Boundary Monitoring	-	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
TW94/1	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
TW94/2	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN, MNA parameters	Y
TW94/3	Stage 4	Excavation Area Monitoring	AEC-12	Y	Y	TRH C6-C40, BTEXN, MNA parameters	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
3) Monitored Natural Attenuation (MNA) parameters include nitrate, ferrous iron, methane and sulphate

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			

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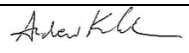
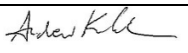
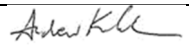
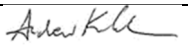
Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
-	D.Balbachevsky	A. Kohlrusch		A. Kohlrusch		23/12/2020
A	D.Balbachevsky	A. Kohlrusch		A. Kohlrusch		18/02/2021

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