Viva Energy Clyde Western Area Remediation Project

Environmental Impact Statement – Main Report

January 2019

VIVA Energy Australia

AECOM

Statement of Validity

Submission of Environmental Impact Statement

Prepared to support the application for Development Consent SSD 18_9302 as required under Section 4.12(8) of the *Environmental Planning and Assessment Act 1979.*

Submission of Environmental Impact Statement prepared by:

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Address	AECOM Australia Pty Ltd Level 21 420 George Street Sydney NSW 2000		

In respect of:

Applicant and Land Details

Applicant	Viva Energy Australia Pty Ltd Durham Street Rosehill NSW 2142
Subject	Viva Energy is seeking Development Consent for the Clyde Western Area Remediation Project (SSD 18_9302) under Part 4 of the *Environmental Planning and Assessment Act 1979.*
Project Summary	Viva Energy is proposing to remediate contaminated soils in the Western Area to facilitate future development of the land for other purposes permissible under the existing land use zoning. The Project would involve the remediation of impacted soils and the management of impacted groundwater within a number of targeted areas within the Western Area. Where remediation is required, the focus of this remediation would be on: • addressing petroleum hydrocarbon impacts in shallow soil horizons; • addressing residual soil/sludge impacts in the drainage network and surrounds; • removing Light Non-Aqueous Phase Liquid (LNAPL) to the extent practicable; and • ensuring potential contamination risks to the environment are removed or mitigated.
Lot and DP	Lot 100/DP1168951

Environmental Impact Statement

An Environmental Impact Statement (EIS) is attached. The EIS assesses the likely environmental impacts of the Project including the matters referred to in the Secretary's Environmental Assessment Requirements provided to the Applicant on 7 June 2018 under Section 4.12(8) of the *Environmental Planning and Assessment Act 1979*.

Declaration

I certify that I have prepared the contents of this EIS in accordance with the requirements of the *Environmental Planning and Assessment Act 1979* and *Environmental Planning and Assessment Regulation 2000* and that, to the best of my knowledge, the information contained in this report is not false or misleading.

Signature: **Date:** January 2018

Name: William Miles

Limitations

AECOM Australia Pty Limited (AECOM) has prepared this Environmental Impact Statement (EIS) in accordance with the usual care and thoroughness and based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this EIS.

This EIS has been produced in accordance with the stipulations in the *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000*.

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Terms and acronyms

Terms

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions associated with past and present day Aboriginal communities.
Aboriginal object	Any deposit, object or material evidence (not being a handicraft made for sale), including Aboriginal remains, relating to the Aboriginal habitation of NSW
Approved methods	The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA 2017).
Aboriginal place	Any place declared to be an Aboriginal place under section 94 of the National Parks and Wildlife Act 1974 (NSW)
Archaeological potential	The likelihood of undetected surface and/or subsurface archaeological materials existing at a location.
Auditor	New South Wales Environment Protection Authority Accredited Site Auditor
AutoNexus	A former vehicle storage and logistics facility located in the western portion of the Western Area.
Average Delay	The average duration in seconds that each vehicle is delayed when negotiating the intersection, which can be considered either by movement, approach lane or the whole intersection.
Biopiling	A process in which concentrations of petroleum constituents in excavated contaminated soils is reduced through the use of biodegradation.
Clyde Barging Facility	The Clyde Barging Facility is associated with the Sydney Metro City and Southwest passenger rail project, and would involve the transfer of machinery and excavated material carried by barges on the Parramatta River to trucks from a site at the eastern end of Grand Avenue (Transport for NSW, 2017c). The Clyde facility will be located adjacent to the north-eastern Site boundary.
Coastal areas	Four areas under the Coastal Management SEPP.
Ecosystem credit species	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development.
Eutrophied	A body of water being rich in nutrients and so supporting a dense plant population, the decomposition of which kills animal life by depriving it of oxygen.
Gate 6	Access point for the Project Area located at the corner of Unwin Street and Colquhoun Street.
Ground Surface Visibility (GSV)	A term used to describe the area of the ground's surface that is visible during archaeological field surveys.
Hazardous materials	Hazardous materials in the Applying SEPP 33 guideline are defined as *"substance falling within the classification of the Australian Code for Transportation of Dangerous Goods by Road and Rail (Dangerous Goods Code)"*.
Heavy vehicle	A vehicle which has a gross vehicle mass or aggregate trailer mass of more than 4.5 tonnes (Austroads, 2015).
Heritage item	Any place, building or object listed on a statutory heritage register.

Term	Definition
Impact	Influence of effect exerted by a project or other activity on the natural, built and community environment
In-area soil mixing	Ground improvement technique that improves soft or loose soils, by mechanically mixing them with oxidising/activating agents such as sodium persulfate/sodium hydroxide.
Landfarming	A process of turning the soil so as to encourage bioremediation.
Level of Service	A measure that uses a scale of A through F to define the value of average delay of vehicles.
Natural attenuation	A process which involves allowing naturally occurring micro-organisms in the ground to biodegrade hydrocarbon contamination.
Parramatta Light Rail project	Parramatta Light Rail Stage 1 is a major infrastructure project proposed by Transport for NSW, comprising a 12 kilometre two-way light rail track, connecting Westmead to Carlingford via Parramatta CBD. The proposed alignment of the main light rail track would run along Hassall Street and along James Ruse Drive. The project would involve the decommissioning of the T6 Carlingford passenger rail service and the construction and operation of a stabling and maintenance facility for the Parramatta Light Rail, located at 6 Grand Avenue, Camellia
Private vehicle	A private vehicle is a light vehicle used to transport the Project workforce to and from the Project Area. A light vehicle is a vehicle that is not a heavy vehicle (Austroads, 2015).
Rating Background Level (RBL)	The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.
Secretary's Environmental Assessment Requirements (SEARs)	Requirements and specifications for an environmental assessment prepared by the Secretary of the NSW Department of the Planning and Environment under section 4.39 of the *Environmental Planning and Assessment Act 1979* (*NSW*).
Stone artefact	Any piece of rock modified by human agency
Swale	A shallow channel with gently sloping sides. Swales would be included in the final landform of the Western Area to direct overland flow directly into Duck River.
the Site	Viva Energy owned land on the Camellia peninsula consisting of the following lots: Lot 398 DP 41324, Lots 100 and 101 of DP1168951, Lot 101 DP809340, Lot 2 DP224288, and Lot 1 DP383675. It includes the Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is either 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. This 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 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.

Term	Definition
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 stormwater management activities.
the Project Area	The Project Area is the land within the Western Area where the Project would occur. The extent of the Project Area, within the Western Area is provided in **Figure 1-1**.
Thermal desorption	An environmental remediation technology that utilises heat to increase the volatility of contaminants in order for contaminants to be separated from the soils.
Turbidity	A measure to the degree of which water loses its transparency due to the presence of suspended particles.
Wastewater	Any water that has been affected by human use, including any combination of domestic, industrial, commercial or agricultural activities, surface runoff or stormwater, and any sewer inflow or sewer infiltration.

Acronyms

Acronym	Definition
AS/NZS	Australian / New Zealand Standard
ABN	Australian Business Number
ACM	Asbestos Containing Material
ACHMPs	Aboriginal Cultural Heritage Management Plans
AEP	Annual Exceedance Probability
AFFF	Aqueous Film Forming Foam
AGO	Automotive Gas Oil
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIPs	Aboriginal Heritage Impact Permits
AMP	Asbestos Management Plan
ANZECC	Australia and New Zealand Environment and Conservation Council
AOC	Accidently Oil Contaminated
AQMP	Air Quality Management Plan
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999
ASS	Acid Sulfate Soil
ASSMP	Acid Sulfate Soils Management Plan
ATSIHP	Aboriginal and Torres Strait Islander Heritage Protection Act 1984
BC Act	Biodiversity Conservation Act 2016
BMP	Biodiversity Management Plan
BOD	Biological Oxygen Demand

Acronym	Definition
BOM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CBD	Central Business District
CCOs	Chemical Control Orders
CEECs	Critically Endangered Ecological Communities
CLM Act	NSW Contaminated Land Management Act 1997
CMP	Contamination Management Plan
CO	Carbon monoxide
Coastal Management SEPP	State Environmental Planning Policy (Coastal Management) 2018
COC	Commonwealth Oil Corporation
Conceptual RAP	Conceptual Remediation Action Plan
CoPC	Chemicals of Potential Concern
CPI	Corrugated Plate Interceptor
CRTN	Calculation of Road Traffic Noise 1988
CSM	Conceptual Site Model
dBA	A-weighted decibels
DBYD	Dial Before You Dig
DCP	Development Control Plan
DPE	NSW Department of Planning and Environment
DI	NSW Department of Industry
DTD	Direct Thermal Desorption
EEC	Endangered Ecological Communities
EHC	Epichlorhydrin
EHC Act	Environmentally Hazardous Chemicals Act 1985
EILs	Ecological investigation levels
EIS	Environmental Impact Statement
EMM	Environmental Management Manual
EMP	Environmental Management Plan
EMS	Environmental Management System
ENM	Excavated Natural Material
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000
NSW EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 2000
EPL	Environment Protection Licence
EPIs	Environmental Planning Instruments

Acronym	Definition
ERA	Environmental Risk Assessment
ESA	Environmental Site Assessment
ESD	Ecologically Sustainable Development
ESLs	Ecological screening levels
GAC	Granular Activated Carbon
GDE	Groundwater Dependent Ecosystems
GGBF	Green and Golden Bell Frogs
GI	Ground Integrity
GILs	Groundwater investigation levels
GME	Groundwater monitoring event
GML	General Mass Limit
GMP	Groundwater Monitoring Plan
GPOP	Greater Parramatta and the Olympic Peninsula
GPR	Ground Penetrating Radar
GSC	Greater Sydney Commission
GSV	Ground Surface Visibility
GWMP	Groundwater Management Plan
ha	Hectares
HILs	Health investigation levels
HSL	Health screening level
HSSE	Health, Safety, Security Environment
HVNL	Heavy Vehicle National Law
ICNG	Interim Construction Noise Guideline
ILUA	Indigenous Land Use Agreements
IPC	NSW Independent Planning Commission
ISEPP	NSW State Environmental Planning Policy (Infrastructure)
km	kilometres
LEP	Local Environment Plan
LGA	Local Government Area
LNAPL	Light Non-Aqueous Phase Liquid
LoS	Level of Service
LPG	Liquefied Petroleum Gas
LTEMP	Long Term Environmental Management Plan
m	metres
m^3	metres cubed
m/s	metres per second
mbgs	metres below ground surface

Acronym	Definition
MHF	Major Hazard Facility
min	minutes
ML	megalitres
MNA	Monitored Natural Attenuation
MNES	Matter of National Environmental Significance
MPE	Multiphase Extraction
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
MW	Monitoring Well
MWSDB	Metropolitan Water, Sewerage & Drainage Board
NAPL	Non-Aqueous Phase Liquid
NDE	Non-destructive Excavation
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHVR	National Heavy Vehicle Regulator
NMLs	Noise Management Levels
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOW	NSW Office of Water
NPfI	Noise Policy for Industry
NPW Act	NSW National Parks and Wildlife Act 1974
NSW	New South Wales
NSZD	Natural Source Zone Depletion
NTA	Commonwealth Native Title Act 1993
OEH	Office of Environment and Heritage
OLM	Ozone Limiting Method
OU	Odour Units
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PCB	Polychlorinated Biphenyls
PCTs	Plant Community Types
PEA	Preliminary Environmental Assessment
PFAS	Polyfluoroalkyl Substances
PFHxS	perfluorohexane sulfonate
PFOS	perfluorooctane sulfonate
PHA	Preliminary Hazards Analysis
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter

Acronym	Definition
PM_{10}	Particulate matter 10 micrometres or less in diameter
PMP	Project Management Plan
PoEO Act	NSW Protection of the Environment Operations Act 1994
POP	Proof of Performance
PPE	Personal Protective Equipment
ppm	parts per million
PRP	Pollution Reduction Program
PSH	Phase Separated Hydrocarbon
PSS	Parramatta Sand Sheet
PTA	Preliminary Treatment Area
RAP	Remedial Action Plan
RAQMP	Reactive Air Quality Management Program
RBL	Rate Background Level
REMP	Remediation Environmental Management Plan
REP	Regional Environmental Plan
RNE	Register of the National Estate
RNP	NSW Road Noise Policy
RtS Report	Response to Submissions Report
RWP	Remedial Work Plan
SAQP	Sampling and Analysis Quality Plan
SEARs	Secretary’s Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SEPP 33	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No. 55 – Remediation of Land
SEPP SRD	State Environment Planning Policy (State and Regional Development) 2011
SGMP	Soil and Groundwater Monitoring Program
SHI	State Heritage Inventory
SHR	NSW State Heritage Register
SIA	Specific Immobilisation Approval
SMCMA	Sydney Metropolitan Catchment Management Authority
SP MS	Social Performance Management System
SSD	State Significant Development
SVE	Soil Vapour Extraction
SWMP	Soil and Water Management Plan
Sydney Harbour SREP	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
t	tonne

Acronym	Definition
TAPM	The Air Pollution Model
TCLP	Toxicity Characteristics Leaching Procedure
TEC	Threatened Ecological Community
The Blue Book	*Managing Urban Stormwater - Soils and Construction Volume 1 and 2* (Landcom, 2004)
TN	Total Nitrogen
TMP	Traffic Management Plan
TP	Total Phosphorus
TPH	Total Petroleum Hydrocarbons
TPZs	Tree Protection Zones
TRH	Total Recoverable Hydrocarbons
TSP	Total suspended particulates
TSS	Total suspended solids
VENM	Virgin Excavated Natural Material
Viva Energy	Viva Energy Australia Pty Ltd
VOCs	Volatile Organic Compounds
WARR Act	NSW Waste Avoidance and Resource Recovery Act 2007
WARR Strategy	Waste Avoidance and Resource Recovery Strategy
WH&S Regulation	NSW Work Health and Safety Regulation 2011
WM Act	NSW Water Management Act 2000
WMP	Waste Management Plan
WRRP	Waste and Resource Recovery Plan
wt%	percentage by weight
WSUD	Water Sensitive Urban Design
WWTP	Wastewater Treatment Plant

Executive summary

Introduction

Viva Energy Australia Pty Ltd (Viva Energy) owns the land associated with the former Clyde Refinery (the 'Site') located at Durham Street, Rosehill on the Camellia Peninsula. Viva Energy currently operates the Clyde Terminal on part of the Site; however, a large part of the former refinery land in the south-western part of the Site (the 'Western Area') is no longer required for operational purposes. As such, Viva Energy is proposing to remediate contaminated soils in the Western Area (the 'Project') to facilitate future development of the land for other purposes permissible under the existing land use zoning.

The Project would involve the remediation of impacted soils and the management of impacted groundwater within a number of targeted areas within the Western Area. The land where the proposed remediation activities would occur consists of approximately 40 hectares within the Western Area and is referred to as the Project Area. The Project Area consists of the majority of land within the Western Area, excluding vegetation within protected areas and certain portions of the Western Area which do not require remediation. The Site, Western Area and Project Area are shown on **Figure ES-1**.

Where remediation is required, the focus of this remediation would be on:

- addressing petroleum hydrocarbon impacts in shallow soil horizons;
- addressing residual soil/sludge impacts in the drainage network and surrounds;
- removing Light Non-Aqueous Phase Liquid (LNAPL) if present, to the extent practicable[1]; and
- ensuring potential contamination risks to the environment are removed or mitigated.

In 2015 development consent was granted for the Clyde Terminal Conversion Project (State Significant Development (SSD) 5147) (the 'Conversion Project'). The Conversion Project included the demolition of redundant tanks and other infrastructure and upgrades and improvements to site infrastructure. Viva Energy recognised that following completion of the Conversion Project, the Western Area would be largely vacant and not required for the Clyde or Parramatta Terminal operations. As such there was an opportunity for this land to be sold, leased or used for alternative land uses, provided these land uses did not adversely affect Viva Energy's retained operations. Given the current land use zoning and based on the findings of a number of site investigations, it was determined that remediation of parts of the Western Area to a commercial/industrial standard would be required.

In June 2016 the NSW EPA declared the Site, including the Western Area, as 'significantly contaminated land' under the *Contaminated Land Management Act 1997 (NSW)* (CLM Act) t (Declaration Number 20131110). More recently, as outlined in the Central City District Plan (Greater Sydney Commission (GSC), 2018b) and the Greater Parramatta and the Olympic Peninsula (GPOP) Vision (GSC, 2016), the Western Area is located in the heart of the GPOP area. The GPOP area is a major focus for the GSC and is considered one of Sydney's most crucial centres of current and future economic activity.

[1] The need to remove LNAPL would be mainly based on the level of potential human health risk for the proposed commercial/industrial end use. It should be noted that LNAPL and dissolved phase plumes are considered stable in the Western Area, and therefore removal to reduce migration in groundwater is not a key driver.

FIGURE ES-1 PROJECT LOCATION

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0 250 500 m

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- State road
- Local road

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

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Viva Energy has developed three main Project objectives to ensure both its business objectives and the necessary regulatory requirements are met:

1. Ensure the ongoing operational viability of Clyde terminal assets and associated licences to operate (including but not limited to SafeWork NSW Major Hazard Facility licence, NSW Environment Protection Authority (NSW EPA) licence and State significant development (SSD) consent conditions).
2. Ensure any future redevelopment decisions are considerate of the operational requirements of the existing Clyde Terminal.
3. Meet applicable regulatory requirements.

In deciding to undertake the Project, Viva Energy considered project alternatives including the option to sell/lease the land in its present condition. However, the considered alternatives would not meet the Project objectives or support the GPOP Vision. The option of remediating contaminated soils in the Western Area (the 'Project') was therefore selected as the preferred option.

AECOM Australia Pty Ltd (AECOM) have prepared this Environmental Impact Statement (EIS) for the Project on behalf of Viva Energy to support the SSD Application under Part 4 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act). This EIS has been prepared in accordance with the provisions of the EP&A Act and addresses the Secretary's Environmental Assessment Requirements (SEARs) for the Project, dated 7 June 2018.

Project description

The Project would involve the remediation of impacted soils and the management of impacted groundwater within the Project Area (refer to **Figure ES-2**).

Apart from preparation works, activities would be completed in an iterative approach and have been split into the following stages:

- Stage 1 – preparation works;
- Stage 2 – removal of redundant infrastructure and wastes;
- Stage 3 – remediation;
- Stage 4 – landforming; and
- Stage 5 – completion works and demobilisation.

Investigations completed within the Project Area have shown that not all of the soil and groundwater within this area requires remediation or management. As such, remediation activities would only be required in a number of targeted areas within the Project Area.

It is assumed that the parts of the Project Area that would be required to be disturbed/excavated would primarily result from activities associated with the removal of existing redundant surface and subsurface infrastructure[2], contaminated land remediation and landforming works. Further, based on the analytical data obtained from several stages of site investigations, the remediation would be limited to less than 4 metres below ground surface (mbgs), and would be generally focused within 2 mbgs.

Where soil in the Project Area has been assessed as not requiring remediation, this is because the soil and groundwater quality either:

1. already meets applicable commercial/industrial land use criteria; and/or
2. the remaining contamination impacts are unlikely to pose a risk to human health or the environment.

[2] Infrastructure that would be removed during the Project consists of pipework, foundations, services, utilities, stockpiles, and wastes. Other above ground infrastructure will be removed as part of the Clyde Conversion Terminal Project (SSD 5147), prior to the commencement of this Project.

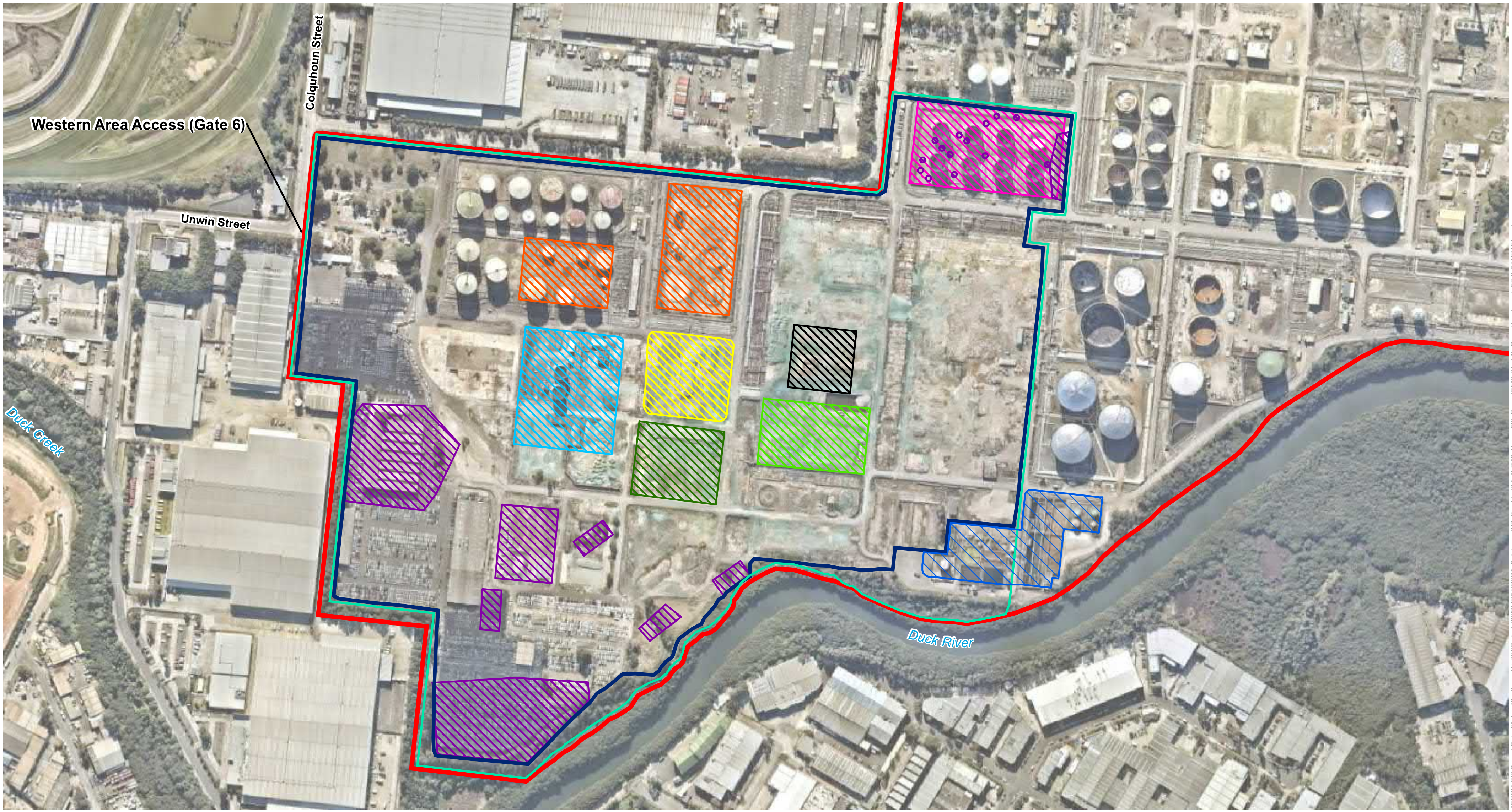

FIGURE ES-2 - PROJECT AREA LAYOUT

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Wastewater Treatment Plant (WWTP)

Potential Location of Remediation Technologies

- Biopiling
- In-area soil mixing / landfarming excavation
- Landfarming
- Stabilisation
- Thermal desorption
- Waste proccessing area
- Contingency treated stockpile area
- On-site management (buried waste)

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

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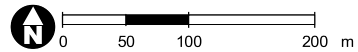

Remediation activities undertaken as part of Stage 3 would generally be undertaken in line with the following steps:

- excavation of soil would be conducted sequentially, moving from one area to the next only once the validation process in the area being remediated has started. Once the area is validated, the excavation would be backfilled and the area clearly marked to avoid potential cross contamination from other areas;
- in-situ remediation works (i.e. in-area landfarming and soil mixing) would also progress in a similar sequential manner with progressive validation testing conducted to confirm the remediation objectives have been achieved;
- once the contaminated soils is excavated, soil testing would occur within the excavations to confirm/validate the remaining soil;
- soils to be treated ex-situ would be excavated and stockpiled based on visual and olfactory evidence, field screening, and laboratory data. The soils would likely be stockpiled in the Waste processing area or another centrally located area;
- contaminated soils would be stockpiled separately depending on the remediation technology required and the type and concentrations of contamination present;
- contaminated soils would be treated with the appropriate remediation technology out of the following selected primary alternatives;
  - biopiling;
  - in-area soil mixing/landfarming;
  - thermal desorption; and
  - stabilisation.
- dewatering may be required from the excavations. The dewatered liquid would be directed to the wastewater treatment plant (WWTP) or collected and temporarily stored either at a designated location at the Waste processing area or close to the excavation. If suitable the collected liquid would be transported and treated in the WWTP. If not, the liquid would be disposed off-site by a licensed contractor;
- excavations would be clearly fenced and signposted while material is being remediated and/or the validation process has started;
- following treatment, soils would be subject to validation testing against a pre-determined validation criteria and in accordance with a specific Validation Sampling and Analysis Quality Plan (SAQP);
- soils which have been validated to meet commercial/industrial land use criteria (including validated imported materials) would be stockpiled separately from soils requiring remediation;
- validated soils or validated soils mixed with the crushed concrete would be placed in excavations as soon as practicable following removal of contaminated soils and subsurface infrastructure;
- at the completion of the remediation works, areas used for stockpiling contaminated soils would be validated appropriately; and
- tracking documentation would be completed for each excavation and stockpile in accordance with material tracking measures documented in the Waste Management Plan.

As outlined above, the remediation would focus on petroleum hydrocarbon impacts in soils. Other non-petroleum chemicals of potential concern may also occur within the soil and groundwater in the Project Area. These include:

- Heavy metals;
- Per- and polyfluoroalkyl substances (PFAS);
- Asbestos; and
- Pesticides/Dioxins/Polychlorinated Biphenyls (PCBs).

As outlined in the Conceptual RAP in **Appendix C**, where it is identified that non-petroleum hydrocarbon impacts warrant remediation, these contaminants would either be treated alongside hydrocarbon impacts in the proposed remediation technologies or would be managed on-site or transported off-site. The decision to treat these contaminants alongside the hydrocarbon impacts would be subject to a range of considerations including their concentration, material/leaching characteristics and/or the presence of other chemicals of potential concern.

Following the completion of remediation works (Stage 3), the Project Area would be fully disconnected from the Clyde Terminal's WWTP. Stormwater from the Project Area would be managed through overland flow, with appropriate erosion and sediment control techniques employed.

It is anticipated that the final landform across the Western Area would be at broadly the same level it is at present. To achieve this, remediated soils mixed with crushed concrete from the Stage 2 and Stage 3 activities would be used as backfill. In order to ensure enough fill is available to perform these landforming activities, an estimated 5,000 cubic metres (m^3) of soil would be imported from other Viva Energy sites and remediated throughout the Stage 3 process.

The volume of soil that would require remediation as part of the Project has been estimated at 105,000 m^3.

Following completion of the Project the Western Area would be a broadly flat, vacant site. Operational activities on the Project Area would be limited to those associated with environmental monitoring and ongoing management of the final landform.

Statutory planning context

The Project Area is situated on land zoned as IN3 Heavy Industrial under the *Parramatta Local Environmental Plan 2011*. The Project's primary purpose involves removing, destroying, reducing, mitigating and containing contaminated land in the Western Area and eliminating or reducing the potential hazards associated with this contamination. Therefore, the Project is considered 'remediation work' under the *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) and therefore requires development consent.

Section 4.36 of the EP&A Act outlines development that is considered SSD. This section notes that a development can be declared SSD by an Environmental Planning Instrument or the NSW Minister for Planning can declare a development on specified land to be SSD. As the Project did not meet all of the requirements of the *State Environment Planning Policy (State and Regional Development) 2011* (SEPP SRD), a 'Call-In Request' was submitted to the NSW Department of Planning and Environment that requested that the Project be declared SSD by the Minister under section 4.36(3) of the EP&A Act. On 20 April 2018 an order was published in the NSW Government Gazette declaring the Project as SSD (ref n2018-1291).

The assessment process has identified the relevant local, regional, State and Commonwealth legislative requirements for the proposed Project. An assessment of the relevant matters of consideration has been undertaken in this EIS and has concluded that the Project is compliant with the requirements of the Parramatta Local Environmental Plan 2011 and other relevant State and Commonwealth legislation.

This State Significant Development application seeks development consent to undertake the Project.

Stakeholder engagement

The EIS has been prepared having regard to the outcomes of consultation with relevant authorities and; community stakeholders, including:

- the surrounding community;
- the NSW Department of Planning and Environment;
- the NSW Environment Protection Authority (NSW EPA);
- NSW Office of Environment and Heritage;
- the NSW Department of Industry;
- the NSW Department of Health;
- Fire and Rescue NSW;
- SafeWork NSW;
- Roads and Maritime Services;
- Port Authority of NSW;
- GSC; and
- City of Parramatta Council.

AECOM and Viva Energy have consulted with the above stakeholders via meetings, letters and the Viva Energy website.

Environmental scoping assessment

The Preliminary Environmental Assessment Report for the Project identified and prioritised potential environmental issues associated with the Project based on the likelihood of an environmental impact occurring and the consequence of that impact should it not be mitigated.

The risk screening for this EIS considered the significance of each potential environmental impact from the preliminary environmental risk screening, in addition to the likely level of stakeholder interest in each issue. This led to the following prioritisation of environmental issues for this EIS:

- High risk issues: soils, groundwater and contamination; surface water, wastewater and flooding; air quality and odour; and human health risk.
- Medium risk issues: waste management; ecology; and hazards and risk.
- Low risk issues: noise and vibration; traffic, transport and access; and heritage.

Other potential issues were considered unlikely to be subject to significant adverse impacts as a result of the Project.

Soils, groundwater and contamination

A number of soil and groundwater contamination studies have been prepared for the Site including the Western Area since the 1990’s. The Project aims to remediate predominantly hydrocarbon petroleum impacted soils and LNAPL to enable the future use of the land for permissible commercial/industrial development under the existing land use zoning.

Soil and groundwater conditions at the Clyde Terminal are currently regulated by Condition U1 of Environment Protection Licence No. 570 (EPL 570) which requires an annual report to be submitted to the NSW EPA.

Remediation activities, including biopiling, in-area soil mixing/landfarming and stabilisation/thermal desorption, would require significant movement and disturbance of contaminated soils, potentially including acid sulfate soils within and around the Project Area. This movement of soils could result in the contamination of previously uncontaminated areas should unintentional spills or cross contamination occur. In addition, the disturbance of soils during the Project has the potential to result in off-site impacts due to the mobilisation of sediment or via airborne dusts during high winds.

Excavations associated with the remediation works would extend to a depth of up to 4 m and are therefore likely to intercept and expose potentially contaminated groundwater. Additionally, the removal of existing infrastructure during Stage 2, including hardstand material within the Project Area, has the potential to result in increased infiltration of surface water within the Project Area. This could result in both vertical and lateral migration of contamination plumes in the Western Area.

Due to predicted contact with groundwater and subject to further consultation with the NSW Department of Industry, an aquifer interference approval may be required under section 91 of the *Water Management Act 2000* (WM Act). In addition, the pumping and removal of groundwater from excavations and subsequent treatment and discharge into the Duck River would involve the removal and movement of water from one water source to another and, subject to discharge volumes, would potentially require a water access licence under section 56 of the WM Act.

The Remediation Environmental Management Plan (REMP) would include measures to minimise the potential impacts associated with contact with chemicals of potential concern and would include measures to mitigate or manage the human health and environmental risks associated with potential soil, groundwater and contamination impacts. Three sub-plans including the Acid Sulfate Soils Management Plan, Soil and Water Management Plan and Validation Sampling and Analysis Quality Plan (as part of the Remedial Work Plan) would include specific measures to manage and minimise soil, groundwater and contamination impacts resulting from the Project.

Surface water, wastewater and flooding

The Site is located at the confluence of the Duck and Parramatta rivers. The Parramatta River is one of the most urbanised catchments in Australia, a fourth order stream and is the main tributary of Sydney Harbour. Duck River is a third order perennial stream and southern tributary of the Parramatta River. The current riparian zone adjacent to the Project Area along Duck River generally meets the prescribed 30 m riparian width criterion for first order streams outlined in the *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012).

A significant portion of the Site is sealed and an extensive surface water drainage network is present across the Site. During Stage 1, the existing surface water management systems would remain in place and surface water from the Project Area would continue to be managed in line with current practices. Stage 2 and Stage 3 works would be undertaken with an iterative approach across the Project Area so as to maintain downstream drainage infrastructure. Throughout these works, water would be directed to the on-site WWTP or would be collected and be transported to the WWTP for treatment and discharge from existing licenced discharge points in accordance with the requirements of EPL 570. Based on the use of the existing surface water and wastewater management systems, it is anticipated that there would be no deterioration in discharge characteristics thus licence discharge conditions would continue to be met during Stages 1 to 3.

Stage 4 and Stage 5, would involve the establishment of the final landform with drainage channels to be made similar to current ground levels and direct overland flow directly towards Duck River. The final landform would employ appropriate erosion and sediment controls (e.g. swales and vegetation) in order to minimise potential contamination of runoff into the Duck River. Following completion of the final landform the overland flow from the Western Area would be of significantly less volume and improved quality compared to the existing system at the Western Area.

The flood potential of the Site was assessed as part of the Conversion Project (WMA Water, 2016). This study indicated that there is some flood inundation of the Site (including the Western Area) for the 1% AEP event which is predominantly contained to the pipe trench routes and the riparian area along the southern boundary. It is unlikely that there would be an impact to flood levels or flow conveyance within Duck River or on neighbouring properties as a result of Stage 1 to Stage 5 of the Project, including the establishment of the proposed final landform as no fill would be placed within the existing 1% AEP flood extent.

Air quality and odour

An Air Quality Impact Assessment was prepared to assess the potential impacts of the Project (Stage 1 to Stage 5) on air quality. The results of the assessment indicated that the predicted incremental concentrations of total suspended particulates (TSP), particulate matter 10/2.5 micrometres or less in diameter (PM_{10}/ $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and hydrogen fluoride (HF) were all below the NSW EPA criteria. When the background concentration is added to the predicted incremental concentration, the resulting cumulative concentration was below the NSW EPA criteria for TSP, CO and NO_2.

Due to the background concentrations of PM_{10} and $PM_{2.5}$ exceeding the NSW EPA criteria an additional particulate emission assessment was undertaken. The assessment concluded that the highest cumulative concentrations for both 24-hour PM_{10} and $PM_{2.5}$ are largely attributed to high background concentrations; particularly where the background concentration exceeds the NSW EPA criterion without contribution from the Project.

Predicted off-site concentrations for air toxic pollutants (i.e. volatile organic compounds (VOCs), acid mist, dioxin and furans) were well below the relevant criterion.

The highest contributor to odour from the Project would be exposed surfaces during excavation; and to a lesser extent remediation activities, where large quantities of contaminated material would be exposed or subject to materials handling activities such as biopiling and landfarming. Off-site odour emissions are likely to be highly variable based on the level of contamination of exposed surfaces and the age of exposed material at any given point in time.

Design mitigation measures to manage Stage 1 to Stage 5 of the works have been incorporated into the modelling undertaken. Further, an Air Quality Management Plan, including a Reactive Air Quality Management Program for particulates and odour would be developed for the Project.

The ongoing operation of the Western Area is not expected to have a significant impact on air quality as soils would have been remediated. The remediation of the Western Area would reduce vapour and odour emissions from soils, and as the final landform would include a layer of topsoil and vegetation, the works would reduce the amount of exposed surfaces therefore mitigating potential dust impacts. As such no air quality impacts are expected during the ongoing operation of the Western Area.

Human health risk

The objective of the human health risk assessment (HHRA) was to assess the human health risks to surrounding residents, commercial workers and recreational users resulting from the exposure to air emissions that may be generated during the Project. The specific evaluation of the risks to on-site workers has not been undertaken as their exposures are addressed via the implementation of appropriate occupational health and safety procedures and management plans.

Using the maximum annual average ground level exposure concentrations and grid maximum predicted exposure concentrations for chemicals of potential concern (including air toxins, dioxins and furans as PCDD and PCDF particulates and acid gases), the hazard indices were well below the adopted acceptable hazard indices of 1.0 for all assessed potential risk pathways. Overall the estimated health risks to off-site residents, recreational users and commercial workers from inhalation and residents from direct contact pathways under worst case conditions are considered low and acceptable.

Waste management

The Clyde Terminal currently operates under EPL 570, which provides for a number of scheduled activities including waste processing by non-thermal treatment of hazardous and other waste. In particular, Condition L5 of the EPL provides for the receipt, generation, storage, processing and disposal of certain wastes scheduled under the *Protection of the Environment Operations (Waste) Regulation 2014*. Waste at the Clyde Terminal is generally managed in accordance with the Waste and Resource Recovery Plan prepared for the Conversion Project, NSW and Commonwealth legislation, and Viva Energy standards.

Potential waste streams that may be produced as part of the Project, as defined in the *NSW Waste Classification Guidelines* (NSW EPA, 2014), include liquid waste, general solid waste, restricted solid waste, hazardous waste and special waste. If not managed responsibly, waste generated by the Project has the potential to cause the following impacts:

- land and water (surface water and groundwater) pollution to sensitive environments in the vicinity of the Project Area resulting in human health and environmental impacts;

- land and water (surface water and groundwater) pollution to sensitive environments during transportation and resulting in human health and environmental impacts; and
- inefficient use of resources.

Management strategies developed for each waste stream for the Project have been designed to be consistent with the waste management hierarchy, meet relevant legislation and policy, and to minimise the environmental impact of the Project.

The ongoing operation of the Project is not expected to generate significant quantities of waste due to the nature of a vacant Project Area.

Noise and vibration

Predicted noise levels generated throughout all stages of the Project (conservatively modelled as being executed at once) are predicted to be well below the applicable Noise Management Levels for all hours (including daytime standard hours, daytime out of hours and night time hours) at all residential and industrial receivers. In addition, based upon the ambient noise monitoring results, potential noise levels experienced at any sensitive receiver would be predominantly comprised of noise from existing (background) sources, rather than noise from the Project. It is therefore concluded that noise impacts from the Project are not likely to be significant.

While the lower vibration limit for human comfort may at time be exceeded at industrial receivers within 30 m of the Project Area, vibration is unlikely to exceed the criteria for structural damage at these industrial properties. Potential vibration impacts from the Project would therefore not be significant.

Road traffic noise predictions were conducted for James Ruse Drive, Silverwater Road and Parramatta Road at the closest residential receivers and confirm that noise criteria for both the day and the night would be exceeded for existing traffic levels. Given the existing traffic volumes and associated noise levels, the contribution from Project-related movements would be negligible at all major roads which Project-related vehicles would travel and along which residential properties are located.

There would be no impacts to sensitive receivers from the ongoing operation, as works would be restricted to inspection and management of the final landform.

Traffic, transport and access

Access to the Project Area from Grand Avenue is via Colquhoun Street or Durham Street, and Devon Street (all local roads) through Gate 6 (refer to **Figure ES-2**). Gate 6 is the access point for the Project Area and is located on the corner of Colquhoun Street and Unwin Street. Access to Gate 6 from Wentworth Street is via Kay Street and Unwin Street (both local roads). Gate 6 meets the requirements for use by heavy vehicles and plant required for the Project.

Due to the industrial zoning surrounding the Project Area, there is good access for heavy vehicles. Local roads around the Project Area are designed to cater for large, heavy vehicles associated with the industrial land use in the area and are of a sufficient width to accommodate both through traffic and parking lanes for heavy vehicles. Public transport connections including the Clyde to Carlingford heavy railway line (T6 Carlingford line), future Parramatta Light Rail and bus and ferry routes are available, albeit restricted due to the need to walk substantial distances combined with the lack of a comprehensive footpath network. The workforce is therefore likely to use private vehicles to access the Project Area.

Although workers accessing the Project Area would be encouraged to utilise more sustainable modes of transport, provision would be made to allow for the workforce to park on-site. Over the course of the Project, a maximum of 80 Project workers would be expected to be on-site at any one time, however lower numbers of workers would likely be on-site for the majority of the Project. Notwithstanding this, a dedicated parking area for up to 80 light vehicles would be set aside within the Project Area.

In the course of undertaking the works, a variety of plant, equipment and materials would be required to be delivered by heavy vehicles to the Project Area. Plant, equipment and materials would also leave the Project Area by heavy vehicles during and at completion of the Project.

Traffic generation analysis was undertaken considering a peak (worst case) scenario that combines the highest likely workforce (up to 80 workers per day during Stage 1) and maximum likely movements of heavy vehicles (up to 100 movements in the peak hour). The analysis indicated that the Project has no impact on the Level of Service for the intersections of James Ruse Drive, Grand Avenue and Hassall Street; James Ruse Drive and Parramatta Road; and Parramatta Road and Wentworth Street. Overall the addition of traffic generated by the Project would be temporary and has a negligible effect on the arterial road network.

The generation of traffic after completion of the Project would be negligible and limited to a small number of vehicles used for maintenance activities. Therefore, potential impacts of Project traffic during ongoing operations would be negligible.

Biodiversity

The Project Area has been subject to historical vegetation clearing and no longer contains remnant native vegetation. The Project Area has been assessed as not supporting native vegetation that would be representative of any NSW Plant Community Types (PCTs). Vegetation within the Project Area consists of planted native and exotic species in a managed industrial landscape setting, and disturbance tolerant species growing as weeds across the Study Area.

The Project Area has been refined to exclude the remnant vegetation along the Duck River riparian area and the drainage line running north-south along the western boundary of the Western Area.

Habitat potentially present with the Project Area in the form of human made structures would be removed by the Conversion Project and retained vegetation does not support high quality habitats for locally occurring threatened fauna.

The Clyde/Rosehill key population of Green and Golden Bell Frog is centred around the wetland present approximately 500 m to the north-east of the Project Area. The Green and Golden Bell Frog is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act). The Project occurs adjacent to known habitat utilised by the important ‘Clyde/Rosehill key population’ of the species (DECCW, 2008) and as such an assessment of potential impacts in accordance with the EPBC Act has been undertaken. The Project is not considered likely to result in a substantial loss of foraging habitat for the population as areas of higher quality habitats would be maintained closer to the wetland and within the Duck River and Parramatta River riparian zones.

It is determined that the Project is unlikely to result in a serious and irreversible impact to biodiversity values. All direct impacts to PCTs and the threatened species habitat they support have been avoided by the Project. As such, offsetting is not required because the Project avoids impacts to native vegetation and impacts to threatened species and their habitats.

Operational impacts on biodiversity as a result of the Project are considered negligible as only minimal operational maintenance activities would be required, such as weed management.

Non-Aboriginal heritage

The historical context of the Site aids in the determination of the archaeological potential and heritage significance of the Project Area. The Site has had four historical phases: Aboriginal occupation; early land grants, John Fells & Co. and British Imperial Oil/Shell. The former Clyde Refinery has previously been assessed as having State significance, although it remains unlisted on any register.

Based on the work undertaken by Australian Museum Consulting in 2015 an updated significance assessment was completed by AECOM in 2018. This significance assessment concluded:

> *“The Clyde Terminal (former Clyde Refinery) is of State significance for its historical, associative values. Historically, it demonstrates NSW’s increasing use of and reliance on fossil fuels and the expansion of business in the State from import to production. It is associated with the Shell Company, one of the leading producers and retailers of fuel in NSW.*
>
> *The Clyde Terminal is of local social and technical significance. It is likely to be of social significance to the local community as it has been an employer of locals for over 80 years and has been an active participant and supporter of community events throughout that time. The former Clyde Refinery can also demonstrate technical developments in the process of refining Crude Oil.*

> *Clyde Terminal does not have any potential for significant relics to be present at the site and that excavations are unlikely to yield substantial information that is not readily available from other sources.*

There is the potential for temporary impact to the heritage value of the former Clyde Refinery during both Stage 1 and Stage 2. Direct impacts would be related to changing the existing site landscape through additions of fencing, temporary facilities, etc. along with the removal of redundant infrastructure. However, direct impacts from the Project to the heritage value of the former Clyde Refinery have already been mitigated by previous archival recordings as part of the Conversion Project. Potential direct impacts associated with Stage 3, 4 and 5 are considered negligible as heritage elements within the Project Area would have already been removed.

In addition, indirect impacts are possible to the adjacent ecological listed items Lower Duck River Wetlands (I47) and Wetlands (I1) if contaminated soil or water migrates off-site and is inadvertently spread into these areas.

The impact to the identified heritage values following completion of the Project would be negligible as any impact would have already occurred.

Aboriginal Heritage

As part of the EIS process, the Project Area was refined so that the vegetation along the Duck River and the Western border of the Project Area were excluded and would not be disturbed. The Duck River frontage was identified by the NSW Office of Environment and Heritage as potentially being of Aboriginal cultural heritage value.

In 2012, an Aboriginal Cultural Heritage Assessment Report (ACHAR) was undertaken for the Conversion Project (AECOM, 2012), including an assessment of the majority of the Project Area. The key findings of the ACHAR undertaken for the Conversion Project, including those of its full Aboriginal community consultation program, are of relevance to the Project. In order to identify potential impacts to Aboriginal cultural heritage values as a result of the Project, an updated review of existing environmental and archaeological data sources for the Project was undertaken, complimented by a standalone visual inspection of the Project Area.

This inspection did not identify any Aboriginal objects within the Project Area and concluded that due to historical land use and disturbance the archaeological sensitivity of land within the Project Area is considered negligible.

The potential for impacts to Aboriginal cultural heritage within the Project Area as a result of the Project (both during and after completion of the remediation works) is therefore considered to be negligible. In the unlikely event that Aboriginal objects would be found within the Project area, mitigation and management measures (to be included in the REMP) would minimise potential impacts.

Hazards and risk

Although the remediation activities are not technically a type of industry, a *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) risk screening assessment has been completed for the Project in accordance with the NSW Department of Planning's *Hazardous and Offensive Development Application Guidelines, Applying SEPP 33* (2011). The risk screening assessment has considered potentially hazardous materials stored, handled and transported to the Project Area for use during the Project (Stage 1 to Stage 5).

The Project would be contained in an area that would be separated from the Clyde Terminal operations. A security fence would be erected between the Clyde Terminal and the Western Area. Personnel working on the Project would not automatically be allowed access to the Clyde Terminal or other parts of the Site. As such the Project is unlikely to increase or change the safety risks associated with the Clyde Terminal.

The Project is likely to decrease the hazard and risk profile of the Western Area with the cleaning and removal of subsurface infrastructure and by reducing the risk of exposure to contaminated material. The screening risk assessment for potentially hazardous materials to be used during the Project indicated that SEPP 33 does not apply and therefore a Preliminary Hazard Analysis is not required. In the event that a material is used during the Project which has not been assessed, or greater quantities and/or vehicle movements are required for materials used during the Project, then an additional screening risk assessment would need to be completed before it can be transported, stored or used on-site.

Cumulative impacts

Cumulative impacts have been considered in relation to potential cumulative effects with other relevant developments in the region. Other proposed developments in the vicinity of the Project Area are not predicted to result in significant cumulative impacts in combination with the Project.

Nevertheless, Viva Energy would continue to undertake consultation with the surrounding community including the developer of the Parramatta Light Rail project and Clyde Barging Facility to ensure that cumulative impacts that may arise are appropriately managed if required.

Project evaluation and justification

The Project supports the principles of Ecologically Sustainable Development and through incorporation of a range of environmental safeguards and measures recommended throughout this EIS would avoid minimise or manage potential impacts. The Project itself would not have a significant adverse impact on the biophysical environment.

In addition the Project supports the Objects of the EP&A Act, through promoting positive social and economic outcomes while minimising potential impacts on the environment and heritage.

The remediation of contaminated soils in the Western Area would reduce the concentration in the soil of chemicals of potential concern. The Project would therefore decrease the hazard and risk profile of the Western Area by reducing the risk of exposure to contaminated material.

The remediation of contaminated soils in the Western Area would also facilitate future development of the land for other purposes permissible under the existing land use zoning. This would help Viva Energy meet its regulatory requirements, business objectives and would assist with the delivery of the GSC vision for GPOP.

While the Project would result in positive social and economic outcomes, as outlined in **Chapter 3** and **Chapter 8** to **Chapter 18**, the potential for minor and temporary environmental impacts remain. Given the implementation of appropriate management and mitigation measures, the Project is anticipated to have no significant residual impacts.

The remediation of the Project Area would ensure the ongoing operational viability of the Clyde Terminal assets and associated licences, as Viva Energy would be able to control the type of development that is built adjacent to the Clyde Terminal. In addition the Project would ensure that any future redevelopment decisions are considerate of the operational requirements of the existing Clyde Terminal while meeting applicable regulatory requirements, including the NSW EPA's requirement that contamination legacies be addressed in a timely and comprehensive manner.

Provided that the recommended mitigation, management and monitoring measures are implemented, the Project presents an overall low to medium risk in relation to each of the identified environmental issues. Overall the Project is considered justifiable on biophysical, economic and social grounds, and is considered to be consistent with the principles of Ecologically Sustainable Development.

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1.0 Introduction

1.1 Project overview

Viva Energy Australia Pty Ltd (Viva Energy) owns the land associated with the former Clyde Refinery (the 'Site') located at Durham Street, Rosehill on the Camellia Peninsula. Viva Energy currently operates the Clyde Terminal on part of the Site; however, a large part of the former refinery land in the south-western part of the Site (the 'Western Area') is no longer required for operational purposes. As such, Viva Energy is proposing to remediate contaminated soils in the Western Area (the 'Project') to facilitate future development of the land for other purposes permissible under the existing land use zoning.

Investigations completed within the Western Area have shown that not all of the soil and groundwater within this area requires remediation or management. As such, the Project would involve the remediation of impacted soils and the management of impacted groundwater within a number of targeted areas within the Western Area. The land where the proposed remediation activities would occur within the Western Area is referred to as the Project Area. The Site, Western Area and Project Area are shown on **Figure 1-1**.

Where remediation is required, the focus of this remediation would be on:

- addressing petroleum hydrocarbon impacts in shallow soil horizons;
- addressing residual soil/sludge impacts in the drainage network and surrounds;
- removing Light Non-Aqueous Phase Liquid (LNAPL) if present, to the extent practicable[1]; and
- ensuring potential contamination risks to the environment are removed or mitigated.

To support this Environmental Impact Statement (EIS), a Conceptual Remedial Action Plan has been developed (refer to **Appendix C**). This document, which includes the conceptual design for the Project, estimates that the volume of soil that would require remediation is approximately 105,000 cubic metres (m^3).

Outside of the Western Area, the rest of the Site would continue to operate as normal during the Project. The operations on the rest of the Site are dominated by the Clyde and Parramatta terminals which receive, store, blend and distribute finished petroleum products. The operation of these two terminals would not change as a result of the Project.

AECOM Australia Pty Ltd (AECOM) have prepared this EIS for the Project on behalf of Viva Energy to support the State Significant Development Application under Part 4 of the *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act). This EIS has been prepared in accordance with the provisions of the EP&A Act and addresses the Secretary's Environmental Assessment Requirements (SEARs) for the Project, dated 1 June 2018.

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[1] The need to remove LNAPL would be mainly based on the level of potential human health risk for proposed commercial/industrial end use. It should be noted that LNAPL and dissolved phase plumes are considered stable in the Western Area, and therefore removal to reduce migration in groundwater is not a key driver.

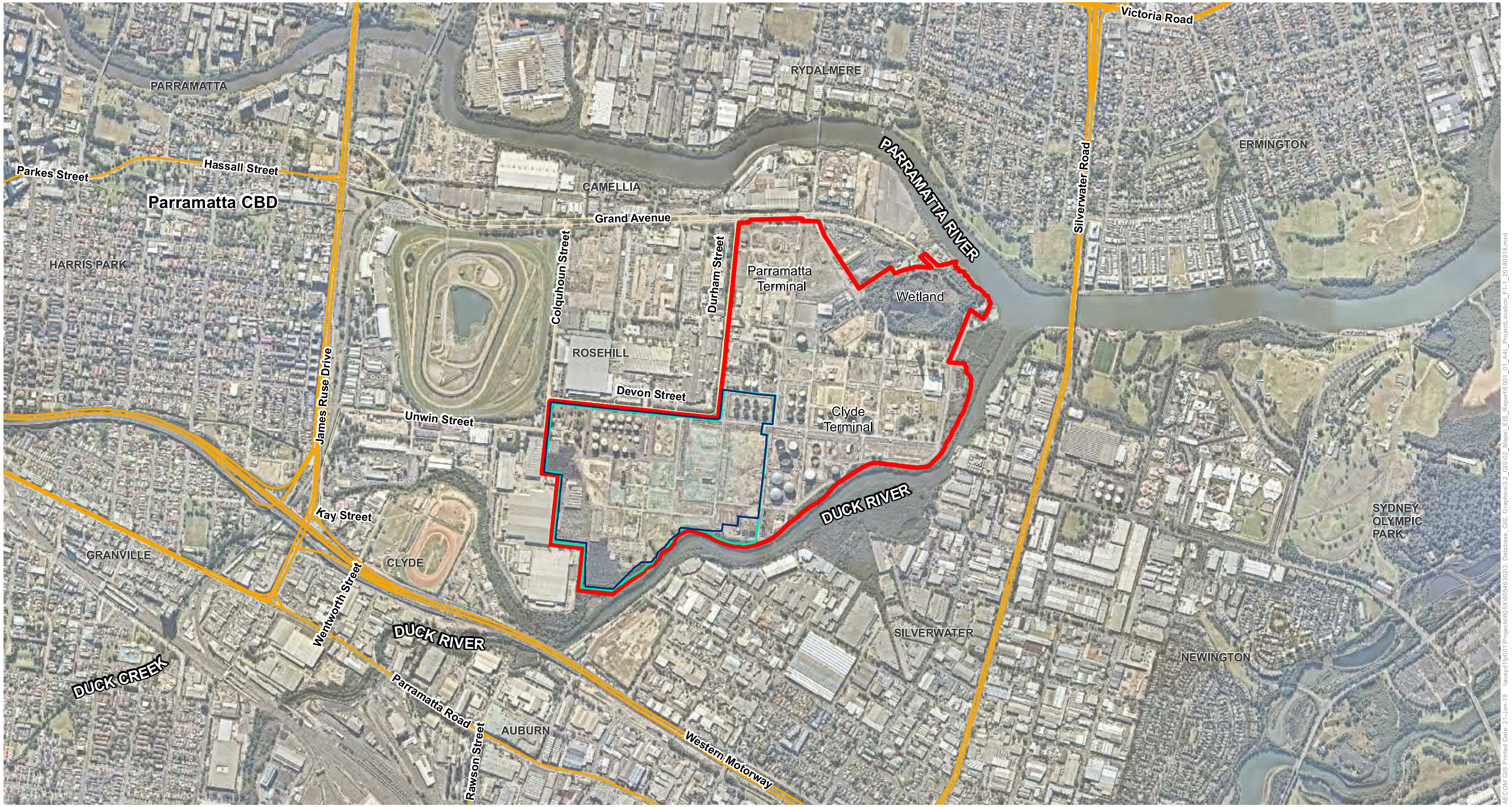

FIGURE 1-1 PROJECT LOCATION

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- State road
- Local road

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

0 250 500 m

1.2 Location and setting

The Site is located approximately 16 kilometres (km) west of the Sydney Central Business District, within the Parramatta Local Government Area (LGA), on the Camellia peninsula. The Site is surrounded by a mixture of land uses but is primarily in an industrial setting. To the west are the Rosehill Gardens Racecourse and a mix of industrial and commercial developments. To the south is Duck River, beyond which there is the industrial and commercial development of Silverwater. Industrial development within the suburb of Rosehill is adjacent to the north and west of the Site. Duck River runs along the south-eastern boundary of the Site and eventually joins the Parramatta River at the eastern most point of the Site (refer to **Figure 1-1**).

The Site is owned by Viva Energy and consists of the following lots:

- Lot 398 DP41324;
- Lots 100 and 101 of DP1168951;
- Lot 101 DP809340;
- Lot 2 DP224288; and
- Lot 1 DP383675.

All of these lots are located within the Parramatta LGA. The whole Site is zoned as IN3 Heavy Industrial under the *Parramatta Local Environmental Plan 2011*.

The Site includes the Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and the Project Area, as shown on **Figure 1-1**.

The Western Area is located within the Site, to the south-west of the Clyde Terminal. The Western Area is approximately 40 hectares (ha) in size and located on Lot 100 DP1168951. This part of the Site was previously dominated by a variety of refinery assets which have now been removed. The land is now largely vacant.

The Project Area is the land within the Western Area where the Project would predominantly occur. The Project Area consists of the majority of land within the Western Area, excluding vegetation within protected areas and certain portions of the Western Area which do not require remediation.

Chapter 2 Site context provides further information on the land use context of the Site.

1.3 Background to the Project

The Site was previously used for refining operations including hydrocarbon processing, fuel storage and fuel transfer. The Site operated as a refinery from 1918 to 2012, with Shell Refining (Australia) Pty Ltd (Shell) as owner and operator of the Clyde Refinery from January 1928. Since 2012, the Site has predominantly operated as the Clyde Terminal, which makes up the majority of the central part of the Site, and receives, stores and distributes fuel products including diesel, jet fuel and gasoline products.

In 2015, development consent was granted for the Clyde Terminal Conversion Project (State Significant Development (SSD) 5147) (the ‘Conversion Project’). The Conversion Project included the demolition of redundant tanks and other infrastructure and upgrades and improvements to site infrastructure. It was aimed at improving the efficiency of the Clyde Terminal by upgrading existing facilities and structures, improving environmental performance and further improving the safety of the Clyde Terminal. The Conversion Project is almost complete and the majority of Clyde Terminal assets have been consolidated into the new Clyde Terminal footprint, have been upgraded where necessary and much of the redundant refinery infrastructure has been demolished and removed.

The Clyde Terminal continues to receive and distribute finished petroleum products, operating under Environment Protection Licence number 570 issued under the *Protection of Environment Operations Act 1997 (NSW)*. The Clyde Terminal is also a Major Hazard Facility (MHF) under the *Work Health and Safety Regulation 2011 (NSW)*.

Long-term and historic use has resulted in contamination impacts to the Site. The Site, including the Western Area, is declared as significantly contaminated land under the *Contaminated Land Management Act 1997 (NSW)* (Declaration number 20131110).

Viva Energy recognised that following completion of the Conversion Project, the Western Area would be largely vacant and not required for the Clyde or Parramatta terminal operations. As such there was an opportunity for this land to be sold, leased or used for alternative land uses; provided these land uses did not adversely affect Viva Energy's retained operations. Given the current land use zoning and contamination profile of the Western Area it was clear that remediation of parts of the Western Area to a commercial/industrial standard[2] would be required.

The operational conditions of consent for SSD 5147 would still apply to part of the Western Area if the Project is approved. However, if this Project is approved, the consent for SSD 5147 may need to be modified to ensure a consistent operational framework for the Western Area. The Site would continue to be classified as an MHF.

The Project has been proposed to remediate impacted soils and manage impacted groundwater within the Project Area to enable the land to be used for purposes permissible under the existing land use zoning in the future.

Chapter 2 Site context provides further detail on the history of the Site and **Chapter 3 Need and alternatives considered** describes the objectives of the Project.

1.4 The Proponent and Team

The proponent and landowner is Viva Energy. The relevant contact for the Project is:

Erica Salazar
Viva Energy Australia Pty Ltd
Durham Street
Rosehill NSW 2142
ABN: 46 004 610 459
Telephone: +61 2 9897 8046

This EIS has been prepared by AECOM Australia Pty Ltd, ABN 20 093 846 925, Level 21, 420 George Street, Sydney NSW 2000, Tel: (02) 8934 0000. The Environmental Planning and Assessment Lead is William Miles, CEnvP IA and Associate Director - Environment.

1.5 Environmental assessment process

1.5.1 Overview

The Project was declared SSD as this ensures that the Project is assessed at a State level commensurate with the economic, social and environmental potential that the land could bring in the future (refer to **Section 5.1** and **Section 5.2**). Therefore, the Project will be assessed under Part 4 of the EP&A Act as SSD. Section 4.5 of the EP&A Act states that the Minister for Planning is the consent authority for SSD.

1.5.2 Preparation of this EIS

This EIS has been prepared to support a development application for the Project as required under section 4.12(8) of the EP&A Act and the EIS has been prepared in accordance with the SEARs (refer to **Appendix A**). The EIS document provides a detailed outline of the environmental constraints, opportunities and subsequent impacts associated with the Project.

This EIS has been prepared by AECOM, on behalf of Viva Energy and in accordance with Part 4 of the EP&A Act and the SEARs issued by the Secretary.

[2] Based on criteria for commercial/industrial land use provided in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council (NEPC), 2013).

The purpose of this EIS is to describe the nature of the activities proposed as part of the Project and to assess the potential impacts of these activities on the natural, built and social environments. This EIS presents:

- a detailed description of the Project;
- assessment of the nature and extent of the potential environmental, social and economic impacts of the Project; and
- a description of the mitigation and management measures to be implemented during delivery of the Project to minimise potential impacts on the environment.

A range of specialist Technical reports have been prepared to address the key environmental issues associated with the Project. These Technical reports are presented in the appendices to this EIS and are summarised in relevant chapters of this EIS. It is therefore important that the EIS is read in conjunction with these technical reports.

Various meetings have been held between Viva Energy, AECOM, regulators and authorities that have focused on key environmental issues associated with the Project. The government agencies that have been consulted include:

- the NSW Department of Planning and Environment (NSW DPE);
- the NSW Environment Protection Authority (NSW EPA);
- NSW Office of Environment and Heritage (NSW OEH);
- the NSW Department of Industry (NSW DI);
- the NSW Department of Health;
- Fire and Rescue NSW;
- SafeWork NSW;
- Roads and Maritime Services (Roads and Maritime);
- Port Authority of NSW;
- Greater Sydney Commission (GSC); and
- City of Parramatta Council.

Various stakeholder meetings have been held in relation to this development application (refer to **Chapter 6 Stakeholder engagement** for details on stakeholder consultation). Consultation prior to and during the preparation of this EIS has also been undertaken with the local community, including nearby businesses and landowners.

1.5.3 Exhibition

The development application and accompanying EIS will be placed on public exhibition by DPE for a minimum statutory period of 28 days. During the exhibition period any person may make a submission regarding the Project. Submissions can be made online at http://majorprojects.planning.nsw.gov.au/ or in writing (citing development application number SSD 18_9302) and addressed to the planning officer listed below:

Department of Planning and Environment
Attention: Deana Burn
GPO Box 39
Sydney NSW 2001

1.5.4 Assessment and determination

Following exhibition of the EIS, DPE would provide Viva Energy with the submissions received from the community or other government agencies during the exhibition period. Submissions received from both the community and government regulators would be responded to within a Response to Submissions (RtS) Report. The Project would then be reviewed again by government regulators including DPE. Once the DPE has finalised its assessment, the Project documentation would be submitted to the Independent Planning Commission for review and determination, unless the following criteria are met, in which case a senior staff member of DPE may act on delegated authority to determine the application:

- where less than 25 public submissions in the nature of objections are received;
- where the local council does not object to the Project; and
- where there have been no reportable political donations made in relation to the Project.

1.6 Document structure

Table 1-1 provides a summary of the document structure of this EIS.

Table 1-1 Document structure

Chapter topic	Description
Executive summary	This summarises the key issues and findings detailed in the other parts of the EIS.
Introduction	**Chapter 1** provides an outline of the Project, the need for the works, briefly outlines the environmental impact assessment process and introduces the various terms used throughout the EIS.
Site context	**Chapter 2** provides a description of the location of the Site, the Western Area and the Project Area and describes the existing environment.
Need and alternatives considered	**Chapter 3** provides an overview of the need for the Project, the Project objectives, and the alternatives and Project options that were considered.
Project description	**Chapter 4** provides a description of the Project including the activities to be undertaken, Project program and working hours and workforce, plant and equipment required.
Statutory planning context	**Chapter 5** includes the relevant controlling Commonwealth and State legislation and State and local policies. It identifies the licences and approvals required to enable the Project to proceed.
Stakeholder engagement	**Chapter 6** summarises the issues raised during consultation with the relevant stakeholders. The issues raised during the consultation process are addressed in the subsequent technical assessment chapters of the EIS.
Environmental scoping assessment	**Chapter 7** provides an assessment of the potential environmental impacts of the Project and identifies the key issues for further assessment.
Environmental assessment	**Chapters 8 - 18** provide an assessment of the potential impacts of the Project, including potential cumulative impacts, and the identification of appropriate mitigation and management measures to safeguard the environment.
Cumulative impacts	**Chapter 19** provides an assessment of the cumulative impacts of the Project.
Environmental management	**Chapter 20** details the relevant environmental mitigation and management measures to safeguard against or minimise potential impacts from the Project.
Project evaluation and justification	**Chapter 21** addresses the principles of Ecologically Sustainable Development and the objects of the EP&A Act as well as providing a justification for the Project.
Appendices	**Appendix A** contains the SEARs, including cross references to the relevant sections in the EIS where the SEARs are addressed. **Appendix B** contains the consultation material for the Project. **Appendix C** contains the Conceptual Remedial Action Plan. **Appendix D** to **Appendix K** contain the Technical reports.

2.0 Site context

2.1 Overview

Viva Energy Australia Pty Ltd's (Viva Energy) land holdings on the Camellia peninsula (the 'Site') consist of the following lots: Lot 398 DP41324, Lots 100 and 101 of DP1168951, Lot 101 DP809340, Lot 2 DP224288, and Lot 1 DP383675. The Site is located within the City of Parramatta Council Local Government Area (LGA) and includes the Clyde Terminal, the Parramatta Terminal, the Wetland, the Western Area and other land that is either currently vacant or leased to third parties. The Project Area is the land within the Western Area where the Project would occur. The Site and its key components are shown on **Figure 2-1** and described in more detail in the following sections.

2.2 The surrounding area

The Site is located on the Camellia peninsula, in the suburb of Rosehill, within the Parramatta LGA. The geographic centre of Parramatta LGA is located approximately 24 kilometres (km) west of the Sydney Central Business District (CBD). The LGA is bounded by the Ryde and Canada Bay LGAs to the east, the Cumberland LGA to the south, the Blacktown LGA to the west, and the Hills and Hornsby LGAs to the north.

The Parramatta LGA comprises 40 suburbs and is approximately 84 square kilometres (km^2). The LGA has a population of approximately 226,000 (Australian Bureau of Statistics, 2016) and is considered to be the second CBD of Sydney, as recognised in *A Metropolis of Three Cities* (Greater Sydney Commission, 2018a). Land use in the Parramatta LGA is dominated by low and medium residential development, as well as large portions of land classified as light industrial, mixed use, business development and the enterprise corridor.

The boundary of the Cumberland LGA is located approximately 300 metres (m) to the south of the Site. The Cumberland LGA comprises of 29 suburbs and is approximately 72 km^2. The Cumberland LGA has a population of approximately 216,000 (Australian Bureau of Statistics, 2016).

Almost two-thirds of jobs within the Parramatta LGA are in the major business hubs of the Parramatta CBD, Westmead and the industrial estates of Camellia, Rydalmere and Rosehill. The Camellia industrial precinct is defined as a strategic precinct under the Parramatta Development Control Plan (DCP) 2011. The DCP notes that Camellia is a significant industrial hub which contains heavy industries, sporting and convention sites.

The Parramatta LGA had a Gross Regional Product in 2017 of approximately $25,000 million, which is an increase of about 3% since 2016 and accounts for 5% of NSW's economy (NIEIR, 2016). The top three productive industry sectors in the Parramatta LGA in 2016/2017 were financial and insurance services (24%), public, administration and safety (10%) and manufacturing (10%). The manufacturing industry sector includes the petroleum and local product manufacturing sector which contributed $34 million of value added in 2016/2017 (NIEIR, 2016).

2.2.1 Surrounding land uses

The Site is surrounded by a mixture of land uses but is primarily an industrial setting and is zoned as IN3 Heavy Industrial under the *Parramatta Local Environmental Plan 2011*.

Significant transport infrastructure is located within the surrounding area including the M4 Western Motorway, James Ruse Drive and the T6 Carlingford suburban passenger railway line. Surrounding transport infrastructure is described further in **Chapter 14 Traffic, transport and access**.

To the west are the Rosehill Gardens Racecourse and a mix of industrial and commercial development. To the south is Duck River, beyond which there is the industrial and commercial development of Silverwater. Industrial development within the suburb of Rosehill is adjacent to the north and west of the Site. Duck River runs along the south-eastern boundary of the Site and eventually joins the Parramatta River at the eastern most point of the Site.

The nearest residential properties are located approximately 360 m to the south of the Site within the suburb of Silverwater, while additional residential properties are located approximately 800 m to the west and 1 km to the north-east in the suburbs of Rosehill and Rydalmere respectively.

Table 2-1 below presents the industrial land uses immediately surrounding the Site.

Table 2-1 Surrounding properties and business activities

Property details	Business activities	Proximity to Site boundary
SRS Road Pty Limited 39 Grand Avenue Lot 2 DP539090	Vehicle depot	300 m north
Veolia Environmental Services 37 Grand Avenue Lot 1 DP 539890	Waste facility	250 m north-east
Earth Power 35 Grand Avenue Lot 23 DP 874055	Recycling/energy production facility	150 m north-east
Boral Plasterboard 3 Thackeray Street Lot 23 DP 793243	Building products	100 m north
Concrete Recyclers Pty Ltd 14 Thackeray Street Lot 4 DP 856266	Recycling facility	170 m north north-east
James Hardie Building Products Devon Street Lot 102 DP868623	Building products	<50 m north-west
CSR Roofing Sales and Manufacturing Head Office 10 Grand Avenue Lot 4 DP623497	Building products	350 m north
Express Waste and Simmonds Lumber Grand Avenue Lot 2 DP607036	Building products and storage	500 m north
Courier Please 3 Shirley Street Lot 2 DP864567	Product transport facility	Adjacent to the western boundary

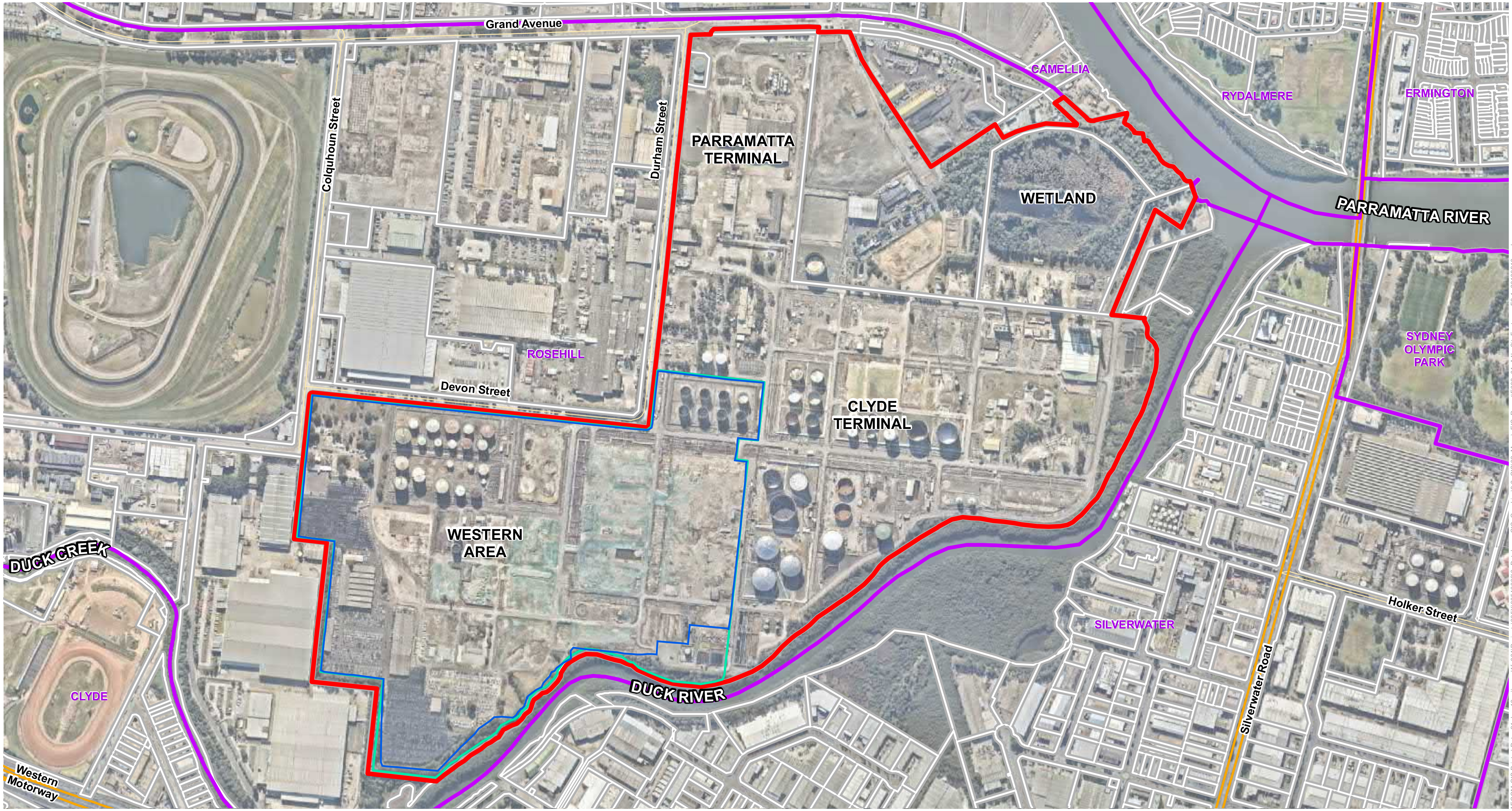

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FIGURE 2-1 SITE FEATURES

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Suburb boundaries
- Lot boundaries
- State road
- Local road

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

0 100 200 300 m

2.3 The Site

2.3.1 Site history and the Clyde Refinery

In 1908, a parcel of 140 acres of land, including the current Site, was transferred to the Commonwealth Oil Corporation who established an oil refinery. The land on which the refinery was established comprised flat, unfenced scrublands and mangrove swamps at the confluence of Parramatta and Duck rivers. In 1918 a shale oil refinery was also established at the Site. Shell Refining (Australia) Pty Ltd (Shell) took over as owner and operator of the Clyde Refinery on 1 January 1928 (CH2M HILL, 2007).

Between 1929 and the mid-1970s numerous expansions and upgrades of the Clyde Refinery took place. These works included constructing new refinery plant, buildings, pipework and infrastructure. The expansion of the operations at the Site included upgrading and expanding the Clyde Refinery assets (e.g. crude distillers, catalytic cracking complex etc.) and also commissioning a lubricating oil plant, introduction of a chemical and hydrocarbon solvents plant, expansion of the Site itself with the purchase of additional land and development of a polypropylene plant.

Following the conclusion of the major phases of expansion and development of the Clyde Refinery in the mid-1970s, only minor additions and modifications were made. In the mid-1980s, the butane de-asphalting plant and oil interceptor were demolished. The area that these elements had occupied was redeveloped, with the central control room constructed at that location in 1988. In 1991, a new propylene unit and platformer unit were commissioned, and in 1994, the mounded Liquefied Petroleum Gas storage facility was built (Shell, 1993).

The Clyde Refinery continued to operate in the early years of the twenty-first century; however in 2011, Shell publicly announced its decision to cease refining at the Clyde Refinery prior to mid-2013. In June 2012, Shell confirmed that from late 2012, the Clyde Refinery would cease processing crude oils and other products.

The fuel and other chemical products that were received, stored and processed at the Clyde Refinery before refining operations ceased in 2012 included:

- crude oil;
- residue;
- condensate;
- gasoline;
- jet fuel;
- automotive gas oil (AGO) otherwise known as diesel;
- intermediates;
- hydrofluoric acid;
- catalyst materials; and
- caustic (sodium hydroxide).

Since 2012, the Site has predominantly operated as the Clyde Terminal, which makes up the majority of the central part of the Site, and receives, stores and distributes fuel products including diesel, jet fuel and gasoline products. Within the Site and to the north of the Clyde Terminal is the Parramatta Terminal, which is used to distribute fuels via road, a large wetland area (the 'Wetland') and various areas of land that Viva Energy leases to third parties.

2.3.2 Topography, geology, groundwater and surface water

The surface of the Site has been re-shaped over time with the use of fill to provide a relatively flat site. This is confirmed on the Parramatta River 1:25 000 topographic map (Central Mapping Authority, 1986), which shows that this area ranges from 2 – 4 m Australian Height Datum (AHD) in elevation.

The geology at the Site has been characterised through previous investigations as generally having four separate horizons overlaying bedrock. These horizons are fill, silty clay/clayey silt, tertiary alluvium clay and residual clay derived from the bedrock. These horizons exist in various thicknesses and locations across the Site. **Chapter 8 Soils, groundwater and contamination**, provides further information on the geology of the Site.

Groundwater is encountered at relatively shallow depths, generally at 1 – 3 m below ground surface (mbgs). The groundwater flow direction has generally remained towards the south-east and east, following the riverbank contour of Duck River with some variation in the north-western and easterly boundaries of the Western Area. Refer to **Chapter 8 Soils, groundwater and contamination** for more information on the groundwater conditions beneath the Site.

The Site contains an extensive on-site drainage network and overflow procedures for heavy rainfall events. Following rainfall, surface water on-site is captured by the drainage network. In general, surface water in the Western Area is treated at the Wastewater Treatment Plant before being directed to Duck River. A portion of the Western Area associated with the former AutoNexus facility drains to the west into an existing stormwater drain and directly into Duck River. **Chapter 9 Surface water, wastewater and flooding** describes the existing surface water environment at the Site.

2.3.3 Clyde Terminal

Since the cessation of refining operations in late 2012, the Clyde Terminal has operated at the Site, and is used for the receipt, storage and distribution of finished petroleum products. Product dosing and product sampling (which is worked back into products) is also undertaken.

Development consent for the Clyde Terminal Conversion Project (State Significant Development (SSD) 5147) (the 'Conversion Project') was granted on 14 January 2015. This consent allowed Viva Energy (previously The Shell Company of Australia Limited) to consolidate the Clyde Terminal operations, undertake a number of construction works to upgrade the Clyde Terminal operations, to convert certain tanks to finished product service, to demolish and remove redundant refinery equipment and infrastructure and to operate solely as a finished petroleum products terminal.

The Conversion Project is almost complete. The majority of terminal assets have been consolidated into the new Clyde Terminal footprint, have been upgraded where necessary and much of the redundant refinery infrastructure has been demolished and removed. The Clyde Terminal continues to receive finished petroleum products from the Gore Bay Terminal via the existing product transfer pipeline, and distributes them by separate pipelines from the Clyde Terminal to the adjacent Parramatta Terminal road gantry, to Sydney Airport, and to Newcastle via existing infrastructure.

Since refining activities ceased, only the following finished petroleum products are stored at the Clyde Terminal:

- gasoline (unleaded 91, 95 and 98);
- diesel (AGO); and
- jet fuel.

Clyde Terminal has consent to store 264 mega litres (ML) of finished petroleum products and 1,550 cubic metres (m^3) of petroleum gases under SSD 5147.

The Clyde Terminal operates 24 hours a day, seven days a week.

The Clyde Terminal operates under NSW Environment Protection Licence number 570 (EPL 570) issued under the *Protection of Environment Operations Act 1997 (NSW)*. EPL 570 applies to the majority of the Site and includes the following land Part Lot 2 DP224288, Part Lot 1 DP383675, Part Lot 101 DP809340, Part Lot 100 DP1168951. It authorises and regulates the carrying out of two scheduled activities: waste processing; and chemical storage. It provides discharge and emission limits for a number of potential pollutants. It also prescribes reporting requirements for Viva Energy.

The Clyde Terminal is also a Major Hazard Facility under the *Work Health and Safety Regulation 2011 (NSW)*.

2.3.4 Western Area

The Western Area is located within the Site, to the south-west of the Clyde Terminal. The Western Area is approximately 40 hectares (ha) in size, located on Lot 100 DP1168951, and previously included a variety of refinery assets but is now largely vacant.

A portion of the Western Area along the western boundary was leased to AutoNexus who provided a range of automotive industry services including vehicle logistics, smash repairs and inventory management.

The Western Area is surrounded by the industrial area of Rosehill to the west and north, the Parramatta Terminal also to the north, the Clyde Terminal to the east and the Duck River to the south. The nearest residential areas to the Western Area are Silverwater, Rosehill and Rydalmere. These communities are located approximately 360 m to the south, 800 m to the west and 1 km to the north-east, respectively. Industrial and infrastructure land uses are located between these areas and the Western Area.

Where relevant the conditions of consent for the operation of the Clyde Terminal, as governed by SSD 5147 also apply to the maintenance of the Western Area.

Following completion of the Conversion Project, the Western Area will no longer be required for Clyde or Parramatta terminal operations.

Existing infrastructure

At present, the following infrastructure is present within the Western Area:

- the north-western corner contains operational and redundant tank farm assets (within Tank Farms A2 and A3);
- the north-eastern corner contains operational and redundant tank farm assets (within Tank Farm C);
- above ground pipework remains in-situ in parts of the Western Area;
- above and below ground drainage remains in-situ across the Western Area;
- a number of third party services across the area, including a water main, mains power, and a stormwater drain (the “James Hardie” drain); and
- sub-grade footings.

Existing tanks, pipework, and associated infrastructure, as approved under SSD 5147, will be decommissioned and removed prior to the Project. The existing infrastructure at the Site is shown on **Figure 2-2**.

2.3.5 The Project Area

The Project Area is the land within the Western Area where the majority of the Project would occur. The Project Area is approximately 40 ha and is bordered by Devon Street and the Clyde Terminal to the north, the Clyde Terminal to the east, Duck River to the south and commercial/industrial properties to the west.

The Project Area consists of the majority of land within the Western Area, excluding vegetation within protected areas and portions of the Western Area which do not require remediation.

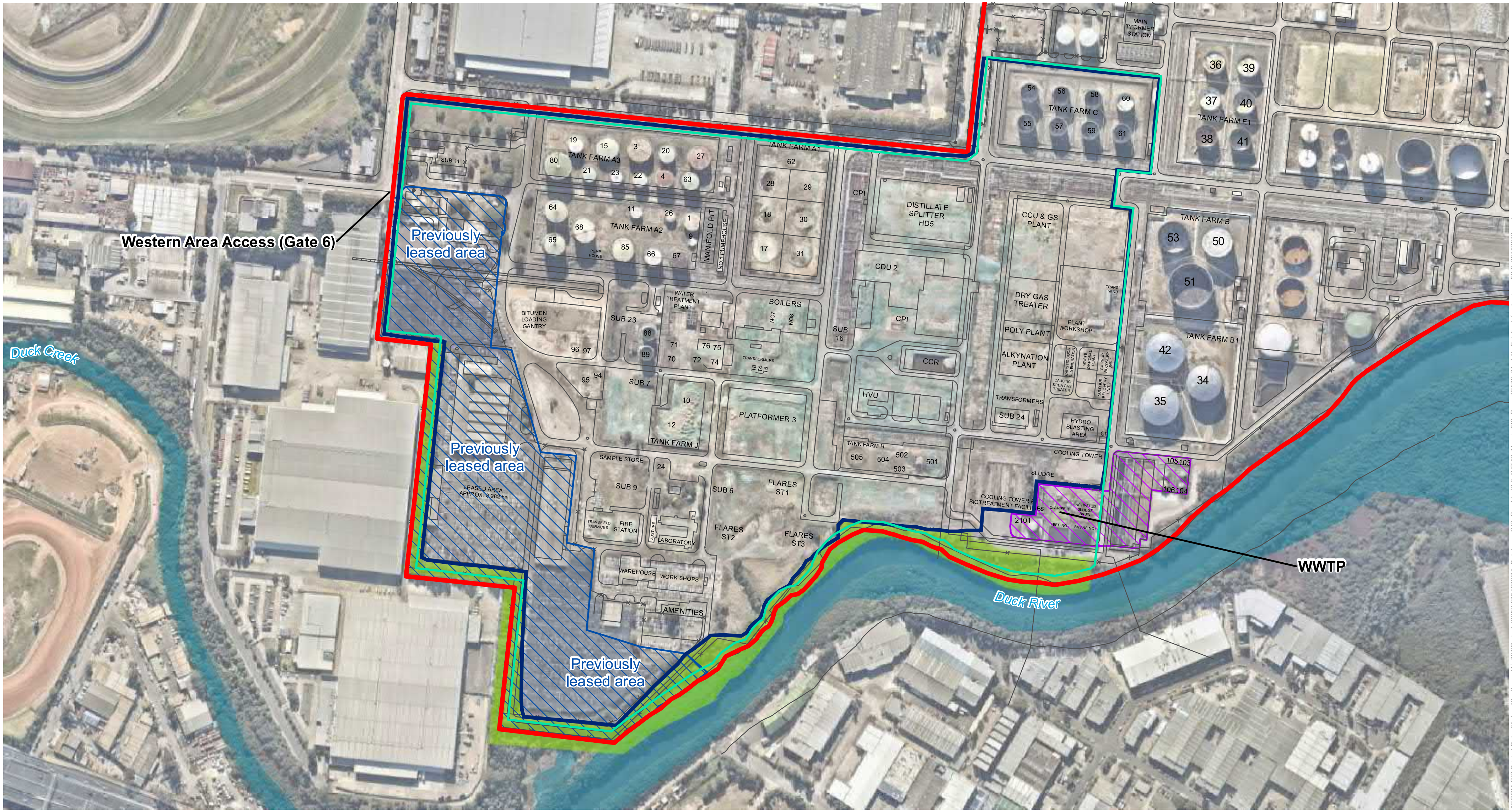

FIGURE 2-2 EXISTING INFRASTRUCTURE AND LOCAL SENSITIVE ENVIRONMENT

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Waste Water Treatment Plant (WWTP)
- Previously leased area

Sensitive receptors

- Riparian vegetation
- Duck River

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

AECOM

0 50 100 200 m

2.3.6 Contamination overview

Ecological, surface water, soil and groundwater investigations have been conducted at the Site (including the Western Area) to support various environmental assessments and regulatory compliance requirements. Results of these investigations have identified the geology, hydrogeology and nature and extent of affected soils and groundwater across the Site. Since 2004, annual reports have been provided to the NSW Environment Protection Authority either in full or in summary.

In 2008, a Conceptual Site Model was prepared to provide a holistic understanding of the Site and provide a means to identify data gaps for further consideration. Since then, the program of both routine and non-routine environmental site assessments has continued, including the routine groundwater monitoring program. The objectives of these investigations have been to address identified data gaps, and to assist in the prevention of exposure risks to human health and the environment.

A summary of the previous contamination investigations undertaken across the Site are presented in **Appendix C**.

Specifically in the Western Area, the long-term and historic use of the area has resulted in a number of contamination impacts to the soils and groundwater. As with many industrial sites, a secondary source of contamination may be caused by imported fill used for historical levelling works.

The current understanding of the nature and extent of the impacts within the Western Area is based on investigation works which were conducted between 1991 and 2017 (refer to **Appendix C**). Based on these investigations, Chemicals of Potential Concern within the Western Area include:

- Total Petroleum/Recoverable Hydrocarbons;
- Benzene, Ethyl-benzene, Toluene and Xylenes compounds;
- heavy metals;
- Polycyclic Aromatic Hydrocarbons;
- phenols;
- Polychlorinated Biphenyls;
- tetraethyl lead; and
- per- and polyfluoroalkyl substances.

Further, the Site’s historic use as a refinery means that other chemicals such as acids, ethanolamine, sodium hydroxide, solvents and trichloroethylene may also be present in the Western Area’s drainage system. There are also areas of buried waste/leaded sludges beneath the Western Area (western and southern boundaries) and there is the potential for asbestos containing materials to be present.

Chapter 8 Soils, groundwater and contamination provides more information on the contamination status of the Project Area, and how the Project would be managed to avoid potential off-site impacts.

2.3.7 Sensitive environmental receptors

Following a review of the Site and its surrounding context the following sensitive environmental receptors were identified in the areas surrounding the Western Area:

- riparian vegetation adjacent the southern Project Area boundary near Duck River;
- surface waters and sediments of Parramatta and Duck rivers, and aquatic flora and fauna within the rivers;
- residential receptors in Silverwater, Rosehill and Rydalmere; and
- man-made wetlands (the ‘Wetlands’) immediately to the north-east of the Clyde Terminal (located approximately 500 m to the north-east of the Western Area); including sensitive/threatened/vulnerable species, such as the Green and Golden Bell Frog, utilising the Wetland as habitat.

The suburbs of Silverwater, Rosehill and Rydalmere are shown on **Figure 1-1** and the locations of the other sensitive environmental receptors are shown on **Figure 2-1** and **Figure 2-2**.

3.0 Need and alternatives considered

3.1 Need for the Project

Viva Energy Australia Pty Ltd (Viva Energy) recognised that following completion of the Clyde Terminal Conversion Project (State Significant Development (SSD) 5147), the Western Area would be largely vacant and not required for the Clyde or Parramatta terminal operations. As such there was an opportunity for this land to be sold, leased or used for alternative land uses; provided these land uses did not adversely affect Viva Energy's retained operations. Given the current land use zoning and contamination profile of the land it was clear that the soil and groundwater in parts of the Western Area would need to be remediated or managed to a commercial/industrial standard[1] before development consent for an alternative land use would be granted.

In 2012, following the announcement of the closure of the Clyde Refinery, the NSW Environment Protection Authority (EPA) wrote to the landowner (now Viva Energy, then the Shell Company of Australia Limited) outlining its expectations that an investigation and remediation program be developed and implemented for the Site such that all contamination legacies be addressed in a timely and comprehensive manner.

In June 2016 the NSW EPA declared the land identified as Lot 398 DP41324, Lot 2 DP224288, Lot 1 DP383675, Lot 101 DP809340, and Lot 100 and 101 DP1168951 as 'significantly contaminated land' under the *Contaminated Land Management Act 1997 (NSW)* (Declaration number 20131110). The Project Area falls within Lot 100 DP1168951 and is therefore declared as significantly contaminated land.

More recently, as outlined in the Central City District Plan (Greater Sydney Commission (GSC), 2018b) and the Greater Parramatta and the Olympic Peninsula (GPOP) Vision (GSC, 2016), the Western Area is located in the heart of the GPOP area (refer to **Chapter 5 Statutory planning**).

The GPOP area is a major focus for the GSC and is considered one of Sydney's most crucial centres of current and future economic activity. The Western Area in particular has been highlighted as land that could be developed to help support the objectives of the GPOP Vision (GSC, 2016). The GSC recommends that the development of Camellia peninsula focus on "Essential Urban Services, Advanced Technology and Knowledge Sectors" in order to develop the area into a diverse economic asset that supports Sydney's 'Central City'.

The Western Area represents a major opportunity for the future development of Sydney and particularly the GPOP area. Its size and location mean that it is ideally located to act as a catalyst for the development of new economic assets at the heart of Sydney's Central City, supporting the GPOP Vision and providing employment, services and patronage for future public transport.

Certain parts of the Project Area are currently contaminated with various chemicals of potential concern (refer to **Chapter 4 Project description** and **Appendix C**). This contamination is present in and on the soils, in the groundwater and in certain sub-surface infrastructure. In its current condition, the Project Area presents potential human health and ecological risks and cannot meet its development potential under the GPOP Vision.

Viva Energy are therefore proposing to remediate this area to a commercial/industrial standard that would allow it to be appropriately redeveloped. This would help Viva Energy meet its regulatory requirements, business objectives and would assist with the delivery of the fifth of the GPOP Vision's 12 Strategic Directions:

"*No 5 - Transform Camellia, Rydalmere, Silverwater and Auburn into 21st Century essential urban service, advanced technology and knowledge assets*".

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[1] Based on criteria for commercial/industrial land use provided in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council (NEPC), 2013).

3.2 Project objectives

Viva Energy has developed three main Project objectives to ensure both its business objectives and the necessary regulatory requirements are met:

1. Ensure the on-going operational viability of Clyde Terminal assets and associated licences to operate (including but not limited to SafeWork NSW Major Hazard Facility Licence, NSW EPA licence and SSD 5147 consent conditions).
2. Ensure any future redevelopment decisions are considerate of the operational requirements of the existing Clyde Terminal.
3. Meet applicable regulatory requirements.

These objectives were used to help guide the options and alternatives process, which is discussed in **Section 3.3**.

3.3 Alternatives and options considered

In light of the Project objectives outlined in **Section 3.2**, three alternatives have been considered by Viva Energy, prior to progressing with the Project. Project alternatives considered include:

- option 1: do nothing;
- option 2: do not remediate and sell the land in its present condition; and
- option 3: remediate the Western Area and sell/lease the land.

These are discussed further below.

3.3.1 Option 1 – Do nothing

Under a 'do nothing' option, no further assessment would be undertaken to confirm the extent of contamination, and no active remediation of soil or management of groundwater would be undertaken within the Western Area.

This option was not supported as it would not achieve the Project objectives outlined above. This option would not meet the regulatory requirements, including the NSW EPA's requirement that contamination legacies be addressed in a timely and comprehensive manner. Certain parts of the Western Area are currently contaminated, presenting potential future human health and ecological risks. Not remediating the Western Area would mean that Viva Energy would retain responsibility for managing these potential risks.

Further, under the 'do nothing' option, the Western Area would not be remediated to a commercial/industrial standard so could not be redeveloped. Under this option, the Western Area would not meet its development potential under the GPOP vision and would not allow Viva Energy to benefit from either selling the land or leasing it to third parties.

3.3.2 Option 2 – Do not remediate and sell the land in its present condition

Under this option, no remediation works would occur, and Viva Energy would sell the land with its current contaminated land status (refer to **Chapter 8 Soils, groundwater and contamination**).

The option was not supported as it would not achieve the Project objectives outlined above. Specifically, Viva Energy would not be able to ensure any future redevelopment decisions are considerate of the operational requirements of the existing Clyde Terminal.

3.3.3 Option 3 – Remediate the Project Area and sell/lease the land

Under this option, targeted remediation technologies would be undertaken by Viva Energy to remediate the Project Area to a commercial/industrial standard. This would:

1. Ensure the on-going operational viability of Clyde Terminal assets and associated licences, as Viva Energy would be able to control the type of development that is built adjacent to the Clyde Terminal.

2. Ensure future redevelopment decisions are considerate of the operational requirements of the existing Clyde Terminal.
3. Meet applicable regulatory requirements, including the NSW EPA's requirement that contamination legacies be addressed in a timely and comprehensive manner.

Further, this option would allow the Western Area to meet its development potential under the GPOP vision.

3.4 Preferred option

Option 3 (as described in **Section 3.3.3**) to remediate and manage the Project Area and sell/lease the land is the preferred option as it allows the Project objectives to be met and supports the GPOP vision.

3.5 Remediation objectives and alternatives

3.5.1 Remediation objectives

Following the assessment that option 3 is the preferred option, remediation objectives have been developed by Viva Energy. The remediation objectives for the Western Area are:

1. 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.
2. 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 the post remediation period.

3.5.2 Remediation options

A wide range of technology options were considered for the remediation of the Project Area in order to meet the remediation objectives outlined above. These options include thermal, biological and chemical remediation technologies and engineering controls:

A qualitative assessment of each remediation technology has been undertaken against five factors:

1. technical viability: both to implement and timeframe required;
2. logistical requirements;
3. financial: capital and operational cost of implementation;
4. sustainability considerations; and
5. regulatory and community acceptance.

The Conceptual Remedial Action Plan (RAP) (refer to **Appendix C**) describes in more detail each of the remediation technologies considered against each of these five factors.

Based on the qualitative assessment, a combination of landfarming, in-area soil mixing, biopiling, thermal desorption, stabilisation and off-site disposal are considered the preferred remediation technologies for soils to achieve the remediation objectives, in conjunction with on-site management.

A separate remediation approach is unlikely to be required to address residual petroleum hydrocarbon impacts in groundwater. This conclusion is based on the existing groundwater monitoring data, which indicates plumes in the Western Area are stable, and are not posing a significant risk to human health or ecological receptors.

The remediation approach, using a combination of the technologies described above, is described further in **Chapter 4 Project description** and the Conceptual RAP in **Appendix C**.

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4.0 Project description

4.1 Project overview

The Project would involve the remediation of impacted soils and the management of impacted groundwater within the Project Area (refer to **Figure 4-1**) to enable the land to be used for permissible development under the existing land use zoning in the future. Investigations completed within the Project Area have shown that not all of the soil and groundwater within this area requires remediation or management. As such, remediation activities would only be required in a number of targeted areas within the Project Area. Where remediation is required, the focus of this remediation would be on:

- addressing petroleum hydrocarbon impacts in shallow soil horizons;
- addressing residual soil/sludge impacts in the drainage network and surrounds;
- removing Light Non-Aqueous Phase Liquid (LNAPL) if present, to the extent practicable[1]; and
- ensuring potential contamination risks to the environment are removed or mitigated.

As presented in **Appendix C**, the volume of soil that would require remediation has been estimated at 105,000 cubic metres (m^3). However, for the purposes of assessment, a contingency soil volume of 30,000 m^3 has also been included for assessment (i.e. a total of 135,000 m^3, refer to **Section 4.4.2**).

For the purposes of the Environmental Impact Statement (EIS), it assumed that the parts of the Project Area that would be required to be disturbed/excavated would primarily result from activities associated with the removal of existing redundant surface and subsurface infrastructure, contaminated land remediation and landforming works. Further, based on the analytical data obtained from several stages of site investigation (refer to **Appendix C**), the remediation would be limited to less than 4 metres below ground surface (mbgs), and would be generally focused within 2 mbgs. This is discussed further in **Section 4.4.1**.

Where soil in the Project Area has been assessed as not requiring remediation, this is because the soil and groundwater quality either:

1. already meets applicable commercial/industrial land use criteria (refer to Section 8.2 of the **Appendix C**); and/or
2. the remaining contamination impacts are unlikely to pose a risk to human health or the environment.

In addition to the remediation activities, a number of associated works would also be completed as part of the Project, these include:

- preparation activities, including erection of temporary offices, delineation of access roads, installation of personnel decontamination equipment, installation and management of temporary erosion and sediment controls, wheel washing facilities, footpath crossings, service locating and fencing the Project Area;
- removal, storage, recycling and disposal of redundant remaining surface and subsurface infrastructure[2] (where required) including pipework, foundations, services, utilities, stockpiles, wastes etc.; and
- mobilisation of plant and equipment to the Project Area;
- establishment of remediation areas/technologies, implementation of the various remediation technologies and associated environmental controls, and storage and disposal of certain contaminated soils;

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[1] The need to remove LNAPL would be mainly based on the level of potential human health risk for proposed commercial/industrial end use. It should be noted that LNAPL and dissolved phase plumes are considered stable in the Western Area, and therefore removal to reduce migration in groundwater is not a key driver.

[2] Infrastructure that would be removed during the Project consists of pipework, foundations, services, utilities, stockpiles and wastes. Other above ground infrastructure will be removed as part of the Clyde Conversion Terminal Project (SSD 5147), prior to the commencement of this Project.

- validation/waste classification testing of materials (i.e. concrete, soils) to confirm suitability for on-site reuse as excavation backfill or grading works or storage and disposal as appropriate;
- backfilling works to achieve the required landform;
- management of stormwater and wastewater during the works, including installation of wastewater management controls;
- progressive separation of the Western Area from the existing stormwater/wastewater system at the Site and installation of stormwater management and erosion and sediment controls for the final landform; and
- dismantling of the remediation area/technologies, removal of temporary erosion and sediment controls, completion works and demobilisation.

These activities have been split into the following stages, which are discussed in more detail below:

- Stage 1 – preparation works;
- Stage 2 – removal of redundant infrastructure and wastes;
- Stage 3 – remediation;
- Stage 4 – landforming; and
- Stage 5 – completion works and demobilisation.

Apart from preparation works, the activities listed above would be completed in an iterative approach across the Project Area. Where possible, excavation, remediation and backfilling would be completed on one part of the Project Area prior to moving onto the next area.

To create the final landform in the Western Area during Stage 4 (refer to **Section 4.5**), additional fill from off-site would be required. It is proposed that this fill includes bringing hydrocarbon impacted soils from other Viva Energy sites to the Project Area to be remediated as part of the Project. It is estimated that 5,000 m^3 of off-site fill from other Viva Energy sites would be brought to the Project Area. This volume of off-site fill is part of the overall remediation volume estimate outlined above (approximately 105,000 m^3).

In addition to this material, the Stage 4 landforming works would likely require additional material to be brought to the Project Area to achieve the required surface levels. This would include beneficially reusing soils from other sites (i.e. appropriate materials validated under a Resource Recovery Exemption from non-Viva Energy sites) in accordance with the *Waste Avoidance and Resource Recovery Act 2001.* This is discussed further in **Section 4.5.**

Following the completion of the Stage 1 to Stage 5 works, a Validation Report would be prepared in accordance with the New South Wales (NSW) Environment Protection Authority (EPA) Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2011) and reviewed/approved by the NSW Environment Protection Authority (EPA) accredited Site Auditor (Site Auditor), confirming that the Western Area is suitable for commercial/industrial land use. The Validation Report may include progressive validation reports for separate portions of the Western Area to enable progressive validation of these areas.

Following completion of the remediation works, the Western Area in its post remediation works landform would continue to be managed by Viva Energy.

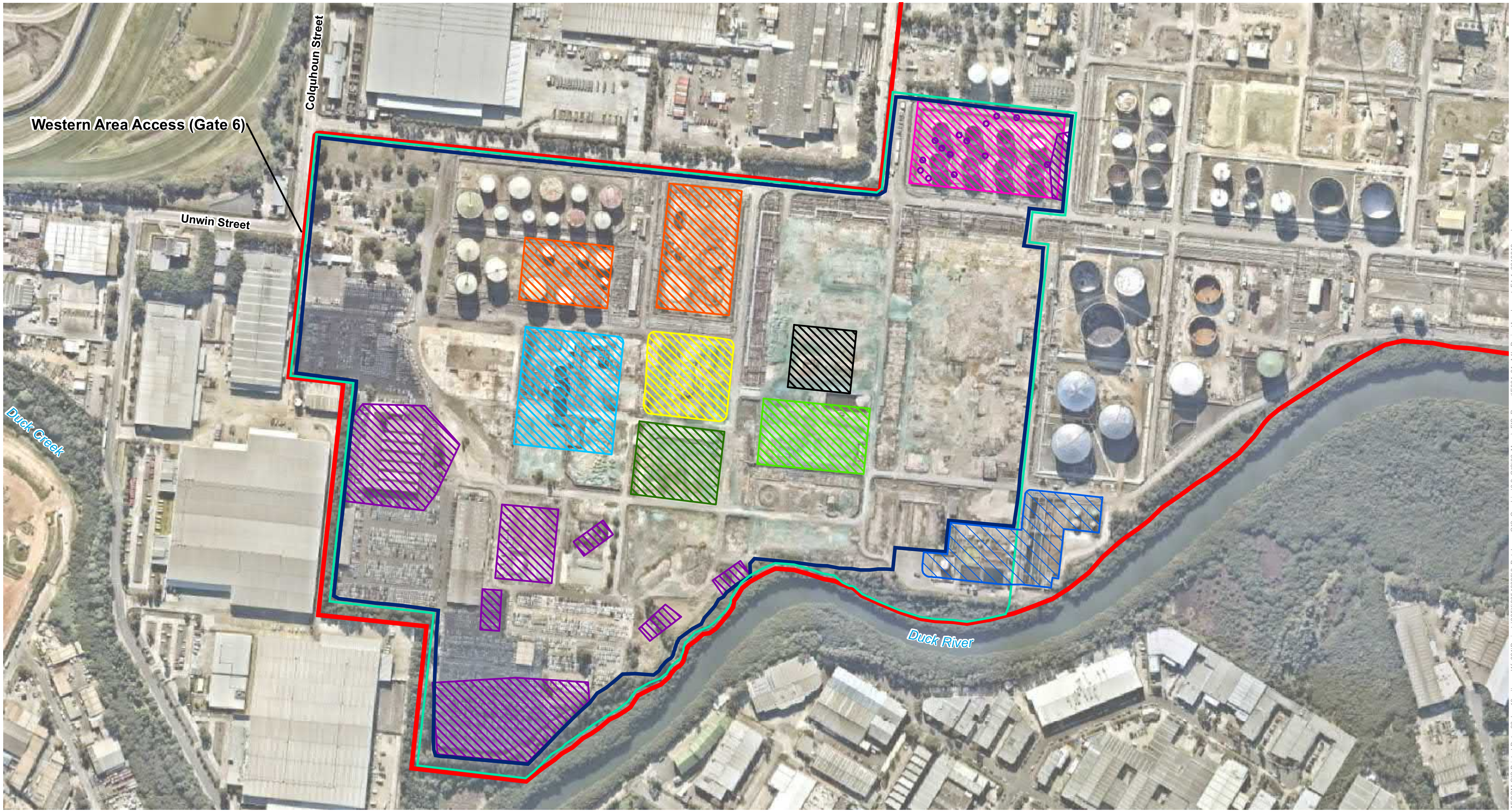

FIGURE 4-1 - PROJECT AREA LAYOUT

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Wastewater Treatment Plant (WWTP)

Potential Location of Remediation Technologies

- Biopiling
- In-area soil mixing / landfarming excavation
- Landfarming
- Stabilisation
- Thermal desorption
- Waste proccessing area
- Contingency treated stockpile area
- On-site management (buried waste)

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

AECOM

0 50 100 200 m

4.2 Stage 1 – Preparation works

Access to the Western Area would be established through an existing access point on the corner of Unwin Street and Colquhoun Street (refer to **Figure 4-1**), known as Gate 6. In order to prepare the Western Area for the Project the following activities would be completed:

- establishment of fencing around the Western Area, including exclusion zones identified as part of the development of the Project Area (refer to **Section 4.2.1**);
- establishment of temporary facilities (e.g. gatehouse and site offices), parking for Project workers and demarcation of footpaths;
- installation of personnel decontamination equipment and wheel washing facilities;
- installation of temporary erosion and sediment controls for the works; and
- service location for live services/utilities.

Where necessary these activities are discussed in more detail below.

4.2.1 Western Area and Project Area demarcation

The Western Area is currently bounded by chain wire fencing to the north (along Devon Street and Durham Street), to the west (adjacent to neighbouring commercial activity), and to the south (adjacent to Duck River). There is no existing physical boundary on the eastern side of the Western Area. Prior to proposed works commencing, cyclone fencing (or suitable equivalent) would be installed to isolate the Western Area from the terminal operations. Gates would be installed at appropriate locations (e.g. to allow access to the wastewater treatment plant (WWTP), or for Viva Energy staff access between the Western Area and the Clyde Terminal). The Western Area and Project Area are shown on **Figure 4-1**.

Further to this, there are some parts of the Western Area that are excluded from the Project Area. The excluded parts of the Western Area primarily relate to the strip of vegetation along the southern border of the Western Area. Excluded areas would be protected from disturbance. No activities related to the Project would occur in these areas.

4.2.2 Project facilities

A temporary gatehouse and temporary Project office would be established at the proposed entrance for the Project Area at Gate 6 (corner of Colquhoun Street and Unwin Street). The following temporary facilities would also be located close to this entrance:

- first aid office;
- stores;
- personnel decontamination area;
- amenities; and
- wheel washing facilities.

These facilities would be removed as part of Stage 5.

4.2.3 Establishment of erosion and sediment controls

Erosion and sediment controls would be established, as required, across the Project Area in accordance with 'The Blue Book' *Managing Urban Stormwater - Soils and Construction Volume 1 and 2* (Landcom, 2004). These would be revised, prior to and during the proposed works as necessary. The objective of the temporary erosion and sediment controls would be to ensure that sediment and contamination that may be mobilised by surface water flows from the Stage 2, 3 and 4 works does not significantly impact land and watercourses outside of the Western Area.

4.2.4 Service location

Service locating would be undertaken across the Project Area to confirm the location of and identify all active services. If necessary additional service investigations would be completed ahead of ground disturbance works commencing. This work would include:

- a desktop assessment of known utility services;
- use of a Ground Penetrating Radar imaging and other service location equipment across the Project Area to identify all known services;
- engagement with utility companies prior to and during the service location works;
- non-destructive Excavation and/or potholing as needed to positively identify services (when required);
- tagging/marking the identified service as required;
- updating utilities survey as-built with known positions, levels and heights of all redundant and live services;
- notifying Dial Before You Dig and utilities companies of services that have not been previously identified if required; and
- reassessing whether changes to the proposed work methodology are needed based on the results of this process.

4.3 Stage 2 - Removal of redundant infrastructure and waste

Following preparation works, the Project Area would be cleared of infrastructure[3] and wastes including pipelines and concrete prior to the remediation works commencing, where necessary and practical to do so. Once surface materials are removed, if necessary subsurface infrastructure would also be excavated and removed. Redundant infrastructure would be cleaned, processed and stored prior to reuse or removal from Site. Infrastructure and waste materials would be tracked in line with a Material Tracking Plan.

On the whole, material would be removed progressively across the Project Area; however surface concrete (mainly slabs) would only be removed once an excavation is required. The retention of this concrete in the short term would help ensure the geotechnical stability of the Project Area (where heavy plant would be moving across the land) and would assist in the management of surface water and dust.

A Waste processing area for all surface and subsurface materials removed (e.g. concrete, metals/reinforcement bar, drainage lines) would be established in the area shown on **Figure 4-1**. Once material is removed or excavated it would be sorted and stockpiled separately in this area prior to processing. The processing area would remain for the duration of the Project.

It is estimated that the Project would involve the processing of approximately 40,000 m^3 of concrete predominantly from slabs and asphalt. Concrete would be crushed within the Waste processing area and where appropriate, used as backfill during Stages 3 and 4 to reduce the soil deficit and to improve the geotechnical stability of the land. Concrete waste that could not be used would be taken off-site for sale, recycling or disposal.

Contaminated soils encountered during the removal of surface infrastructure would be managed in line with the description provided for Stage 3 in **Section 4.4**. Where contaminated liquids could be encountered (for example potentially where pipework is being removed), appropriate containment/spill mitigation measures would be employed. LNAPL and/or impacted water would be directed to the WWTP or disposed off-site by a licensed contractor (refer to **Section 4.4.4**).

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[3] Infrastructure that would be removed during the Project consists of pipework, foundations, services, utilities, stockpiles, wastes. Other above ground infrastructure will be removed as part of the Clyde Conversion Terminal Project (SSD 5147), prior to the commencement of this Project.

Other potential waste streams that may be produced as part of the Project include liquid waste, general solid waste, restricted solid waste, hazardous waste and special waste (asbestos). Waste streams could include contaminated soils, inert and oversize materials, treated (stabilised/immobilised) soils, processed materials and process wastes. These wastes would need to be tracked and managed as part of the Project. Waste management is discussed further in **Section 4.12**.

4.4 Stage 3 – Remediation

4.4.1 Remediation overview

Stage 3 would broadly occur concurrently with Stage 2 to allow certain pre-remediation works to occur. Approximately three months would be required for pre-remediation works planning (dependent on the remediation technology) prior to the commencement of the full scale remediation works. Pre-remediation work planning would include mobilisation of plant, construction of environmental controls and bench scale trials[4]. The remediation treatment areas are shown on **Figure 4-1**.

As outlined in **Section 4.1**, excavation and/or in-situ remediation depths are likely to be a maximum of 4 mbgs, and would be generally focused on the top 2 m of the ground surface. The average depth of soil contamination, LNAPL, and likely depth of residual soils/sludges in the drainage network and surrounding ground is 2 m. During remediation, if significant impacts are identified below 4 mbgs (including LNAPL), an area-specific risk assessment would be prepared to assess the requirement for remediation (and/or management measures) and would be reviewed by the Site Auditor.

The management of the remediation works across the Project Area would follow the steps below (detailed further in **Appendix C**):

- excavation of soil would be conducted sequentially, moving from one area to the next only once the validation process in the area being remediated has started. Once the area is validated, the excavation would be backfilled and the area clearly marked to avoid potential cross contamination from other areas;
- in-situ remediation works (i.e. in-area landfarming and soil mixing) would also progress in a similar sequential manner with progressive validation testing conducted to confirm the remediation objectives have been achieved;
- once the contaminated soils is excavated, soil testing would occur within the excavations to confirm/validate the remaining soil;
- soils to be treated ex-situ would be excavated and stockpiled based on visual and olfactory evidence, field screening, and laboratory data. The soils would likely be stockpiled in the Waste processing area or another centrally located area;
- contaminated soils would be stockpiled separately depending on the remediation technology required and the type and concentrations of contamination present;
- contaminated soils would be treated with the appropriate remediation technology (refer to **Section 4.4.2**). The indicative locations of the proposed remediation technologies within the Project Area are shown on **Figure 4-1**;
- excavations would be clearly fenced and signposted while material is being remediated and/or prior to backfilling with validated soils;
- following treatment, soils would be subject to validation testing against a pre-determined validation criteria and in accordance with a specific Validation Sampling and Analysis Quality Plan (SAQP);
- soils which have been validated to meet commercial/industrial land use criteria[5] (including validated imported materials) would be stockpiled separately from soils requiring remediation;

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[4] Where required and if not already completed prior to the commencement of this Project.
[5] The soil criteria adopted for the Project is the criteria for commercial/industrial land use as defined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, amended 2013 (ASC NEPM) (National Environment Protection Council (NEPC), 2013).

- dewatering may be required from the excavations. The dewatered liquid would be directed to the WWTP or collected and temporarily stored either at a designated location at the Waste processing area or close to the excavation. If suitable the collected liquid would be transported and disposed of in the WWTP. If not, the liquid would be disposed off-site by a licensed contractor;
- validated soils or validated soils mixed with the crushed concrete would be placed in excavations as soon as practicable following removal of contaminated soils and subsurface infrastructure;
- at the completion of the remediation works, areas used for stockpiling contaminated soils would be validated appropriately; and
- tracking documentation would be completed for each excavation and stockpile in accordance with the Material Tracking Plan.

Should unexpected conditions be encountered during these works, contingency measures would be utilised, as described in **Appendix C**.

4.4.2 Remediation technologies

As presented in **Appendix C**, the volume of soil that is anticipated to require remediation has been estimated at 105,000 m^3. The main technology to remediate these soils would be on-site biopiling. Other technologies that would be utilised include:

- in-area soil mixing/landfarming;
- thermal desorption; and
- stabilisation.

Off-site disposal and on-site management would also be considered (refer to **Section 4.4.2.4** and **4.4.2.5**).

For the purposes of this assessment, a contingency soil volume of 30,000 m^3 has also been included (i.e. a total of 135,000 m^3). This additional amount of soil has been included to provide some flexibility in the limits of consent for the Project and to ensure that this environmental assessment considers a realistic worst case.

The rationale behind the soil volume estimate in the Conceptual Remedial Action Plan (RAP) and contingency soil volume is outlined below:

- **In-area soil mixing/landfarming:** The landfarming and in-area soil mixing remediation techniques would be used to treat a maximum of 10,000 m^3 of soil impacted with the lighter end hydrocarbons.
- **Stabilisation/thermal desorption:** A best case and worst case volume for the thermal desorption and/or soil to be stabilised was calculated based on the nature and extent of identified hydrocarbon contamination within the Project Area (i.e. heavy end hydrocarbon fractions and highly impacted soils that are unlikely to be amenable to landfarming or biopiling). The current estimate of soil proposed to be remediated through these two technologies is between 10,000 m^3 and 40,000 m^3 of soil. As such, it has been assumed that a maximum of 40,000 m^3 could be treated by either stabilisation or thermal desorption.
- **Biopiling:** the biopiling volume (55,000 m^3) has been calculated as the remainder of the soil not proposed for treatment by in-area soil mixing/landfarming or thermal desorption/stabilisation. However, in order to assess a worst case biopiling scenario in this EIS, it has been assumed that a large portion of the soil proposed to be sent to thermal desorption could be treated by biopiling instead (i.e. 85,000 m^3 based on only 10,000 m^3 being treated by thermal desorption/stabilisation and 10,000 m^3 being treated by in-area soil mixing/landfarming). As such, for the purposes of the assessments within this EIS it has been assumed that a maximum of 85,000 m^3 would be treated via biopiling.

Where it is not feasible to remediate the soils with the technologies above, they would be disposed off-site (untreated, and in accordance with the Waste Classification Guidelines (NSW EPA, 2014a)) to an appropriately licensed facility.

A description of the remediation technologies, their indicative location within the Project Area and relevant environmental controls is provided below.

4.4.2.1 Biopiling

Biopiles would be created and positioned on the northern edge of the Project Area (refer to **Figure 4-1**), within an existing bunded area (likely to be within the former Tank Farm A1 and A2 areas). If required, the tank farm areas would be remediated and/or managed prior to being lined with clay in preparation for the biopiling works. Biopiles would be used to remediate soils impacted with light and heavier end hydrocarbons. The biopiles would be covered with an impermeable material to reduce stormwater ingress and dust creation. Measures to minimise the creation of dust and odour emissions during the construction of the biopiles would include:

- covering surfaces;
- minimising exposed areas[6];
- wetting down exposed soils; and/or
- dust monitoring.

Soils requiring biopiling would be mixed with nutrients and placed in the biopile area. Moisture, temperature, nutrients, oxygen, and pH would be monitored regularly and controlled to enhance biodegradation. Bench scale trial and pilot trial testing[7] will be undertaken prior to the commencement of the full scale biopiles.

The soils would be placed on a compacted sand base within the biopile area to enable adequate air exchange into the biopile. The biopile would be maintained under negative pressure with blowers thereby mitigating fugitive gas emissions to the atmosphere. Off-gas from the process would be passed through air filters to remove volatile hydrocarbons and regular air monitoring of the air emissions would confirm when exchange of air filters is required.

The addition of nutrients, compost, microbes and moisture (as appropriate) to the biopile and the movement of air with a blower through the material would stimulate aerobic microbial activity within the soils and promote the biodegradation of hydrocarbons.

The biopiling base would be graded towards a collection point. Leachate from the biopile would be sent to the WWTP prior to being discharged in line with the NSW Environment Protection Licence number 570 (EPL 570).

An indicative cross section of the biopiling treatment process is shown in **Plate 1**.

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[6] It is assumed that only approximately 20% of a biopile would be exposed during biopile construction works based on a total volume of 10,655 m^3 to minimise potential air quality impacts.
[7] Where required and if not already completed prior to the commencement of this Project.

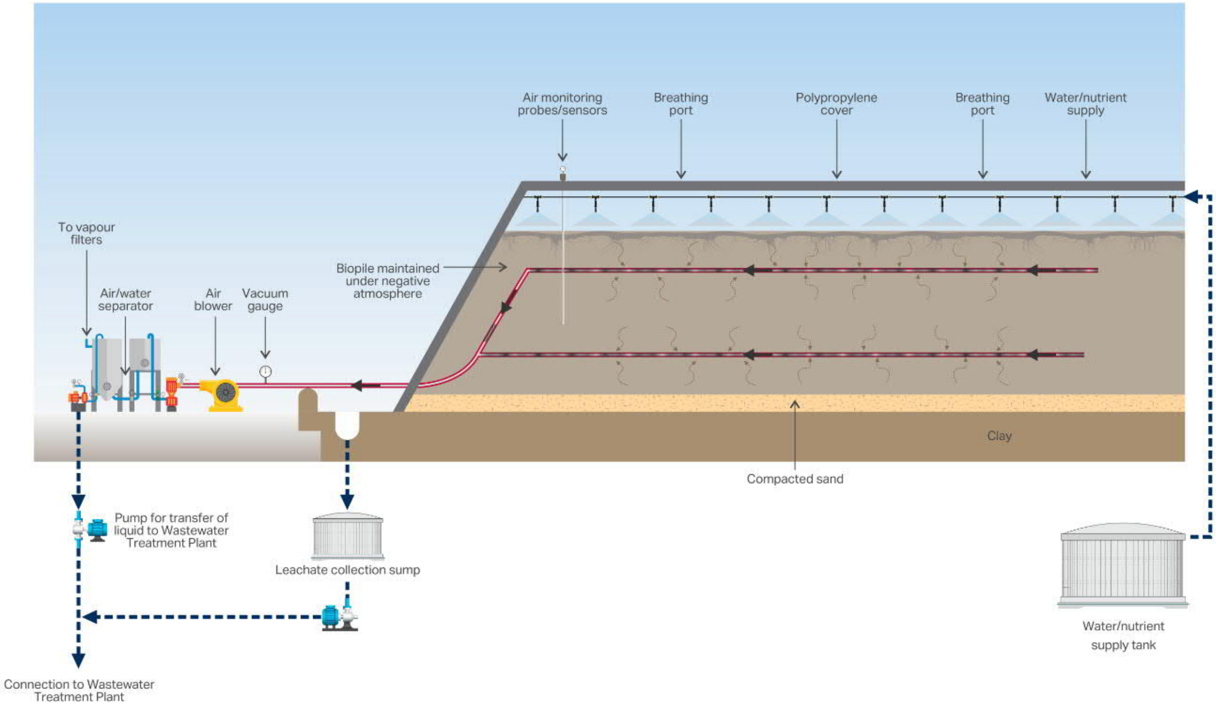

Plate 1 Indicative biopile cross section

The volume of soil anticipated to be treated via biopiling is approximately 55,000 m^3, however 85,000 m^3 has been assessed (refer to **Section 4.4.2**). It is anticipated that two biopiles would operate concurrently, with staggered construction and deconstruction periods.

4.4.2.2 Landfarming and in-area soil mixing

Soils impacted with predominantly lighter end hydrocarbons are known to be present within the Project Area. The nature of the hydrocarbon contamination within these soils means that landfarming or in-area soil mixing would be the most appropriate remediation technology. The in-area soil mixing and landfarming remediation approach would be utilised for approximately 10,000 m^3 of soil (refer to **Section 4.4.2**).

Landfarming (turning the soil and/or adding nutrients/compost/microbes so as to encourage bioremediation) would be utilised as a remediation technique for shallower and less impacted areas. It is likely that the landfarming would be conducted in a staged manner (i.e. involving 3 – 4 batches) with the soils being moved to a central location away from the Project Area boundary. An excavator would be used to regularly turn the soils and to ensure an even application of nutrients/microbes.

In-area soil mixing (with oxidising/activating agents such as sodium persulfate/sodium hydroxide) would be used for deeper and more impacted areas. The mixing would be completed vertically, using a large piling rig and large diameter mixing augers (approximately 1.2 m), in order to avoid a direct interface between the impacted soils and the atmosphere (i.e. this approach has the advantage of bringing only small volumes of soil to the ground surface during the mixing process). The auger locations would be overlapped to provide treatment of the material through the soil profile to the required depth. A bench scale trial[8] would likely be conducted prior to the full scale works to ensure appropriate mixing of the soils can be achieved and to optimise the application of the oxidising agents.

The likely location of in-area soil mixing is in the north-eastern corner of the Project Area. Soils from this location would be either treated in situ here or excavated and taken to the landfarming area (refer to **Figure 4-1**).

[8] Where required and if not already completed prior to the commencement of this Project.

Figure 4-1 also shows that a small part of the land where in-area soil mixing is proposed may also require on-site management due to the potential for existing buried waste. Where this is the case, the wastes/soils requiring on-site management would be excavated and removed from this area prior to landfarming and/or in-area soil mixing commencing (refer to **Section 4.4.2.5**).

Plate 2 provides an overview of the in-area soil mixing process.

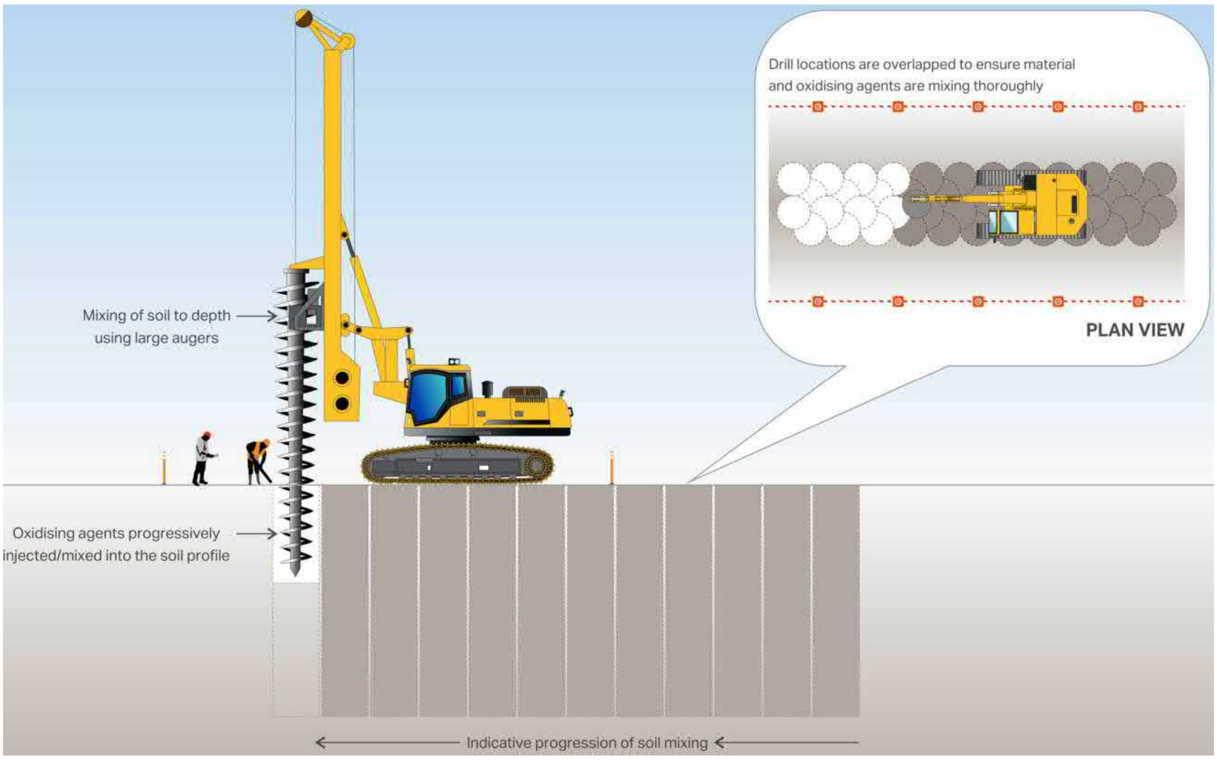

Plate 2 Indicative in-area soil mixing

4.4.2.3 Thermal desorption and stabilisation

As outlined in **Section 4.4.2**, thermal desorption and stabilisation would mainly be undertaken to treat soils/sludges which are highly impacted (i.e. too impacted for bioremediation due to Total Recoverable Hydrocarbon (TRH) concentrations greater than 40,000 milligrams per kilograms (mg/kg) or too heavy by carbon fraction (e.g. >C34)). The volume of soil anticipated to be remediated by thermal desorption/stabilisation is between 10,000 m^3 and 40,000 m^3 (refer to **Section 4.4.2**). Thermal desorption may also be utilised for lighter fractions if required and appropriate.

Thermal desorption

The activities required to set up the thermal desorption process include establishing an appropriate area (including concrete slab) for the unit, constructing the Direct Thermal Desorption (DTD) unit and associated infrastructure, controls etc. and undertaking the necessary bench scale trial testing[9], including Proof of Performance testing in consultation with the NSW EPA.

As discussed above, the impacted soils that would be treated by the DTD unit would either have a high concentration of TRH and/or would consist of hydrocarbons with a high carbon fraction. Soils requiring treatment at the DTD unit would be excavated and transported to the DTD unit in trucks.

Impacted materials would be pre-classified and screened to remove oversize materials, etc. before being fed into and treated by the DTD unit. A hopper would feed the soils into the DTD unit where they would be heated in a rotary dryer causing the hydrocarbons to evaporate and separate from the soils. The soils would then pass through the DTD unit and be cooled and collected. The soils would be validated to confirm they have been remediated and meet acceptance criteria prior to being reused within the Project Area as backfill.

[9] Where required and if not already completed prior to the commencement of this Project.

The hydrocarbons would be contained within the high temperature off-gas from the rotary dryer. This off-gas would pass through a cyclone to remove large dust particles prior to being routed to a thermal oxidiser, where contaminants would be destroyed by high temperature combustion. The hot gas stream would then be transferred to a quench where water mist would be injected to rapidly cool the treated gas. The gas stream then passes through a baghouse, where fine dust particles are removed. A wet scrubber is the final step in the gas treatment system where products from the combustion of contaminants are neutralised. Air from the process would be exhausted to the atmosphere through a stack, which would be subject to periodic stack testing, as per requirements outlined by the NSW EPA.

The thermal desorption treatment area is expected to have a footprint of approximately 2,500 m^2. The DTD unit would be established in a bunded area with its own internal surface water drainage control measures. Electrical power to the DTD unit would be provided by a diesel powered generator. Natural gas required for the operation of the DTD unit would be sourced from an existing connection point adjacent to the Project Area on Devon Street (refer to **Section 4.13**). Refer to **Plate 3** for a conceptual design of the material handling, thermal treatment and validation process.

The DTD unit is assumed to operate 24 hours per day between Monday and Saturday, with scheduled maintenance assumed on Sundays. The maximum throughput rate for the DTD unit was assumed to be 15 tonnes per hour (t/h).

The DTD unit would likely be located in the thermal desorption area shown on **Figure 4-1**.

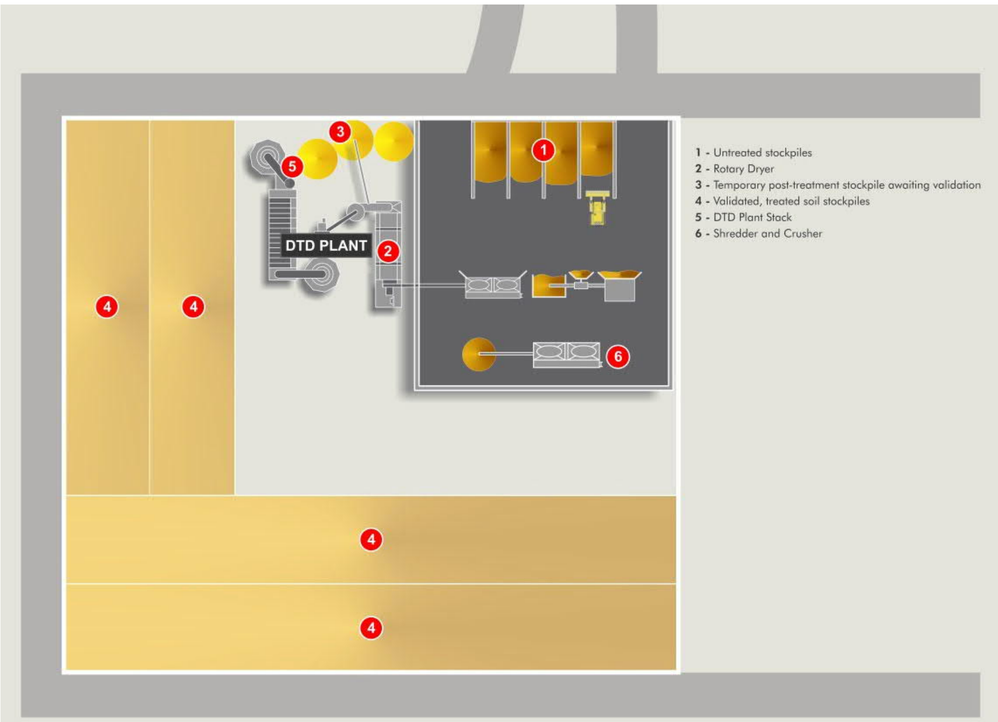

Plate 3 Indicative thermal desorption treatment set up

Stabilisation

Stabilisation of impacted materials and subsequent off-site disposal is also an option for the treatment of highly impacted materials (e.g. highly impacted soils, sludges etc.). It is likely that the decision to adopt either thermal desorption or stabilisation for these highly impacted materials would be based on a cost benefit analysis noting that stabilisation would require off-site disposal and, subsequently, would require a greater volume of imported material for the required landforming works.

Stabilisation involves the use of a binding reagent to encapsulate contaminants into a solidified mass. Common additives which can be used for the stabilisation process are ordinary Portland cement and/or pulverised fly ash (or combinations of these).

As an initial step in the stabilisation process, bench scale trial testing[10] would be undertaken to:

- confirm the optimal treatment application (i.e. additive ratios) as part of obtaining a Specific Immobilisation Approval (SIA) from the NSW EPA;
- demonstrate the stabilised material cures appropriately and attains the required unconfined compressive strength (as per the NSW EPA's General Approval of the Immobilisation of Contaminants in Waste[11] and in accordance with clause Part 10 of the Protection of the Environment Operations (Waste) Regulation 2014); and
- demonstrate that the treated material has been appropriately stabilised to be able to be accepted by an appropriately licenced landfill.

The bench scale trial and associated NSW EPA SIA approvals would take approximately four months to complete. Once obtained, the full scale stabilisation works would commence.

The first stage in the full scale stabilisation works would be the setup of the stabilisation plant and related environmental controls. This would take approximately one month.

The next stage in the stabilisation process involves the thorough mixing of the selected additives into the soil. This would be achieved using a high shear mixing plant including a feed hopper, mixing paddles and an additive hopper to ensure accurate control of the additive dosing rates.

The treated material would then be disposed off-site to a NSW EPA landfill facility licensed to receive treated materials.

4.4.2.4 Off-site disposal (untreated soils)

Off-site disposal of untreated soils or sludges to an appropriately licenced facility or landfill by licenced contractors would be considered when these materials cannot be remediated using the technologies described above or are not suitable for reuse on-site. For the purposes of the assessments within this EIS it is assumed that approximately 40,000 m^3 of untreated material may require off-site disposal. This untreated material may be petroleum or non-petroleum impacted soils or sludges.

As required, waste classification testing would be undertaken in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014a) prior to disposing of materials off-site. This is discussed further in **Section 4.12**.

4.4.2.5 On-site management

Based on the available data, on-site management of non-petroleum contaminated soils is not considered necessary but may need to be required based on the outcomes of the Detailed Site Investigation (refer to **Appendix C**). If identified impacts are confirmed to not represent a risk to human health and the environment and on-site management is necessary, the impacted area would be appropriately managed (in-situ without excavation works) by implementing a Long Term Environmental Management Plan (LTEMP, refer to **Section 4.14**). This LTEMP would clearly identify the management area, the type and location of the contamination present and the type of management required.

4.4.2.6 Suitability of remediation technologies for other chemicals of potential concern

As outlined in **Section 4.1**, the remediation would focus on petroleum hydrocarbon impacts in soils. Other non-petroleum chemicals of potential concern may also occur within the soil and groundwater in the Project Area. These include:

- Heavy metals;
- Per- and polyfluoroalkyl substances (PFAS);
- Asbestos; and
- Pesticides/dioxins/ Polychlorinated Biphenyls (PCBs).

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[10] Where required and if not already completed prior to the commencement of this Project.
[11] https://www.epa.nsw.gov.au/your-environment/waste/tracking-transporting-hazardous-waste/immobilisation/gen-applying-immobilised-contaminants-approval

As outlined in the Conceptual RAP in **Appendix C**, where it is identified that non-petroleum hydrocarbon impacts warrant remediation, these contaminants would either be treated alongside hydrocarbon impacts in the proposed remediation technologies or would be managed on-site or transported off-site. The decision to treat these contaminants alongside the hydrocarbon impacts would be subject to a range of considerations including their concentration, material/leaching characteristics and/or the presence of other chemicals of potential concern.

4.4.3 Groundwater

A separate remediation approach is unlikely to be required to address residual petroleum hydrocarbon impacts in groundwater. This conclusion is based on the existing groundwater monitoring data and associated reports (refer to the **Appendix C**), which indicate plumes in the Western Area are stable, and are not posing a significant risk to human health or ecological receptors. Furthermore, the groundwater conditions are likely to improve further based on the following:

- **Primary sources**: Primary sources (e.g. above ground storage tanks) have or will be removed prior to the soil remediation commencing, with the majority of remnant subsurface infrastructure (such as below ground pipework) to be removed during the Project.
- **Secondary sources**: Shallow LNAPL impacts would be addressed as part of the soil remediation works by the excavation of LNAPL impacted soil to the extent practicable. As part of these works, impacted water may accumulate in these excavations and would be removed via pumping. Both LNAPL impacted soil and water would be managed and treated through the remediation technologies outlined in **Section 4.4**, or in the case of water, by being sent to the Site's existing WWTP for treatment and discharge in accordance with EPL 570.
- **Ongoing monitoring**: Following soil remediation, groundwater monitoring would continue to confirm that the works have not adversely affected the groundwater conditions in the short term. The 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).

Therefore active remediation of groundwater during the Project is not proposed. Following soil remediation, a passive approach to managing contaminated groundwater would be employed. As recommended by the Conceptual RAP, a Groundwater Monitoring Plan (GMP) would be prepared to confirm that natural attenuation processes are occurring for concentrations of dissolved phase hydrocarbons in the Project Area. The GMP would be reviewed and approved by the Site Auditor as part of their review and approval of the Detailed RAP.

4.4.4 Surface water management

During the remediation phase, the existing surface water management system (pipeways and box drains) would continue to operate.

As the remediation progresses, the stormwater and wastewater system would be progressively isolated where remediation works are occurring, with excavation pits being bunded temporarily to minimise the impact on surface water from contact with contaminated soils. Stormwater would be diverted around the work areas using temporary drainage channels. Surface water runoff would continue to follow existing drainage patterns, unless diversion from active remediation is warranted.

The approach to managing water within remediation areas/disturbed areas is as follows:

- minimise the volume of potentially contaminated water during the Project wherever possible by directing surface water away from excavations, depressions, pits and stockpiles by the construction of drainage works such as bunds and diversion drains. These measures would minimise the flow of surface water into parts of the Project Area that contain potentially contaminated materials;
- capturing uncontaminated surface water where possible and using it during the works for various activities, e.g. dust suppression, wheel washing, etc. To assist in the collection of surface water, a temporary sediment basin may be constructed in a suitable location to be determined during detailed design; and

- capturing potentially contaminated water (e.g. in bunded remediation areas) and directing it to the WWTP if appropriate or disposing of it at an appropriately licensed facility.

The generation of impacted surface water would be minimised by:

- covering biopiles and contaminated soil stockpiles to reduce the amount of contaminated water produced; and
- completing the remediation in a staged manner so as to minimise the extent of excavations at any one time that could collect water and require dewatering and treatment at the WWTP.

Liquids/water that is produced or collected during the works would be directed through the existing surface water drainage system and, where possible, to the WWTP which is located at the south eastern corner of the Western Area. If it is not practical for the liquids/water to be sent via this system, it would be collected (e.g. in a tanker, vacuum truck) and be transported to the WWTP for subsequent treatment and discharge in line with EPL 570. Accumulated groundwater in excavated areas would be tested to confirm that it can be appropriately treated in the WWTP.

4.5 Stage 4 – Landforming

It is anticipated that the final landform across the Western Area would be at broadly the same level it is at present. To achieve this, remediated soils mixed with crushed concrete from the Stage 2 and Stage 3 activities described above would be used as backfill. However, given that, some of the below ground infrastructure would be removed, that certain pipeways need to be partially infilled and that potentially some impacted soils would be disposed off-site, additional fill would be required to achieve the required levels.

This additional fill would be brought to the Western Area from off-site sources. This off-site fill could include:

- contaminated soils from other Viva Energy sites in NSW that would be remediated as part of the Project and then used as additional fill; and
- fill that has been validated and meets commercial/industrial criteria; and
- fill that is appropriate for use based on a NSW EPA approved Resource Recovery Exemption (including Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM)).

The volume of contaminated soils to be brought from other Viva Energy sites for remediation is estimated to be up to 1,700 m^3 per year over the duration of the Project (estimated total of 5,000 m^3). The soils would be remediated (if required) and/or managed through the biopiling and landfarming process, outlined in **Section 4.4.2**. These soils would require a NSW EPA specific Resource Recovery Order. The soils would be managed in line with this Order as well as a specific Validation SAQP, which would outline acceptance criteria, and sampling and analytical requirements. Once material is validated (using the criteria outlined in the Validation SAQP), the soil would be reused on-site under a NSW EPA approved Resource Recovery Exemption. Where soils are brought from other sites a NSW EPA specific Resource Recovery Exemption would be required.

These soils would be used to develop the final landform. The final landform would be at the approximate surface level of the existing Western Area, with roads, drainage/pipe channels to be broadly filled to existing ground levels. A layer of topsoil would form part of the final landform and would be vegetated with grasses. Following completion of this stage the Western Area would be broadly flat with a slight gradient towards Duck River.

Following the completion of remediation works (Stage 3), the Western Area would be fully disconnected from the Clyde Terminal's WWTP. Stormwater from the Western Area would be managed through overland flow, with appropriate erosion and sediment control techniques employed.

4.6 Stage 5 – Completion works and demobilisation

Demobilisation from the Project Area would be undertaken progressively as landforming (Stage 4) is occurring. This would include:

- confirming the final erosion and sediment controls are operating effectively;

- removal of remediation and landforming plant and equipment (including dismantling of the DTD unit and stabilisation plant);
- ensuring the Western Area is secured; and
- removal of offices, temporary structures etc. installed within the Project Area as part of Stage 1.

Following the completion of the Project, a Validation Report would be prepared for the remediation works in accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011) and reviewed/approved by the Site Auditor, confirming that the Western Area is suitable for commercial/industrial land use. The Validation Report may include progressive validation reports for separate portions of the Western Area to enable progressive validation of these areas.

4.7 Remediation program and working hours

Should this application for development consent be approved, prior to the Project commencing, a number of additional activities would be undertaken. The conditions of consent would inform the specific requirements of the various Environmental Management Plans (EMPs) which would be prepared. Any additional approvals required for the Project, including a new or varied EPL, would also be sought at this stage. Bench scale trials and the Detailed Site Investigation (DSI) may commence prior to or soon after receipt of the development consent. In consultation with the Site Auditor, the conditions of consent, the results from the DSI, the EMPs and bench scale trials would inform the final detailed design for the Project and Detailed Remedial Action Plan (RAP) for the Western Area. The Detailed RAP would require Auditor approval prior to being implemented. It is anticipated that this process would occur over approximately six months following receipt of development consent.

Once the additional approvals and/or licences are received and a contractor engaged (approximately six months from consent), the Project is expected to occur over a three year period. An indicative schedule of works is provided in **Table 4-1,** which provides flexibility for up to a three year schedule commencing in Q1 2020 and finishing in Q1 2023.

Apart from Stage 1 and Stage 5, the stages listed below would be completed in an iterative approach across the Project Area.

Table 4-1 Indicative program of works

Stages		Indicative commencement date	Indicative duration
Stage 1 – Preparation works		January 2020	3 months
Stage 2 – Removal of redundant infrastructure and waste	Concrete and waste processing	March 2020[1]	36 months
	Excavation of drainage and other infrastructure	March 2020	18 months
Stage 3 – Remediation technologies	Landfarming	March 2020	18 months
	In-area soil mixing	March 2020	5 months
	Biopiling	March 2020	28 months
	Thermal desorption	Set up from January 2020 Operation from November 2020[2]	11 months setup 6 months operation
	Stabilisation	Set up from January 2020, Operation from May 2020	4 months setup 9 months operation
Stage 4 – Landforming		Would occur periodically throughout the Project as materials and remediated areas are validated	22 months
Stage 5 – Completion works and demobilisation		Dependent on completion of Stages 3 and 4	Completed by March 2023

Notes:

1. Concrete processing would be limited to 15, five day periods at various stages during the Project.
2. Operation of the DTD unit would be required 24 hours a day, six days a week.

It is anticipated that the majority of the Project would be undertaken between the hours of 7:00 am and 6:00 pm Monday to Friday, and 8:00 am to 5:00 pm Saturdays. These working hours are consistent with those consented under State Significant Development (SSD) 5147.

The DTD unit would be required to operate outside of these hours for part of the Project program (refer to **Table 4-1**). The DTD unit would operate 24 hours a day, six days a week. Maintenance would occur on the seventh day of the week.

With the exception of the DTD unit, no works would occur on Sundays and Public Holidays.

4.8 Workforce

The indicative workforce required for the Project, against each stage, is presented in **Table 4-2**. These would be remediation contract workers and would be in addition to the existing workforce at the Site.

Table 4-2 Indicative workforce

Stages		Peak workforce no. per day
Stage 1 – preparation works		**80**
Stage 2 – removal of redundant infrastructure and waste	Concrete/waste processing	4
	Excavation of drainage/other infrastructure	4
	Total peak for Stage 2	**8**
Stage 3 – remediation	Excavation of remediation areas	4
	Landfarming	3
	In-area soil mixing	6
	Biopiling	1
	Thermal desorption	25
	Stabilisation	6
	Total peak for Stage 3	**45**
Stage 4 – landforming		**10**
Stage 5 – completion works		**60**

4.9 Plant and equipment

The indicative plant and equipment per stage is presented in **Table 4-3**.

Table 4-3 Indicative plant and equipment

Stages		Plant	Maximum number required per day
Stage 1 – preparation works	Preparation works	20 tonne (t) excavator	2
		Bobcat	1
		Water cart	1
	DTD unit construction	Large crane	2
		Elevated work platform	2
		Telehandler	2
		Franna crane	2
		Cement truck	2
Stage 2 – removal of redundant infrastructure and waste	Concrete/waste processing	20 t excavator	3
		Concrete crusher	1
		Dump truck	1
	Excavation of drainage/other	20 t excavator	2
		Dump truck	1

Stages		Plant	Maximum number required per day
	infrastructure		
Stage 3 – remediation technologies	Excavation of remediation areas	20 t excavator	3
		Dump truck	1
	Landfarming	20 t excavator	2
	In-area soil mixing	Large piling rig	1
		Batching plant	1
	Biopiling	20 t excavator	4
		Hitachi SR2000G soil mixer	1
		Cat 966 loader	1
		Dump truck	1
		Other related operation and monitoring equipment	See below[1]
	Thermal desorption	35 t excavator	2
		Dump truck	1
		Cat 966 loader	1
		Concrete trucks	2
		DTD unit and operators	1 (see below[2])
	Stabilisation	20 t excavator	1
		Hitachi SR2000G soil mixer	1
		Cat 966 loader	1
		Telehandler	1
	General	Truck and dog (off-site disposal)	6
Stage 4 – landforming	Landforming	20 t excavator	2
		Cat 966 loader	2
		Pad foot roller	2
		Truck and dog (import of soil)	16
		Dump truck	2
Stage 5 – completion works and demobilisation	General	20 t excavator	2
		Cat 966 loader	2
		Pad foot roller	2
		Dump truck	
		Truck and dog (off-site disposal)	6
	DTD unit demobilisation	Larger crane	2
		Elevated work platform	2
		Telehandler	2
		Franna crane	2

Notes:

1. Infrastructure required to provide air circulation through the biopile and enable addition of nutrients/compost/microbes to assist the biodegradation process (i.e. radial compressor, knock-out pot, air blowers, transfer pump, Granular Activated Carbon (GAC) filters (for water and vapour), amendments solution tank, amendments solution dosing pump and various monitoring equipment).
2. A typical DTD unit would include a pre-treatment screen, DTD unit feed system, a radial stacking conveyor, DTD unit stack.

4.10 Materials required

Other materials likely to be required during the Project would include:

- **Stage 1 – Preparation works:**
  - all remediation technologies:
    - diesel for the operation of excavators, loader and trucks (as required); and
    - dust and sediment control fencing and other environmental control materials;
  - thermal treatment:
    - concrete as required for construction of the DTD unit; and
    - diesel for the operation of construction plant (as required).
- **Stage 2 – Removal of redundant infrastructure and waste:**
  - diesel for the operation of excavators, loader and trucks (as required).
- **Stage 3 – Remediation:**
  - landfarming:
    - supply of nutrients/compost/microbes to assist the biodegradation process;
    - diesel for the operation of excavators, loader and trucks (as required); and
    - dust and sediment control fencing and other environmental control materials;
  - in-area soil mixing:
    - oxidising and activating agents (i.e. sodium persulphate and sodium hydroxide);
    - diesel for the operation of the piling rig and other plant (as required); and
    - dust and sediment control fencing and other environmental control materials;
  - biopiles:
    - polypropylene covers;
    - supply of nutrients/compost/microbes to assist the biodegradation process;
    - diesel for the operation of excavators, loader and trucks (as required);
    - dust and sediment control fencing and other environmental control materials; and
    - GAC filters (for water and vapour);
  - thermal treatment:
    - natural gas, sourced from existing connection point located adjacent the Site on Devon Street, to fire the heating burners of the DTD unit;
    - electricity supplied from a diesel generator;
    - diesel (as required) for the generator for the DTD unit as well for the operation of other plant (including excavators, loader and trucks);
    - potable water for the cooling process within the quench and the acid gas scrubber within the DTD unit (supplied from existing mains supply); and
    - dust and sediment control fencing and other environmental control materials;
  - stabilisation:
    - stabilisation additives (i.e. Portland cement and/or fly ash);
    - water supply for mixing;
    - diesel for the operation of excavators, loader and trucks (as required); and

  - dust and sediment control fencing and other environmental control materials.

- **Stage 4 – Landforming:**
  - soil would be required to be brought from off-site to create the final landform at various stages during the Project (approximately 5,000 m^3, refer to **Section 4.5**); and
  - diesel for the operation of excavators, loader, compaction rollers and trucks (as required).
- **Stage 5 – Completion works and demobilisation:**
  - diesel for the operation of excavators, loader, trucks and various plant required for the dismantling works (as required).

4.11 Traffic management and access

Road access to the Site is well established. Project related traffic movements would be largely along Grand Avenue, Durham Street and Devon Street, entering the Western Area at Gate 6 located at the corner of Unwin Street and Colquhoun Street. The Site can also be accessed from Parramatta Road via Wentworth Street, Kay Street and Unwin Street. The use of this route enables access to the Project Area without using James Ruse Drive or Grand Avenue.

Given the industrial nature of the Study Area and the characteristics of the local road network, it is not anticipated that any changes to access or local roads would be required to accommodate traffic generated by the Project.

The traffic generated by the Project would incorporate a mix of plant vehicles (refer to **Table 4-3**), delivery vehicles and workforce movements.

A summary of the vehicles that would be required during the Project is summarised in **Table 4-4**. Further detail is provided in **Chapter 14 Traffic, transport and access**.

Table 4-4 Workforce and plant requirements for the Project

Description		Maximum daily traffic generation (movements[1])	Maximum peak hour traffic generation (movements)
Remediation equipment	Heavy vehicles (trucks/concrete trucks etc.)	100	20
Private vehicles	Project workforce	160	80
Total		**260**	**100**

Note:

1. A movement is a one way trip to or from the Project Area.

Construction vehicles would be parked within the Project Area or, if required, in existing parking areas immediately adjacent to the Project Area on the Site. Given the reduction in personnel at the Site over the past two years, there is a large amount of available parking areas throughout the Site and adjacent to the Project Area.

4.12 Waste management

In addition to the discussion on waste management in **Section 4.3**, the Project would result in the production of certain waste streams. The target is to recycle waste material and where possible reuse it at the Site. As waste is produced it would be classified in line with the *Waste Classification Guidelines* (NSW EPA, 2014a) and stored in identified areas on-site prior to being reused, recycled or disposed.

All wastes received or removed from the Project Area would be stored, transported and disposed of in accordance with relevant regulatory requirements and tracked via implementation of the Material Tracking Plan.

Further detail is provided in **Chapter 12 Waste management**.

4.13 Utilities

Power and water supply to the Western Area is currently limited, and is restricted to the current operational tank farms (to be removed as part of the Clyde Terminal Conversion Project (SSD 5147)), the Autonexus Area, and the WWTP. Power and water supplies would be re-established as part of the preparation works for the Project (Stage 1). However, as described in **Section 4.10**, diesel would likely still be required to power the DTD unit. This would be confirmed during detailed design.

Existing utilities include a Metropolitan Water, Sewerage and Drainage Board (MWSDB) sewer line and a TransGrid pilot cable, as well as the drainage network. Existing utilities would be identified (and marked where appropriate) during Stage 1 (refer to **Section 4.2.4**).

A natural gas connection point is located adjacent the northern Project Area boundary on Devon Street and would supply natural gas to the Project Area for the operation of the DTD unit (refer to **Section 4.4.2.3**).

During the Project, sewage would either be managed through a connection to the existing sewage infrastructure at the Project Area or it would be pumped and disposed in line with relevant requirements.

4.14 Ongoing operation

Following completion of the Project, the Western Area would be a broadly flat, vacant site. Ongoing operational activities on the Project Area would be limited to those associated with environmental monitoring and ongoing management of the final landform. Minimal equipment, vehicles and workforce would be required for these activities.

Ongoing management requirements for the Western Area after completion of the remediation works would be detailed in the LTEMP which would be prepared in accordance with the NSW EPA *Guidelines for the NSW Site tor Scheme (third edition)* (NSW EPA, 2017a) and reviewed/approved by the Site Auditor.

A GMP would also be prepared to detail the ongoing groundwater monitoring requirements which would be required to confirm that natural attenuation processes are occurring in the groundwater in the Western Area (as discussed in **Section 4.4.2**).

The management of the Western Area would likely be removed from EPL 570.

The operational conditions of consent for SSD 5147 would still apply to part of the Western Area following completion of the Project. These conditions may be augmented by conditions of consent for this Project. If this Project is approved, the consent for SSD 5147 may need to be modified to ensure a consistent operational framework for the Western Area.

Ongoing environmental monitoring and management requirements are discussed further in **Chapter 20 Mitigation and management.**

5.0 Statutory planning context

5.1 Environmental Planning and Assessment Act

The *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act) is the primary legislation that governs land use and provides a framework for development control in NSW. The EP&A Act is supported by the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and a number of Environmental Planning Instruments (EPIs) which include State Environmental Planning Policies (SEPPs) and Local Environment Plans (LEPs).

Part 4 of the EP&A Act establishes a framework for assessing development that requires consent under an EPI. It allows development to be classified as 'exempt development' (where no consent is required), 'complying development', 'development that needs consent', or 'prohibited development'. The term 'development' is defined under section 1.5 of the EP&A Act.

Section 4.2 of the EP&A Act states that where "*an EPI provides that specified development may not be carried out except with development consent, a person must not carry the development out on land to which the provision applies unless: (a) such a consent has been obtained and is in force, and (b) the development is carried out in accordance with the consent and the instrument.*"

This section of the EP&A Act therefore allows EPIs to specify when development consent is required. As discussed under **Section 5.2.1** the EPI *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) defines the Project as remediation, makes the Project permissible at the Western Area and requires that Viva Energy apply for development consent to undertake the Project.

Section 4.36 of the EP&A Act outlines development that is considered State Significant Development (SSD). This section notes that a development can be declared SSD by an EPI or the NSW Minister for Planning can declare a development on specified land to be SSD.

Most developments are declared as state significant as they meet the requirements of *State Environment Planning Policy (State and Regional Development) 2011* (SEPP SRD). However as the Project did not meet all of the requirements of the SEPP SRD, a 'Call-In Request' was submitted to DPE that requested that the Project be declared SSD by the Minister under section 4.36(3) of the EP&A Act.

On 20 April 2018 an order was published in the NSW Government Gazette declaring the Project as SSD (ref n2018-1291).

Section 4.12(8) of the EP&A Act states that a "*development application for State significant development is to be accompanied by an environmental impact statement prepared by or on behalf of the applicant in the form prescribed by the regulations.*" Schedule 2 of the EP&A Regulation sets out the requirements of an Environmental Impact Statement (EIS) and requires that the content of an EIS is '*subject to the environmental assessment requirements that relate to the EIS'*.

As noted in section 4.40, SSD applications are evaluated and determined in line with the requirements of section 4.15 of the EP&A Act.

In line with section 4.5 of the EP&A Act, the consent authority for the Project will be the NSW Minister for Planning.

Section 4.41 of the EP&A Act lists the Acts or sections of Acts relating to approvals which do not apply to SSD projects. The potentially relevant approvals to the Project include:

- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974;* and
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000.*

The other approvals listed under section 4.41 do not apply to this Project.

Sections 4.42 of the EP&A Act identifies authorisations that cannot be refused if necessary for carrying out a SSD respectively. The potential relevant authorisation to the Project is a NSW Environment Protection Licence (EPL) under Chapter 3 of the *Protection of the Environment Operations Act 1997 (NSW)* (PoEO Act) (for any purposes referred to in section 43 of that Act). The other authorisations listed under section 4.42 do not apply to this Project.

The Site has two existing EPLs, EPL number 570 (EPL 570) is the relevant licence for the Western Area. These EPLs and the potential need to amend one of these EPLs is discussed in **Section 5.4.2**.

5.2 Environmental Planning Instruments

5.2.1 State Environmental Planning Policy No. 55 – Remediation of Land

SEPP 55 provides development control provisions for the remediation of contaminated land. Clause 4 of SEPP 55 defines remediation as:

(a) "*removing, dispersing, destroying, reducing, mitigating or containing the contamination of any land, or*

(b) *eliminating or reducing any hazard arising from the contamination of any land (including by preventing the entry of persons or animals on the land).*"

The Project's primary purpose involves removing, destroying, reducing, mitigating and containing contaminated land in the Western Area and eliminating or reducing the potential hazards associated with this contamination. Therefore the Project is considered 'remediation work' under SEPP 55.

Clause 8(1) of the SEPP 55 states that "*a person may carry out remediation work in accordance with this Policy, despite any provision to the contrary in an environmental planning instrument, except as provided by clause 19 (3)*". This clause makes remediation work permissible in any location in NSW including the Western Area.

Clause 8(2) of SEPP 55 states that: "*a person must not carry out a category 1 remediation work except with the consent of the consent authority.*" Clause 9 defines 'category 1 remediation work' and notes that category 1 remediation work is, amongst other things, remediation work that is considered 'designated development'.

Schedule 3 of the EP&A Regulation defines designated development. Clause 15(a), (b) and (c) of this schedule apply to this Project. Most relevant is clause 15(c)(ii) and (iii) which state:

"*Contaminated soil treatment works (being works for on-site or off-site treatment of contaminated soil, including incineration or storage of contaminated soil, but excluding excavation for treatment at another site):*

(c) that treat contaminated soil originating exclusively from the site on which the development is located and:

…

(ii) treat otherwise than by incineration and store more than 30,000 cubic metres of contaminated soil, or

(iii) disturb more than an aggregate area of 3 hectares of contaminated soil."

More than 30,000 cubic metres (m^3) of contaminated soil is likely to be treated by a method other than incineration and the remediation activities are likely to disturb more than an aggregate area of 3 hectares (ha) of contaminated soil. Therefore, the Project is considered designated development, and in turn, category 1 remediation works. As such, the Project requires development consent.

5.2.2 State Environmental Planning Policy (State and Regional Development) 2011

The SEPP SRD aims to identify development that is SSD, State significant infrastructure, critical State significant infrastructure and regional significant development.

Clause 8 of SEPP SRD states that a project is to be determined as SSD if it is "*by the operation of an environmental planning instrument, not permissible without development consent under Part 4 of the Act, and the development is specified in Schedule 1 or 2*".

Schedule 1 of the SEPP SRD provides a list of 24 different types of development and a number of associated criteria. Clause 24 of Schedule 1 relates to the ‘Remediation of contamination land’. To be designated SSD under this clause; development needs to be considered category 1 remediation works on significantly contaminated land and the works would need to be carried out under a management order that requires:

- taking an action to remediate the land; or
- taking an action to treat, store or contain on the land, or remove from the land and treat or dispose of, any solid or liquid materials including any soil, sand, rock or water; or
- the preparation of a plan of management that provides for the taking of any such action described in the two points above.

As discussed in **Section 5.2.1**, the Project is considered category 1 remediation works and as discussed in **Section 5.4.4** the Site, including the Western Area is considered to be ‘significantly contaminated land’, however, the land is not under a *Contaminated Land Management Act 1997 (NSW)* (CLM Act) management order. Therefore the Project does not meet the criteria under clause 24 of Schedule 1 of the SEPP SRD and is not considered SSD under this EPI.

As noted above the Project was not declared as SSD under this EPI. Nevertheless certain clauses within this SEPP still apply to SSDs. For this Project the key clause that applies is clause 11, which makes it clear that the requirements of development control plans (DCPs) do not apply to SSD. However, the DCP requirements have been considered and are discussed in **Section 5.2.5**.

5.2.3 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The Western Area falls within the boundary of the ‘Foreshore and Waterways area’ and is therefore subject to the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Harbour SREP), which is a deemed SEPP.

The Sydney Harbour SREP outlines a number of planning principals for the Foreshore and Waterways area and requires that these principals are considered, and where possible, achieved for environmental studies and masterplans. There are nine principles in total which request that:

(a) *“development should protect, maintain and enhance the natural assets and unique environmental qualities of Sydney Harbour and its islands and foreshores,*

(b) *public access to and along the foreshore should be increased, maintained and improved, while minimising its impact on watercourses, wetlands, riparian lands and remnant vegetation,*

(c) *access to and from the waterways should be increased, maintained and improved for public recreational purposes (such as swimming, fishing and boating), while minimising its impact on watercourses, wetlands, riparian lands and remnant vegetation,*

(d) *development along the foreshore and waterways should maintain, protect and enhance the unique visual qualities of Sydney Harbour and its islands and foreshores,*

(e) *adequate provision should be made for the retention of foreshore land to meet existing and future demand for working harbour uses,*

(f) *public access along foreshore land should be provided on land used for industrial or commercial maritime purposes where such access does not interfere with the use of the land for those purposes,*

(g) *the use of foreshore land adjacent to land used for industrial or commercial maritime purposes should be compatible with those purposes,*

(h) *water-based public transport (such as ferries) should be encouraged to link with land-based public transport (such as buses and trains) at appropriate public spaces along the waterfront,*

(i) *the provision and use of public boating facilities along the waterfront should be encouraged.”*

Under the provisions of the Foreshore and Waterways area the SREP zones the Duck River as W2 – Environmental Protection which has the following objectives:

(a) *“to protect the natural and cultural values of waters in this zone,* *(b) to prevent damage or the possibility of longer term detrimental impacts to the natural and cultural values of waters in this zone and adjoining foreshores,*

(c) to give preference to enhancing and rehabilitating the natural and cultural values of waters in this zone and adjoining foreshores,

(d) to provide for the long-term management of the natural and cultural values of waters in this zone and adjoining foreshores."

The SREP also lists certain heritage items. Whilst there are no items listed in the Western Area, there are two items on and close to the wider Site, namely No. 35 Shell Oil Refinery Wharf on the Duck River (refer to **Figure 5-1**) and No. 36 Industrial Wharves at 33 Grand Avenue, Camellia.

In addition, the SREP also designates certain parts of the Western Area adjacent to the Duck River as 'Wetlands Protection Area' (refer to **Figure 5-1**). The Project Area has been designed to avoid areas designated as 'Wetlands Protection Area'. This designation requires that development in this area is only carried out with development consent and that a number of 'matters' are taken into consideration by consent authorities before granting consent to development under Part 4 of the EP&A Act.

The matters to be taken into consideration in relation to any development in this area are as follows:

(a) "the development should have a neutral or beneficial effect on the quality of water entering the waterways,

(b) the environmental effects of the development, including effects on:

- *(i) the growth of native plant communities,*
- *(ii) the survival of native wildlife populations,*
- *(iii) the provision and quality of habitats for both indigenous and migratory species,*
- *(iv) the surface and groundwater characteristics of the site on which the development is proposed to be carried out and of the surrounding areas, including salinity and water quality and whether the wetland ecosystems are groundwater dependent,*

(c) whether adequate safeguards and rehabilitation measures have been, or will be, made to protect the environment,

(d) whether carrying out the development would be consistent with the principles set out in The NSW Wetlands Management Policy (as published in March 1996 by the then Department of Land and Water Conservation),

(e) whether the development adequately preserves and enhances local native vegetation,

(f) whether the development application adequately demonstrates:

- *(i) how the direct and indirect impacts of the development will preserve and enhance wetlands, and*
- *(ii) how the development will preserve and enhance the continuity and integrity of the wetlands, and*
- *(iii) how soil erosion and siltation will be minimised both while the development is being carried out and after it is completed, and*
- *(iv) how appropriate on-site measures are to be implemented to ensure that the intertidal zone is kept free from pollutants arising from the development, and*
- *(v) that the nutrient levels in the wetlands do not increase as a consequence of the development, and*
- *(vi) that stands of vegetation (both terrestrial and aquatic) are protected or rehabilitated, and*
- *(vii) that the development minimises physical damage to aquatic ecological communities, and*
- *(viii) that the development does not cause physical damage to aquatic ecological communities,*

(g) whether conditions should be imposed on the carrying out of the development requiring the carrying out of works to preserve or enhance the value of any surrounding wetlands."

The provisions of the Sydney Harbour SREP will need to be considered for the Project, including for the contamination, water, biodiversity, and heritage assessments (refer to **Chapter 8 Soils, groundwater and contamination**, **Chapter 9 Surface water, wastewater and flooding**, **Chapter 15 Biodiversity** and **Chapter 16 Historical heritage**).

The Sydney Harbour SREP is currently under review by DPE as part of DPE's SEPP Review Program. DPE is proposing to consolidate and repeal seven existing SEPPs, including the Sydney Harbour SREP into one Environment SEPP. At the time of preparing this EIS the Environment SEPP had not yet been drafted and DPE was considering feedback on the Explanation of Intended Effect for the Environment SEPP.

FIGURE 5-1 SYDNEY HARBOUR SREP 2005 - PROTECTED AREAS AND BIODIVERSITY

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Foreshore and Waterways area
- Wetlands Protection area
- W2 Environmental Protection zone
- State road
- Local road

Heritage Items

- Shell Oil Refinery Wharf
- Industrial Wharves

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

AECOM

0 250 500 m

5.2.4 State Environmental Planning Policy (Coastal Management) 2018

The *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) has established a new, strategic land use planning framework for coastal management. Specifically, it aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the *Coastal Management Act 2016 (NSW).*

This SEPP has introduced new 'coastal areas'. Parts of the Western Area, adjacent to the Duck River, fall within three of the coastal areas; being: Coastal wetland and littoral rainforests area, Coastal environment area, and Coastal use area. Further, parts of the Western Area fall within land designated as within the Proximity area for coastal wetland of littoral forest (refer to **Figure 5-2**). The Project therefore needs to ensure that the consent authority is satisfied that certain considerations for these areas have been addressed.

In regards to development in the Coastal wetlands and littoral rainforests area, the Project can be undertaken with development consent, if under clause 10(4), the consent authority is satisfied that *"sufficient measures have been, or will be, taken to protect, and where possible enhance, the biophysical, hydrological and ecological integrity of the coastal wetland or littoral rainforest".*

For works within the Proximity area for coastal wetlands or littoral rainforest, clause 11(1) provides that development consent must not be granted unless the consent authority is "*satisfied that the proposed development will not significantly impact on:*

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest."

While, clause 10(4) and clause 11(1) have been considered in **Chapter 15 Biodiversity** and **Chapter 9 Surface water, wastewater and flooding**, the Project Area avoids areas designated as Coastal wetlands.

Although the Western Area is located on land within the Coastal environment and Coastal use areas, the considerations for these areas do not apply as the land is also within the Foreshores and Waterways Area as defined by the Sydney Harbour SREP (refer to clause 13(3) and 14(2) of the Coastal Management SEPP).

Division 5 of the Coastal Management SEPP outlines general considerations for land within the coastal zone. These are: *"development consent must not be granted to development on land within the coastal zone unless the consent authority:*

- *is satisfied that the proposed development is not likely to cause increased risk of coastal hazards on that land or other land";* and
- *"has taken into consideration the relevant provisions of any certified coastal management program that applies to the land"*.

Coastal hazards are considered in **Chapter 9 Surface water, wastewater and flooding.** The Site lies within the Parramatta River Estuary and therefore is subject to the Parramatta River Estuary Coastal Zone Management Plan (Cardno, 2013). The Parramatta River Estuary Coastal Zone Management Plan does not include any actions for land within the Western Area.

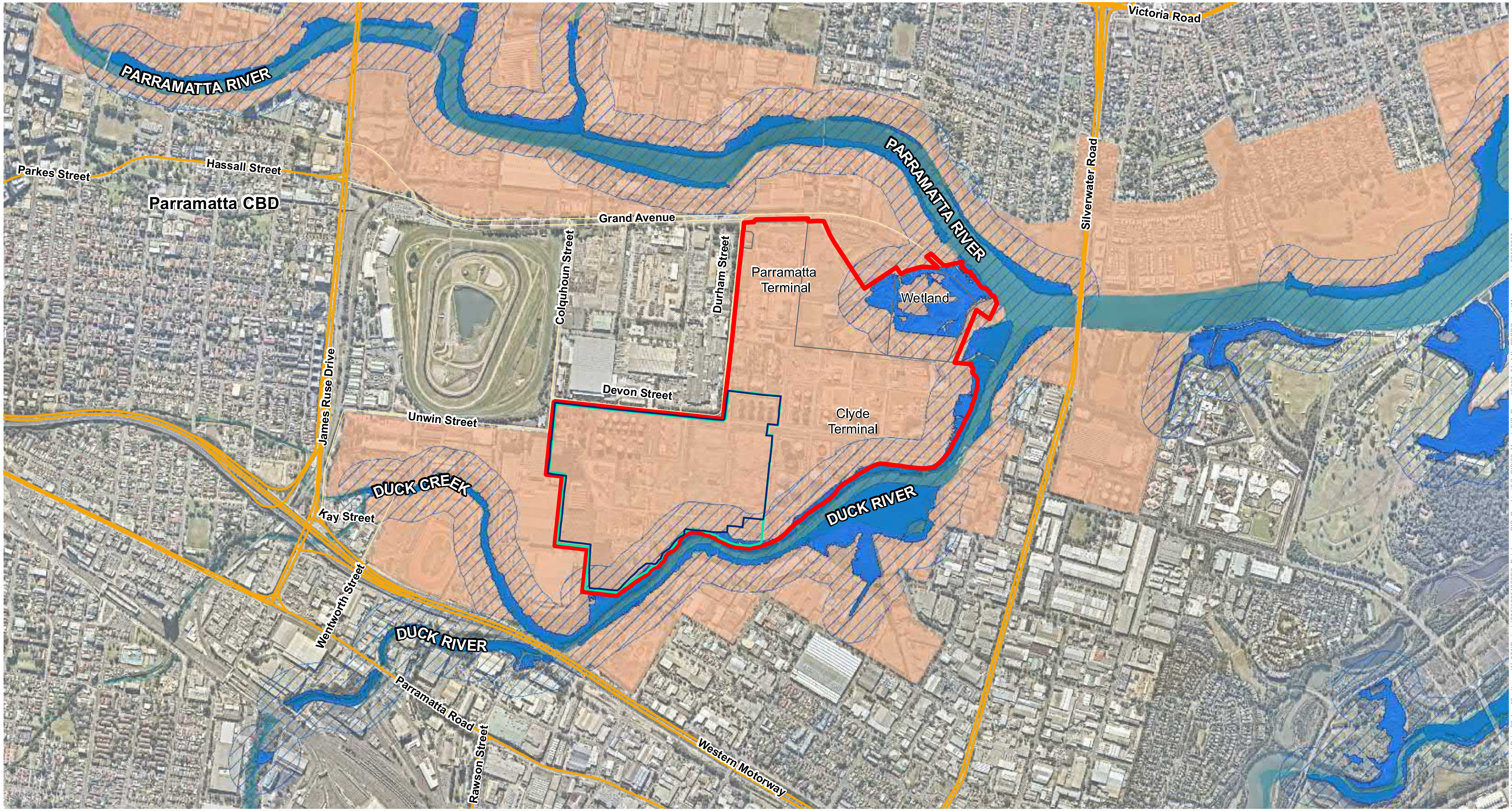

FIGURE 5-2 COASTAL MANAGEMENT SEPP COASTAL MANAGEMENT AREAS

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KEY

- Site boundary
- Project area boundary
- Western Area boundary
- State road
- Local road
- Coastal Wetlands
- Proximity Area for Coastal Wetlands
- Coastal Use Area Map and Coastal Environment Area Map

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

5.2.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

The *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) provides an approach for the planning and assessment of potentially hazardous and/or offensive development.

SEPP 33 applies to hazardous and offensive industries as well as potentially hazardous and offensive industries. SEPP 33 requires a preliminary hazards analysis (PHA) to be completed for potentially hazards industry, which is defined as industrial development, that when operating without proper controls would pose significant risk to human health, life, property or the biophysical environment.

Whilst remediation activities are not technically a type of industry, a SEPP 33 Screening assessment has been completed for the Project in accordance with the requirements of the SEARs and to demonstrate that the Project is not considered potentially hazardous.

The assessment is provided in **Chapter 18 Hazards and risks**.

5.2.6 Parramatta Local Environmental Plan 2011

The Site, including the Western Area, is zoned as IN3 – Heavy Industrial in the *Parramatta Local Environmental Plan 2011* (Parramatta LEP). The objectives of this zone are:

- *"To provide suitable areas for those industries that need to be separated from other land uses.*
- *To encourage employment opportunities.*
- *To minimise any adverse effect of heavy industry on other land uses.*
- *To support and protect industrial land for industrial uses.*
- *To allow a wide range of industrial and heavy industrial uses serving the Greater Metropolitan Area of Sydney and beyond.*
- *To ensure that opportunities are not lost for realising potential foreshore access on land that is contaminated and currently not suitable for public access."*

The land use table for IN3 lists development that is permitted without consent, development that is permitted with consent, and development that is prohibited. Remediation is not listed in the land use table, however, any development that is not specified under the three categories is considered permitted with consent as an innominate permissible use. Notwithstanding this point, the Project is permissible under clause 8(1) of SEPP 55 as explained in **Section 5.2.1** above.

The Parramatta LEP contains a number of other considerations for development in the Western Area, which would be taken into account through the design and assessment of the Project. Of note are that the Western Area falls under Class 2, 3 and 4 Acid Sulfate Soil Classes, a Riparian Land and Waterways designation is applied to land adjacent to Duck River and Schedule 5 lists Duck River and Parramatta River as part of the heritage listed Camellia Wetlands (and Ermington; Parramatta; and Rydalmere). Further, Duck River and the Parramatta River are mapped as Riparian Land and Waterways to which the Water Protection clause of the Parramatta LEP applies (Part 6 Clause 6.5). This clause aims to maintain the hydrological functions of riparian land, waterways and aquifers, by protecting water quality, natural water flows, the stability of the bed and banks of waterways and groundwater systems. These considerations are discussed in **Chapter 8 Soils, groundwater and contamination**, **Chapter 15 Biodiversity** and **Chapter 16 Historic heritage**.

As outlined in **Section 5.2.2**, DCPs do not apply to the Project. However, for certain aspects, where appropriate, the Project would also consider the *Parramatta Development Control Plan 2011* (City of Parramatta Council, 2011) (Parramatta DCP).

The Clyde Terminal is located within the Camellia and Rydalmere Strategic Precinct as stated in the Parramatta DCP. The Parramatta DCP also outlines that the Parramatta River Corridor is a major asset for the area and highlights that development should support the health of the river and foreshores and protection of the vegetated riparian areas. The overall objectives for this Strategic Precinct that relate to the Project include:

- *"Create a vibrant attractive and mutually supportive industrial, educational and research precinct"*
- *"Encourage industrial development that is innovative and incorporates into its business best practice environmental management"*
- *"Require industry to operate using bets practice environmental management techniques"*
- *"Minimise energy and resource use and reduce impact to off-site air quality or disturbance by noise, odour, dust, water, soil and contamination".*

The Parramatta DCP also outlines objectives for the preservation of trees or vegetation within the Parramatta Local Government Area (LGA).

The Project has avoided and minimised environmental impacts where practical and feasible through the design and assessment process. Mitigation and management measures have been developed to manage potential environmental impacts, which could not be avoided. The considerations outlined in the above objectives are discussed in **Chapter 8 Soils, groundwater and contamination**, **Chapter 9 Surface water, wastewater and flooding**, **Chapter 10 Air quality**, **Chapter 12 Waste management** and **Chapter 13 Noise and vibration**.

5.3 Strategic plans

5.3.1 Greater Sydney Regional Plan – A Metropolis of Three Cities

In March 2018 the Greater Sydney Commission (GSC) released, *Greater Sydney Region Plan: A Metropolis of Three Cities* (the Plan) (GSC, 2018a). The primary purpose of the Plan was to set a 40 year vision (to 2056) for Greater Sydney in the context of social, economic and environmental matters and to establish a 20 year plan to manage growth and change. The Plan is built on a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places.

The Site is located within the 'Central River City'. The population of the 'Central River City' is projected to increase from 1.3 million people to 1.7 million people over the next 20 years, contributing to a predicted 817,000 new jobs within the Sydney region.

The Plan integrates land use, transport and infrastructure planning between the three tiers of government and across State agencies.

The NSW Government has set down goals for Sydney, including that it will be a city of housing choice with homes that meet Sydney's needs and lifestyles, and that it will be a sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources. Each goal has a number of priority areas which provide a focus for the actions needed to meet the goals for Sydney. This includes growing the Central River City by accelerating urban renewal and providing homes closer to jobs.

The Plan also identifies the importance of protecting the natural environment and biodiversity. It notes that the impacts of development on the environment need to be managed to meet the goals for growing Sydney.

The Western Area represents a major opportunity for the future development of Sydney and the 'Central River City' as it is located in the strategically important 'Greater Parramatta and the Olympic Peninsula' (GPOP) area (refer to **Section 5.3.2** and **Section 5.3.3**). The Project would support the Plan by enabling the land to be used for purposes permissible under the existing land use zoning in the future.

5.3.2 Greater Sydney Commission Central City District Plan

In partnership with the Plan outlined above (GSC, 2018a), the GSC released the *Our Greater Sydney 2056: Central City District Plan* (District Plan) (GSC, 2018b). This District Plan sets out a vision, priorities and actions for the development of the Central City District of Greater Sydney. This district, centred on the Parramatta metropolitan area, covers the Blacktown, Cumberland, Parramatta and the Hills LGAs.

The District Plan identifies ten directions to support the 20 year vision for a metropolis of three, 30 minute cities. These are:

1. A collaborative city: working together to grow a Greater Sydney;
2. A city supported by infrastructure: infrastructure supporting new developments;
3. A city for people: celebrating diversity and putting people at the heart of planning;
4. Housing the city: giving people housing choices;
5. A city of great places: designing places for people;
6. A well connected city: developing a more accessible and walkable city;
7. Jobs and skills for the city: creating the conditions for a stronger economy;
8. A city in its landscape: valuing green spaces and landscape;
9. A resilient city: adapting to a changing world; and
10. An efficient city: using resources wisely.

At the heart of this district is the strategically important area, the GPOP. The District Plan identifies that industrial land within the GPOP provides capacity for a range of activities that are critical to supporting population and jobs growth (GSC, 2018b).

The Site and the Western Area fall within the GPOP area. Within this area, the Site and the Camellia peninsula as a whole are designated Quarter 3: Essential Urban Services, Advanced Technology and Knowledge Centres. With significant infrastructure spending currently facilitating Australia's biggest urban renewal within the GPOP, the GPOP is becoming a magnet for human talent, innovation and creativity (GSC, 2018b).

5.3.3 Greater Parramatta and the Olympic Peninsula

The GPOP area is a 4,000 ha area in the heart of Sydney. It spans 13 kilometres (km) east–west from Strathfield to Westmead, and 7 km north–south from Carlingford to Lidcombe and Granville. It is the geographic and demographic centre of Greater Sydney. In October 2016, a vision document for the GPOP area was released by the GSC (GSC, 2016).

The Camellia peninsula, and therefore the Site and Western Area, are located in the centre of the GPOP area. The vision document recognises that this area currently provides a number of essential activities that service Parramatta and in many cases Sydney and the whole of NSW (e.g. fuel distribution).

The vision document goes on to note the proposed infrastructure linkages across the GPOP area, including the light rail and potentially the Sydney Metro. It then discusses each of the precincts within the GPOP area. The Site falls within 'Quarter 3' – Essential Urban Services, Advanced Technology and Knowledge Sectors. With regards to the Site the following is stated:

"*Viva Energy's evolution from an oil refinery to an oil distributor — a change brought about by changes in the global fuel supply chain — represents a landmark change and an opportunity for GPOP. Around 40 hectares of surplus land in Camellia will become available for modern enterprise with relatively high density employment. Its future use must be compatible with the requirements of Viva's* [sic] *fuel terminal.*"

The vision for 'Quarter 3' is to maintain this central employment and urban services area, intensify employment uses and connect with the 21st century global economy. To do this, the focus will be on creating "*unique and positive connections between Science, Technology, Engineering, Art and Mathematics (STEAM), health, education, sports, culture and business sectors — to drive innovations* *that arise from an eco-system of interdependency, growth and change.*" The Site and the Western Area are within this vision and the expected transformation of Camellia.

As noted in **Section 5.3**, the increased development potential of the Western Area brought about by the strategic planning documents noted above has increased the importance of remediating this land. The aspirations in each of these planning documents are a key consideration for the need for the Project (refer to **Chapter 3 Needs and alternatives considered**).

5.4 Other NSW legislation

5.4.1 Water Management Act 2000

The *Water Management Act 2000 (NSW)* (WM Act) establishes a framework for managing water in NSW. The Site and Western Area is within the jurisdiction of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* and the *Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan 2011*.

The WM Act creates:

- mechanisms for protecting and restoring water sources and their dependent ecosystems;
- improved access rights to water; and
- partnership arrangements between the community and the government for water management.

Section 91 of the WM Act discusses activity approvals and notes that there are two types of approvals, namely controlled activity approvals and aquifer interference approvals.

Section 4.41 of the EP&A Act means that SSD projects do not need certain approvals under the WM Act. However aquifer interference approvals under section 91(3) of the WM Act may still be required.

The WM Act defines an aquifer interference activity as that which involves any of the following:

- the penetration of an aquifer;
- the interference with water in an aquifer;
- the obstruction of the flow of water in an aquifer;
- the taking of water from an aquifer in the course of carrying out mining or any other prescribed activity; and
- the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.

The WM Act defines an aquifer as a geological structure or formation that is permeated with water or is capable of being permeated with water. Active remediation of groundwater during the Project is not proposed; however as the Project would encounter groundwater in soils and rock under the Project Area, an aquifer interference approval for activities associated with groundwater management within excavations may be required. Groundwater from the Project Area is not considered suitable for beneficial reuse (including drinking water) based on the industrial setting of the Site. A search of groundwater bores within 500 m from the boundary of the Project Area found all registered bores were classified as monitoring bores. Potential impacts on groundwater are discussed in **Chapter 8 Soils, groundwater and contamination**. **Chapter 9 Surface water, wastewater and flooding** discusses wastewater management.

5.4.2 Protection of the Environment Operations Act 1997

The PoEO Act provides for the issue of an EPL for premises based scheduled activities pursuant to section 48 of the PoEO Act, and non-premises based scheduled activities pursuant to section 49 of the PoEO Act. Activities requiring an EPL are listed in Schedule 1 of the Act. An EPL can also be sought for an activity if discharges to waters are proposed which would otherwise constitute pollution of waters.

The Site holds two EPLs for various scheduled activities. EPL 570 applies to the majority of the Site and applies to the Western Area. It authorises and regulates the carrying out of two scheduled activities: waste processing; and chemical storage. It provides discharge and emission limits for a number of potential pollutants. It also prescribes reporting requirements for Viva Energy. The Project would be carried out in line with the conditions stipulated in EPL 570.

The Parramatta Terminal is 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 Project does not require the use of the Parramatta Terminal and therefore the conditions of EPL 660 do not apply to the Project.

Clause 15 of Schedule 1 lists 'contaminated soil treatment' as a scheduled activity. Contaminated soil treatment, means "*the on-site or off-site treatment of contaminated soil (including, in either case, incineration or storage of contaminated soil but excluding excavation for treatment at another site).*" The definition is the same as the definition for soil treatment works in Schedule 3 of the EP&A Regulation (refer to **Section 5.2.1**). Therefore, this clause applies to the Project.

Clause 16 of Schedule 1 lists 'contaminated groundwater treatment' as a scheduled activity. Contaminated groundwater treatment, is a scheduled activity "*if it has the capacity to treat more than 100 mega litres per year of contaminated water.*" Active remediation of groundwater during the Project is not proposed; therefore it is considered that this clause does not apply to this Project.

Following the completion of remediation works (Stage 3), the Western Area would be fully disconnected from the Clyde Terminal's WWTP. Prior to this occurring, stormwater and wastewater from the Western Area would be collected and discharged in line with EPL 570.

The Project would be considered a scheduled activity under the PoEO Act. As such the relevant EPL (EPL 570) would be varied to allow the remediation activities to occur. The EPLs for the Site are frequently amended, in consultation with the NSW Environment Protection Authority (NSW EPA), to ensure that the activities at the Site are appropriately managed. Any amendments required to EPL 570 as a result of the Project would be managed in consultation with the NSW EPA.

The PoEO Act also provides for the management of water, air and noise pollution and the control of wastes. These requirements would also need to be met and are discussed in **Chapter 8 Soils, groundwater and contamination**, **Chapter 9 Surface water, wastewater and flooding**, **Chapter 10 Air quality**, **Chapter 12 Waste management** and **Chapter 13 Noise and vibration**.

5.4.3 Protection of the Environment Operations (Waste) Regulation 2005

The *Protection of the Environment Operations (Waste) Regulation 2005* (PoEO Waste Regulation) sets out provisions for tracking certain wastes as they are transported throughout NSW and interstate. Some wastes managed by the Project, such as contaminated soils and asbestos, are likely to be identified under Schedule 1 of the PoEO Waste Regulation as being required to be tracked when transported off-site and disposed of.

These waste tracking requirements relate to record keeping that must be undertaken by consigners, transporters and receivers when these types of wastes are transported.

Regardless of whether it can be classified as a trackable waste under the PoEO Waste Regulation (this would depend on whether it is being transported interstate or not), asbestos waste is required to be securely packaged, be in a sealed container, be wetted down, or be covered in a leak-proof vehicle for transportation off-site (clause 42).

All wastes received or removed from the Western Area would be stored, transported and disposed of in accordance with PoEO Waste Regulation requirements and tracked via implementation of the Material Tracking Plan.

The management of wastes is discussed in further detail in **Section 4.5** and **Chapter 12 Waste management**.

5.4.4 Contaminated Land Management Act 1997

The overarching objective of the CLM Act is to establish a process for investigating and, where appropriate, remediating land that the NSW EPA has reason to believe is significantly contaminated so as to warrant regulation under the CLM Act.

Under section 60 of the CLM Act, an owner of land that has been contaminated (whether before or during the ownership of the land) must notify the NSW EPA that the land is contaminated where certain criteria are satisfied. Section 60 also states that a person whose activities have contaminated the land must notify the NSW EPA in writing.

Ground investigations completed to date have concluded that chemicals of potential concern (e.g. heavy metals, hydrocarbons, asbestos etc.) are variably present within soil and fill material at the Site.

The CLM Act establishes a process for investigating and remediating land areas where contamination presents a significant risk of harm to human health or some other aspect of the environment. Where land is identified as potentially contaminated, consultation with the NSW EPA should be undertaken.

On 22 June 2012, the NSW EPA issued a Preliminary Investigation Order under the CLM Act requesting reports on environmental contamination (sediment, soil, and water), data gaps and a proposed investigation plan. Following receipt of a number of reports and discussions with Viva Energy, in June 2016 the NSW EPA declared the Site, including the Western Area, as ‘significantly contaminated land’ under the CLM Act (Declaration number 20131110). At present, there is no Voluntary Management Proposal for any portion of the Site. Equally Viva Energy is not subject to a management order relating to the Site under the CLM Act.

Ongoing operations at the Site and associated management actions required to reduce potential impacts to human health or the environment as a result of contamination would continue to be regulated by the requirements of both the PoEO Act and the CLM Act.

Contamination within the Western Area is summarised in in **Chapter 2 Site context** and **Chapter 8 Soils, groundwater and contamination**.

5.4.5 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016 (NSW)* (BC Act) repealed the *Threatened Species Conservation Act 1995 (NSW)* and parts of the EP&A Act. The BC Act commenced on 25 August 2017.

The purpose of the BC Act is to maintain a healthy, productive and resilient environment for the greatest wellbeing of the community consistent with the principles of the ecological sustainable development in NSW.

The legislation change has resulted in a change to the method for biodiversity assessment for SSD from the former Framework for Biodiversity Assessment (OEH, 2014) to the Biodiversity Assessment Method (BAM) (OEH, 2017a). The Project has been assessed under the BAM. A summary of this assessment is provided in **Chapter 15 Biodiversity**.

5.4.6 Fisheries Management Act 1994

Part 7a, section 220A of the *Fisheries Management Act 1994 (NSW)* (FM Act) provides for the conservation of all biological diversity of aquatic and marine vegetation. It also ensures that the impact of any ‘action’ affecting threatened species, populations or ecological communities is appropriately assessed. No impacts on values protected by the FM Act are expected as a result of the Project. Potential impacts on aquatic and marine vegetation are discussed in **Chapter 15 Biodiversity**.

5.4.7 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993 (NSW)* provides for the identification and control of noxious weeds and specifies the duties of public and private landholders to control noxious weeds. The Act stipulates that an occupier of land must take steps to control noxious weeds on their land. The Act also provides for the monitoring of and reporting on the effectiveness of the management of weeds in NSW. Appropriate methods for controlling noxious weed species are defined under the control category or categories for particular species of weeds.

Management of noxious weeds within the Western Area as part of the Project would be managed via a Long Term Environmental Management Plan.

Potential impacts on biodiversity are discussed in **Chapter 15 Biodiversity**.

5.4.8 Heritage Act 1977

The *Heritage Act 1977 (NSW)* aims to promote an understanding, encourage conservation and provide for protection of NSW State heritage. State and/or local heritage significance can relate to historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values of a place, building, work, relic, moveable object or precinct.

Under Section 170 of the Heritage Act 1977, NSW Government agencies are required to maintain a register of heritage assets. The Register places obligations on the agencies, but not on non-government proponents, beyond their responsibility to assess the impact on surrounding heritage items. The Site is not listed on any Section 170 registers. Further a search of the State Heritage Register returned no results for within or adjacent the Western Area. Locally listed heritage items have been identified within the vicinity of the Western Area. Potential impacts on heritage have been assessed and are summarised in **Chapter 16 Historic heritage**.

5.4.9 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974 (NSW)* provides for the conservation of objects, places or features of significance to Aboriginal people. Desktop searches and previous investigations have indicated that there are no known Aboriginal sites or objects located within the Western Area.

Given the existing levels of disturbance within the Western Area, it is unlikely that any Aboriginal items remain in-situ and no impacts to Aboriginal heritage values are therefore anticipated during the removal of subsurface infrastructure and remediation activities. Potential impacts on Aboriginal heritage, including archaeological potential, have been assessed and are summarised in **Chapter 17 Aboriginal heritage**.

5.4.10 Roads Act 1993

Clause 138 of the *Roads Act 1993 (NSW)* states that consent is required from the relevant roads authority to carry out work in, on or over a public road, including digging up or disturbing the surface of a public road.

It is not anticipated that any changes to access or local roads would be required to accommodate traffic generated by the Project and therefore consent from the relevant roads authority is not required.

5.4.11 Work Health and Safety Act 2011

The *Work Health and Safety Act 2011* (WH&S Act) and its supporting Regulation 2017 (WH&S Regulation) defines Major Hazard Facilities (MHFs), regulates their operation and includes measures to prevent accidents occurring at MHFs. They also include specific provisions regarding the management of asbestos and asbestos containing materials (ACMs). The Clyde Terminal is classified as a MHF.

Any works to or modifications of a MHF need to be discussed with SafeWork NSW as the administrators of the WH&S Act. The Project would not occur within the part of the Site where the Clyde Terminal is located. Viva Energy regularly consults with SafeWork NSW regarding the Clyde Terminal and will continue to do so moving forward. However, as the Project would not affect the MHF, consent and approval of SafeWork NSW is not required.

The WH&S Regulation sets out the procedures for dealing with asbestos in the workplace, as well as the process of licensing certain personnel as official asbestos removalists. The Project is expected to yield a certain amount of asbestos waste, or waste materials containing asbestos. Viva Energy would abide by these regulations for dealing with asbestos waste. Issues regarding asbestos management are considered in **Chapter 8 Soils, groundwater and contamination** and **Chapter 12 Waste management**.

5.4.12 Environmentally Hazardous Chemicals Act 1985

The *Environmentally Hazardous Chemicals Act 1985 (NSW)* (EHC Act) provides the NSW EPA with the power to regulate the use of certain chemicals and chemical wastes in NSW by issuing Chemical Control Orders (CCOs). Two CCOs have been made by the NSW EPA under the EHC Act to control the use of Polychlorinated Biphenyl (PCB) materials and wastes and scheduled chemical wastes, which includes the management of such materials at the Clyde Terminal. The CCOs outline controls on the generation, processing, storing, conveying and disposal of PCB and scheduled chemical materials or wastes. Any PCB or scheduled chemical wastes generated as part of the Project above the limits provided in the CCOs would be managed according to the CCO.

The management of wastes is discussed in **Chapter 12 Waste management**.

5.5 Environmental Protection and Biodiversity Conservation Act 1999

Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)* (EPBC Act) states that an action which has, will have or is likely to have a significant impact on a matter of national environmental significance may not be undertaken without prior approval of the Commonwealth Minister for Environment, as provided for under the provisions of Part 9 of the EPBC Act. The EPBC Act identifies the following as matters of national environmental significance for which Ministerial approval is required:

- world heritage properties;
- national heritage places;
- wetlands of international importance (including Ramsar Wetlands);
- listed threatened species and ecological communities;
- listed migratory species protected under international agreements (e.g. CAMBA and JAMBA);
- protection of the environment from nuclear actions; and
- commonwealth marine areas.

The EPBC Act also protects the environment within which any action is proposed to be undertaken, or where an action will affect Commonwealth land.

The Project would not involve a nuclear action, is not expected to have a significant effect upon the health and viability of any migratory species listed under provisions of the Act, would not affect any World Heritage property, and would not affect any Commonwealth land or its environment.

Chapter 15 Biodiversity outlines that are several records of Commonwealth listed Vulnerable or Endangered flora and fauna within 500 metres (m) of the Western Area. The *Casuarina* dominated vegetation present on-site is listed as Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community. The Project Area has been designed to avoid potential impacts on this vegetation.

The records also include and the Green and Golden Bell Frog (listed as Vulnerable under the EPBC Act) which has been recorded approximately 100 m from the Project Area. The likelihood of this species being significantly impacted by the Project is also discussed in **Chapter 15 Biodiversity**.

The conclusions of the biodiversity assessment confirm that the Project would be unlikely to significantly impact ecological values considered to be matters of national environmental significance under the EPBC Act.

5.6 National Environment Protection (Assessment of Site Contamination) Measure 1999

The desired outcome of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended in 2013 (NEPC, 2013) (ASC NEPM) is to provide adequate protection of human health and the environment, where site contamination has occurred. The ASC NEPM provides a framework and criteria for site contamination assessments.

The ASC NEPM provides investigation and screening levels for commonly encountered contaminants, for different matrices (e.g. soil, groundwater and soil vapour) which are applicable to a range of generic land use scenarios. These include:

- Ecological investigation levels (EILs);
- Ecological screening levels (ESLs);
- Groundwater investigation levels (GILs);

- Health investigation levels (HILs);
- Interim soil vapour health investigation levels (interim HILs);
- Health screening levels (HSLs); and
- Petroleum hydrocarbon management limits (management limits).

The generic land use scenarios differ for each of the screening or investigation levels but generally include residential, open space/recreation and commercial/industrial.

The Project Area would be remediated to a commercial/industrial standard, as per the criteria given in the ASC NEPM. The criteria for the remediation activities are described in the Conceptual RAP (refer to **Appendix C**).

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6.0 Stakeholder engagement

6.1 Introduction and objectives

This chapter documents the consultation and stakeholder engagement that has been completed for the Project to date.

To guide effective consultation Viva Energy Australia Pty Ltd (Viva Energy) have developed an Approvals and Consultation Strategy (refer to **Appendix B**) which outlines how Viva Energy will approach stakeholder and community consultation for the Project to achieve the approvals required.

As part of the Approvals and Consultation Strategy consultation objectives were developed. These objectives are to:

- identify relevant stakeholders;
- provide clear communication about the scope of the Project;
- provide an understanding of the regulatory approvals and permitting process to facilitate undertaking the Project;
- seek information, feedback and local knowledge as input to the regulatory approval process;
- determine the key concerns held by regulators and the community; and
- proactively work with the community, regulatory agencies and the City of Parramatta Council (Parramatta Council) as part of the approvals process for the Project.

In addition, the SEARs also require that certain consultation takes place. The SEARs require Viva Energy to:

- *'consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.'*

The SEARs outline a number of key government stakeholders that should be consulted. These are identified in **Section 6.4**. The SEARs require that the Environmental Impact Statement (EIS) outline the issues that have been raised during the consultation process and indicate where in the EIS these issues are addressed. This summary is contained within **Table 6-2**.

A summary of the SEARs and where they have been addressed are presented in **Appendix A**.

Consultation will continue throughout the exhibition of the EIS, following approval (if granted) and during delivery of the Project.

6.2 Community consultation

Viva Energy has an existing relationship with the local community on the Camellia peninsula and has existing, established communication pathways. These pathways include:

- dedicated webpage for the Project[1]
- community updates on a range of matters relating to the Clyde Terminal, which are posted on the Viva Energy Clyde Terminal web page[2];
- 24 hour community hotline (including complaints line);
- general enquiry line; and
- email, phone and post pathways to provide comments and feedback.

[1] https://www.vivaenergy.com.au/about-us/terminals-and-refinery/clyde
[2] https://www.vivaenergy.com.au/about-us/terminals-shipping/clyde/community

Viva Energy has actively consulted with the local community and local businesses regarding the Project throughout the environmental assessment process. This consultation has been undertaken through the Viva Energy website and letter drop. Between the 10 November and 25 November 2018, Viva Energy mailed approximately 2,300 residents (bounded by Victoria Road to the north, Silverwater Road to the east, M4 Western Motorway to the south and James Ruse Drive to the west) to inform them about the Project. The mail drop footprint was formulated in consultation with the City of Parramatta Council and is consistent with the previous footprint utilised for the Clyde Terminal Conversion Project (State significant development (SSD) 5147) (the 'Conversion Project') community consultation process with the addition of new residential developments and residents from Silverwater based on noise assessment contours. No responses to this consultation exercise were received prior to finalising this EIS.

6.3 Aboriginal community involvement

A full program of Aboriginal community consultation was carried out as part of the Aboriginal Cultural Heritage Assessment for the Conversion Project (AECOM, 2013). This assessment, in consultation with the Registered Aboriginal Parties (RAPs), identified no specific cultural values for the Duck River frontage component of the Site. As the RAPs involved in the Conversion Project identified no specific cultural values on the Site, no further consultation with the Aboriginal Community has been undertaken for this Project.

6.4 Government agency consultation

Viva Energy has identified a number of government agencies that could be considered stakeholders for the Project. These government agencies are consistent with the government agencies identified in the SEARs.

Viva Energy has consulted with the following government agencies regarding the Project:

- the NSW Department of Planning and Environment (NSW DPE);
- the NSW Environment Protection Authority (NSW EPA);
- NSW Office of Environment and Heritage (NSW OEH);
- the NSW Department of Industry (NSW DI);
- the NSW Department of Health;
- Fire and Rescue NSW;
- SafeWork NSW;
- Roads and Maritime Services (Roads and Maritime);
- Port Authority of NSW;
- Greater Sydney Commission (GSC); and
- City of Parramatta Council.

These government agencies have been consulted with at various stages of the Project development and in a variety of forms. Details of the agencies consulted with and the type of consultation used is provided in **Table 6-1**.

Table 6-1 Summary of Government agency consultation activities undertaken

Government agency	Details of consultation	Timing of consultation
NSW DPE	• Meeting 14 September 2017: to discuss the approach to the Project, including the Conceptual RAP (**Appendix C**) • Meeting 21 May 2018[1]: Planning Focus Meeting, including project overview, site visit, planning pathway and process and environmental assessment scope and requirements	• Prior to preparation of the EIS • During preparation of the EIS
NSW EPA	• Meeting 17 October 2017: provided an introduction to the Project and an update on the status of the Site, EIS and Conceptual RAP • Meeting 1 May 2018: Provided an update on the Project regarding ground investigations and Conceptual RAP and development consent and EIA process • Meeting 21 May 2018: Planning Focus Meeting, including project overview, site visit, planning pathway and process and environmental assessment scope and requirements • Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required • Meeting 9 November 2018: Meeting with the NSW EPA Site Auditor to brief them on the Project • Meeting 20 November 2018: Meeting to brief the NSW EPA on the approach to the air quality impact assessment	• Prior to preparation of the EIS • During preparation of the EIS • During preparation of the EIS • During preparation of the EIS • During preparation of the EIS During preparation of the EIS
NSW OEH	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required • Ongoing consultation regarding approach to the Aboriginal heritage assessment for the Project	• During preparation of the EIS • During preparation of the EIS
NSW DI	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
NSW Department of Health	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
Fire and Rescue NSW	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
SafeWork NSW	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
Roads and Maritime	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
Port Authority of NSW	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS

Government agency	Details of consultation	Timing of consultation
GSC	• Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required	• During preparation of the EIS
Parramatta Council	• Meeting 21 May 2018: Planning Focus Meeting, including project overview, site visit, planning pathway and process and environmental assessment scope and requirements • Letter 6 September 2018: Letter was sent to provide an update on the Project and invite ongoing consultation, as required • Email 31 October 2018: confirming the footprint of proposed community engagement	• During preparation of the EIS

Note:
1 A number of Government agencies were invited to Planning Focus Meeting held on 21 May 2018; however the following agencies were an apology: NSW OEH, NSW DI, NSW Department of Health, Fire and Rescue NSW, SafeWork NSW, Roads and Maritime, Port Authority of NSW and GSC.

During consultation with the government agencies, various issues were raised relating to a variety of environmental aspects. The key issues raised by the government agencies has been summarised in **Table 6-2**.

Table 6-2 Key issues raised by the government agencies of where they are addressed in the EIS

Government agency	Key issues raised	Where addressed in the EIS
NSW DPE	• Asbestos and PFAS • Off-site material characterisation • Consultation	Conceptual RAP (**Appendix C**)
NSW EPA	• Waste management • General air and odour issues • Soil and groundwater contamination and assessment • Remediation of contaminated soil • Need for various management plans including for water, soil and erosion, groundwater, waste, acid sulfate soil, air quality and noise • Additional requirements for the Conceptual RAP • Considerations for the air quality impact assessment	The Conceptual RAP (**Appendix C**) was updated to address the comments provided by the NSW EPA at the various meetings noted in **Table 6-3**. These changes have influenced the assessments in the EIS. **Appendix E** was refined to address comments from the NSW EPA on the air quality impact assessment
NSW OEH	• Approach to Aboriginal heritage assessment was raised	Justification for approach provided in **Chapter 17** and **Appendix K**

Government agency	Key issues raised	Where addressed in the EIS
NSW DI	• Water, surface and groundwater resources • Aquatic ecosystems • Form of final landform	An assessment on the potential water impacts is provided in **Chapter 8 soils, groundwater and contamination** and **Chapter 9 Surface water, wastewater and flooding**. Potential impacts to groundwater dependent ecosystems are discussed in **Chapter 15 Biodiversity**. A description of the final landform is provided in **Chapter 4 Project description**.
NSW Department of Health	• No response provided	-
Fire and Rescue NSW	• No response provided	-
SafeWork NSW	• No additional issues raised	-
Roads and Maritime	• No response provided	-
Port Authority of NSW	• No additional issues raised	-
GSC	• No response provided	-
Parramatta Council	• Confirmed the footprint of community engagement	-

6.5 Ongoing or future consultation

6.5.1 Environmental Impact Statement exhibition

The development application and accompanying EIS will be placed on public exhibition by DPE for a minimum statutory period of 28 days. During the exhibition period any person may make a submission regarding the Project, and these submissions will be considered in the assessment of the development application. Submissions can be made online at http://majorprojects.planning.nsw.gov.au/ or in writing (citing development application number SSD 18_9302) and addressed to the planning officer listed below:

Department of Planning and Environment
Attention: Deana Burn
GPO Box 39
Sydney NSW 2001

During exhibition of the EIS, government agencies would be offered Project briefings and community information activities would be undertaken. During community consultation, the following is proposed:

- provide an overview of aspects of the Project that may potentially affect the community (i.e. traffic, dust etc.) and how these are proposed to be addressed; and
- an Information Session during exhibition of the EIS which will aim to inform the community of matters to be considered in the EIS and the approach to engagement and participation outcomes to be achieved.

6.5.2 Response to Submissions report

A Response to Submissions report will be prepared following the EIS exhibition period. This report will summarise the key issues raised by the community and government agencies and provide a response to these issues.

6.5.3 Close-out consultation

Following approval of the Project, if granted, Viva Energy would continue to engage with the community and government agencies. Consultation with the community would occur in accordance with a Community Consultation Plan which would be developed to guide ongoing community consultation during the execution of the Project. This would be included in the suite of remediation documentation as part of the Project Management Plan.

The Clyde Terminal webpage would remain accessible and continue to provide contact information, such as the 24 hour community (including complaints) hotline and instructions on how to provide comments or feedback.

The local Camellia community would be informed of the Project including projected timelines and potential impacts from planned works. Communications would continue to provide details of contact point(s) to which community complaints and enquiries may be directed, including a telephone number, a postal address and an email address.

Ongoing consultation with government agencies such as NSW DPE, NSW EPA and City of Parramatta Council would likely occur in the form of meetings, review of documents and other approvals (if required).

7.0 Environmental Scoping Assessment

7.1 Overview

This Environmental Impact Statement (EIS) documents a number of environmental assessments for the Project. These environmental assessments identify potential environmental impacts resulting from the Project and identify appropriate measures to manage or mitigate these impacts. The identification of potential impacts, and confirmation of appropriate assessment methodologies, is determined through a scoping process.

The scoping process for this Project was documented in the Viva Energy Clyde Western Area Remediation Project Preliminary Environmental Assessment (PEA) (AECOM, 2018a). The PEA provided an initial scoping assessment of the potential areas of environmental impact that the Project may have on the environment. Environmental aspects were considered based on previous similar projects, previous environmental studies undertaken at the Site and site-specific influences.

Following identification of environmental aspects to be considered in the EIS, potential issues were prioritised based on available details regarding the Western Area and the Project and in the general absence of potential mitigation measures.

The prioritisation of environmental aspects for the Project was based on the need to recognise that a higher degree of investigation and assessment is required for the aspects with the highest level of potential environmental or social risk.

The findings of the PEA are summarised below.

7.2 Summary of environmental aspects to be considered

The environmental aspects considered to be relevant to the Project include:

- soils, groundwater and contamination;
- surface water, wastewater and flooding;
- air quality and odour;
- human health;
- waste management;
- noise and vibration;
- traffic and transport;
- ecology;
- heritage (Aboriginal and non-Aboriginal);
- hazards and risk;
- land use and socio-economic; and
- visual amenity.

7.3 Prioritisation of potential issues

To understand the potential level of risk associated with each environmental aspect, a qualitative risk assessment was conducted and was documented in the PEA.

The analysis categorised levels of risk for a given event based on significance of effects (consequences) and the ability to manage those effects (likelihood). A prioritisation matrix was then developed and applied to identify whether the potential environmental or social risks associated with the Project would be considered to be High, Medium or Low prior to further detailed assessment. **Table 7-1** shows the prioritisation matrix used in the scoping assessment, this is further detailed in the PEA.

Table 7-1 Environmental aspects prioritisation matrix

		Consequence		
		Major	Moderate	Minor
Likelihood	Unlikely	Medium	Medium	Low
	Possible	High	Medium	Low
	Likely	High	High	Medium

This risk assessment aimed to prioritise issues for further assessment and generally did not consider the application of mitigation measures to manage environmental effects. In all cases, appropriate and proven mitigation measures, chosen based upon consultation with regulatory authorities and other similar projects would be used to minimise potential impacts.

The prioritisation of environmental aspects related to the Project is provided in **Table 7-2**. This assessment is based on the PEA, and generally presents the unmitigated risks. This table also explains where in the EIS the relevant assessment for each aspect can be found.

Table 7-2 Prioritisation of unmitigated environmental aspects

Environmental aspect	Risk	Location in the EIS
Key issues		
Soils, groundwater and contamination	Medium – High	**Chapter 8**
Surface water, wastewater and flooding	Medium – High	**Chapter 9**
Air quality and odour	Medium – High	**Chapter 10**
Human health risk	High	**Chapter 11**
Waste management	Low – Medium	**Chapter 12**
Noise	Low	**Chapter 13**
Traffic and Transport	Low	**Chapter 14**
Ecology	Medium	**Chapter 15**
Heritage	Low	**Chapter 16** and **17**
Hazards and risk	Medium	**Chapter 18**
Land use and socio-economic	Low	**Chapter 2 Site context** provides the land use and socio-economic context for the Project. In reviewing the SEARs and Project description, further assessment of land use and socio-economic impacts was determined not be required due to the temporary nature of the works, the industrial context around the Western Area and that no changes to the existing land use zoning is proposed.
Visual	Low	Not considered. In reviewing the SEARs and Project description, visual impacts were not considered to be a relevant environmental aspect. This is due to the nature of the works, the industrial setting of the Western Area and the distance to sensitive receivers which means that significant visual impacts are highly unlikely.

Note:

1 In the PEA heritage was assigned a risk rating of medium. The medium risk rating was based on the understanding that there was archaeological potential within the Western Area. Since the preparation of the PEA, a report by Australian Museum Consulting (AMC, 2015) was reviewed which concluded that, due to a combination of construction techniques and past disturbance within the identified areas of archaeological potential, *"there is no potential for significant relics to be present"*, and that no further assessment or investigation was required, As such, this rating has been reduced to 'low'.

7.4 Format of assessment chapters

A common format has been adopted for reporting each of the assessment chapters of the EIS. This is outlined below.

7.4.1 Introduction

This section provides an overview of the environmental aspect under consideration. It also provides cross-reference to other Technical reports or relevant appendices that have been used to inform the assessment chapter.

7.4.2 Scope of the assessments

This section outlines the relevant SEARs for the particular environmental aspect and explains how detailed key issues identified by government agencies have been considered and addressed.

7.4.3 Legislation and planning policy

Where required, this section outlines legislation, policies and plans relevant to the environmental aspect. Where appropriate, certain guidance may also be discussed. A review of legislation and policy relevant to the Project in general is considered in **Chapter 5 Statutory planning context**, so not all chapters will feature this section.

7.4.4 Method of assessment

This section summarises the methodology for:

- determining the existing environment relevant to the particular environmental aspect;
- conducting an assessment of the potential impacts of the Project in relation to the particular environmental aspect;
- determining whether these impacts are significant; and
- providing a suite of mitigation and management measures that would minimise and manage these impacts.

For each environmental assessment there is an explanation of the approach to identifying impacts and assessing whether a potential impact is likely to be considered significant. Assessments can either be quantitative (relying on criteria, standards and thresholds) or qualitative (using certain scientific material, but ultimately making decisions based on professional judgement).

7.4.5 Existing environment

This section describes the key components, characteristics and the status of the existing environment relevant to the environmental aspect. It also considers changes to the existing environment over the period of time that the Project takes place.

The key receptors for each assessment are identified and described in this section.

7.4.6 Impact assessment

This section identifies potential impacts of the Project on the sensitive receptors for the particular environmental aspect and evaluates the significance of the impact in accordance with the criteria detailed in the 'Method of assessment' section.

Impacts may be referred to either prior to (potential impact) or following mitigation (residual impact). In the 'Impact assessment' section all identified impacts are potential impacts.

Impacts can be considered:

- direct or indirect;
- adverse or beneficial; and
- significant, non-significant (negligible) or neutral.

Where existing criteria, guidance, environmental standards or assessment methodologies exist, the significance of an impact is based on that information. Where possible and/or necessary quantitative judgements about the significance of an impact is made using this information. Where no explicit guidance or information exists, qualitative judgements on the significance of an impact are made. Where qualitative judgements are required, some or all of the following impact characteristics are considered to understand its potential magnitude:

- extent – the area potentially affected by the impact;
- magnitude – the size or amount of the impact;
- duration – how long the impact is likely to last;
- frequency – whether the impact is continuous, brief or intermittent;
- timing – if the impact occurs at a particularly sensitive time; and
- permanence – whether the impact is permanent or temporary.

The judgement as to whether an impact is significant depends on the importance or sensitivity of the receptor (e.g. as defined by legislation, policy, standards or guidance) and the magnitude of the impact affecting it (as decided by quantitative or qualitative means). For the purposes of the 'Impact assessment' section of each assessment chapter all identified impacts are considered 'alone' and not cumulatively.

7.4.7 Mitigation

This section describes the mitigation and management measures that have been identified to avoid, reduce or compensate for the effects of significant impacts on the environment.

The mitigation hierarchy has been used to help identify mitigation and management measures for each of the technical assessments. Wherever possible, impacts have been firstly avoided where possible, then either reduced at source or at receptor where avoidance cannot be achieved, and finally either compensated or offset where avoidance or reduction is not possible or would not achieve practicable or acceptable levels of mitigation.

If mitigation and management measures are to be implemented through particular environmental management plans, then these are also discussed.

Once all of the measures are identified and described, this section also considers residual impacts that would remain following the application of the mitigation and management measures.

At the end of the mitigation chapter a summary is provided. This summary notes residual impacts and other relevant permits or licences that are required. It also provides a table summarising the mitigation and management measures for the Project.

The management and mitigation tables from all of the technical assessments are collated into a single table (Table 20-1) within **Chapter 20 Mitigation and management**.

7.4.8 Cumulative Impact Assessment

This section outlines a Cumulative Impact Assessment for the environmental aspect, if required, based on the identification of residual impacts in the Chapter. For further description on how cumulative impacts are considered, refer to **Chapter 19 Cumulative impacts**.

8.0 Soils, groundwater and contamination

8.1 Introduction

This Chapter presents a description of the soil, groundwater and contamination status within the Project Area. This description and assessment is based on information included in the Conceptual Remedial Action Plan (RAP) (refer to **Appendix C**) and identifies potential impacts to soil, groundwater and contamination as a result of the Project. Where impacts have been identified, mitigation and management measures are provided to avoid or minimise the potential impacts.

8.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 8-1**. **Table 8-1** also presents where in this chapter each of the requirements have been addressed.

Table 8-1 SEARs – soils, groundwater and contamination

SEARs	Where addressed
Water and soils:	
• A detailed description of baseline surface and groundwater conditions;	**Section 8.5** and **Chapter 9 surface water, wastewater and flooding**
• an assessment of the potential surface and groundwater impacts of the remediation works;	**Section 8.6** and **Chapter 9 surface water, wastewater and flooding**
• details of any required dewatering and management of contaminated groundwater;	**Section 8.7**
• volumes of surface and groundwater to be taken from each water source as defined by the relevant water sharing plan;	**Section 8.6** and **Chapter 9 surface water, wastewater and flooding**
• a detailed description of the mitigation and management controls that would be put in place to manage erosion and sediment, stormwater, groundwater and acid sulphate soils during and after remediation works; and	**Section 8.7** and **Chapter 9 surface water, wastewater and flooding**
• details of proposed surface and groundwater monitoring, including on-going and long-term management.	**Section 8.7** and **Chapter 9 surface water, wastewater and flooding**

The NSW Environment Protection Authority (NSW EPA), NSW Office of Environment and Heritage (OEH) and Department of Industry, also provided input to the SEARs. Where applicable to this Chapter, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

8.3 Legislation and planning policy

8.3.1 State legislation, policies and plans

Protection of the Environment Operations Act 1997

The Site (including the Western Area) operates under Environment Protection Licence number 570 (EPL 570) issued to Viva Energy Australia Pty Ltd (Viva Energy) under the *Protection of the Environment Operations Act 1997 (NSW).* The EPL licences various scheduled activities on the Site. It provides discharge and emission limits for a number of potential pollutants. It also prescribes reporting requirements for Viva Energy. The Project would be carried out in line with the conditions stipulated in EPL 570.

Soil and groundwater monitoring at the Clyde Terminal (i.e. prior to and outside the requirements of the Project) are regulated by Condition U1 of the EPL which outlines the reporting requirements of soil and groundwater monitoring and investigation activities. Viva Energy must annually submit to the NSW EPA a report which includes:

a. a summary of groundwater monitoring results for the previous 12 months;
b. details of any soil or groundwater investigations undertaken and the results of such investigations;
c. details of the progress against works proposed in the previous year's report;
d. an update of the conceptual site model (CSM) if conditions change significantly; and
e. an update of the Soil and Groundwater Monitoring Program (SGMP) if required.

These requirements are satisfied through the submission of a yearly Annual Progress Report to the NSW EPA. The 2017 version of the Annual Progress Report (ERM, 2017a) was used to inform this assessment on the potential impacts to soils, groundwater and contamination as a result of the Project.

Water Management Act 2000

The *Water Management Act 2000 (NSW)* (WM Act) establishes a framework for managing water in NSW. Section 91 of the WM Act requires a proponent to obtain an aquifer interference approval for activities that involve any of the following:

- the penetration of an aquifer;
- the interference with water in an aquifer;
- the obstruction of the flow of water in an aquifer;
- the taking of water from an aquifer in the course of carrying out mining or any other prescribed activity; and
- the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.

Active remediation of groundwater during the Project is not proposed; however the Project may require an aquifer interference approval or a water access licence for activities associated with groundwater management within excavations. This would be confirmed in consultation with the Department of Industry during the detailed design of the Project.

8.4 Method of assessment

This assessment involved a desktop review of existing information relevant to the Project Area, including previous investigations, historic site information, records of contamination and details of past contamination management/remediation activities.

The information presented in this section is primarily drawn from a review of the Conceptual RAP for the Project (refer to **Appendix C**) and associated reports including the Targeted Site Investigation (TSI) conducted by AECOM in April 2018 (AECOM, 2018b). Additional information has been drawn from Annual Progress Reports (e.g. ERM, 2017a), Quarterly Groundwater Monitoring Reports (e.g. ERM, 2017b) and the Clyde Terminal Conversion Project Environmental Impact Statement (AECOM, 2013).

As presented in the Conceptual RAP, the applicable criteria (i.e. Ecological Screening Levels (ESLs)) for the Project for the future commercial/industrial land use are outlined in the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, amended 2013 (ASC NEPM) (National Environment Protection Council (NEPC), 2013). ESLs applicable to the Project for commercial/industrial, coarse soil (for total recoverable hydrocarbon (TRH) fractions, benzene, toluene, ethylbenzene and xylenes (BTEX), benzo(a)pyrene, from 0 – 2 metres (m) depth) include:

- toluene: 135 milligram per kilogram (mg/kg);
- ethylbenzene: 165 mg/kg;

- xylenes: 180 mg/kg;
- benzo(a)pyrene: 0.7 mg/kg;
- benzene: 75 mg/kg;
- F1 (C_6-C_{10}): 215 mg/kg; and
- F2 (>C_{10}-C_{16}): 170 mg/kg.

The NEPC also identifies management limits for petroleum hydrocarbon compounds. Management limits are the maximum values that should remain in a site following evaluation of human health and ecological risks and risks to groundwater resources and apply to all soil depths based on site-specific considerations. Applicable management limits for the Project include:

- F1 (C_6-C_{10}): 700 mg/kg; and
- F2 (>C_{10}-C_{16}): 1,000 mg/kg.

The information in the Conceptual RAP was used to complete a qualitative impact assessment of the potential impacts of the Project related to soils, groundwater and contamination. A number of measures have been agreed to avoid or mitigate these potential impacts.

8.5 Existing environment

8.5.1 Topography

The Site and the surrounding general industrial area are located on the Camellia peninsula bounded by Parramatta River to the north and by Duck River to the south and east. The Western Area is considered to be generally flat and ranges from 2 – 4 metres Australian Height Datum (mAHD) in elevation, sloping gently towards the Duck River.

8.5.2 Soils

The Western Area is currently characterised by predominantly impermeable hardstand above layers of historical fill. Fill material was used extensively across the Site, including the Western Area, to raise and profile the low lying areas adjacent to the Parramatta River and Duck River. The fill has been described as a mixture of silt, clay and gravel with localised slag, furnace ash and concrete; typically less than 1 m thick but up to a maximum of 3 m in thickness in localised areas (ERM, 2012). The *Soils of the Sydney 1:100 000 sheet* (Chapman and Murphy, 1989) identified one soil landscape within the Project Area. This landscape is described in **Table 8-2**.

Table 8-2 Soil landscapes and characteristics at the Site (Soil Landscapes of the Sydney 1:100 000 Sheet)

Unit	Landscape type	Soil type	Limitations
Disturbed Terrain	Disturbed	Turfed fill areas commonly capped with up to 40 centimetres (cm) of sandy loam or up to 60 cm of compacted clay over fill or waste materials.	Dependent on the nature of the material. Mass movement hazard, unconsolidated low wet-strength materials, impermeable soil, poor drainage, localised very low fertility and toxic materials.

Soils are impacted by both lighter and heavier end petroleum hydrocarbons. The vertical extent of impact is typically within the uppermost 2 m, which typically comprises fill, silty gravels or silty clays. Available data indicate that there is a significant reduction in contaminant concentrations in deeper soils (> 3 metres below ground surface (mbgs)), which is likely due to the low permeability silty clays found at this depth reducing downward migration of contamination. Clay has been found to occur as shallow as approximately 0.5 mbgs and extends to at least 8 mbgs. This is discussed further in **Section 8.5.6**.

8.5.3 Geology

Shallow geology at the Site is comprised of Quaternary to Tertiary aged alluvial and estuarine sediments, which are underlain by mid-Triassic Minchinbury Sandstone and Ashfield Shale of the Wianamatta Group, overlying earlier mid-Triassic Hawkesbury Sandstone (NSW DMR, 1983).

The geology at the Site (including the Project Area) has been characterised through previous investigations, including a Targeted Site Investigation for the Project (AECOM, 2018b). These investigations have identified up to four separate horizons overlying the bedrock. These horizons are presented in **Table 8-3** below.

Table 8-3 Geological units within the Site

Thickness	Strata Unit	Description
< 3 m thick	Unit I	Fill: consists of poorly compacted silt, sand, clay and gravel with isolated areas of slag rubble, furnace ash and concrete. Fill was used across the Site to raise low lying swampy areas adjacent to tidal flats. Generally fill depth is less than 0.5 – 1 m with the maximum record depth approximately 3 m.
< 4 m thick	Unit II	Silty clay/clayey silt: Quaternary age estuarine and alluvial sediments typically consisting of silty clay and clayey silt with occasional sandy lenses and shall fragments. This unit is generally restricted to the area adjacent to the Parramatta and Duck rivers.
Variable thickness up to 20 m	Unit III	Clay: Tertiary alluvium comprised of red-brown stiff clay of medium to high plasticity. These clays generally grade into a clayey sand and gravel towards the base of the unit.
<2 m thick	Unit IV	Clay: Residual clay derived from the in-situ weathering of the underlying bedrock. Clay is mottled grey and brown and is of very stiff to hard consistency with a high plasticity.

Shallow sandstone has been identified in the middle of the Project Area at a depth of approximately 2.2 mbgs.

8.5.4 Acid Sulfate Soils

A review of the *Parramatta Local Environmental Plan 2011* (Parramatta LEP) Acid Sulfate Soil (ASS) Risk Maps was undertaken. The ASS Risk Maps categorise soils into five classes based on the risk of encountering ASS, with Class 1 being the highest risk and Class 5 being the lowest risk.

A review of the ASS Risk Maps for the Project Area identified:

- the south-eastern edge of the Project Area is classified as Class 2;
- an eastern portion of the Project Area is classified as Class 3; and
- the rest of the Project Area is classified as Class 4.

The ASS environment within the Project Area is shown on **Figure 8-1**.

ASS in each identified class within the Project Area is likely to be found in:

- Class 2 - below the natural ground surface;
- Class 3 - beyond 1 m below the natural ground surface; and
- Class 4 - beyond 2 m below the natural ground surface.

Any works extending to the zone where ASS is likely to be encountered, or resulting in lowering the water table to below this level would trigger the requirement for assessment and may require implementation of a management plan. It's important to note that the natural ground surface is located below areas of 'Fill', so ASS may be at greater depths than those outlined in the Parramatta LEP.

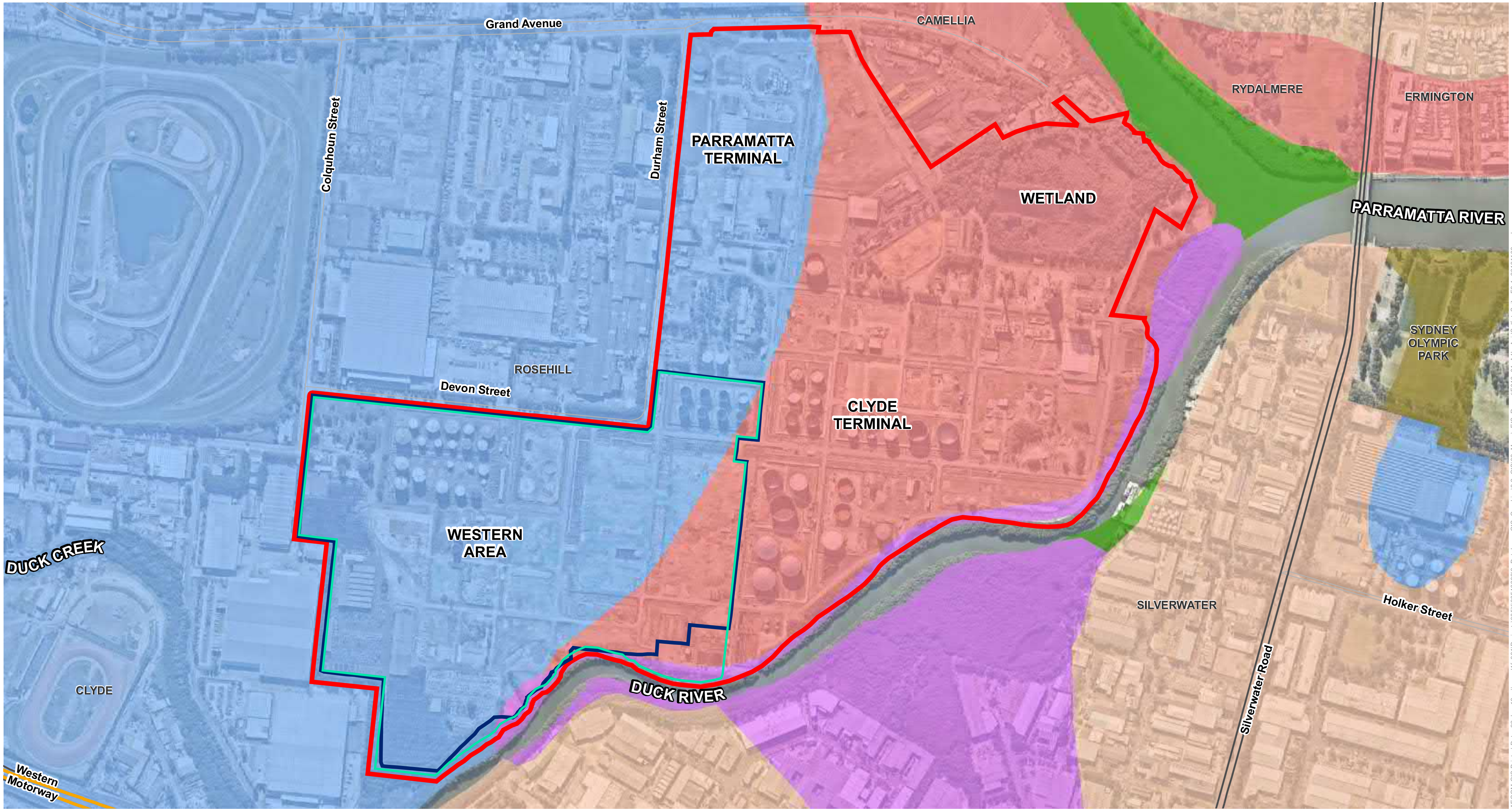

FIGURE 8-1: ACID SULFATE SOILS

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Motorway
- Primary road
- Local road

Soil Class

- Class 1
- Class 2
- Class 3
- Class 4
- Class 5
- Disturbed terrain

AECOM

0 100 200 300 m

8.5.5 Hydrogeology

Groundwater conditions within the Site are monitored through an established groundwater monitoring well network that includes wells in internal operational areas and adjacent to the Site boundary. A six-monthly groundwater monitoring program is implemented at the Site to assess the potential for off-site migration of hydrocarbon contaminated groundwater.

Fill material within the Project Area is generally limited to a permeable layer of approximately 500 millimetres (mm) in thickness overlaying a relatively impermeable layer of silty clays which limit the vertical and lateral infiltration and migration of surface water to the underlying groundwater system.

Groundwater is represented as a shallow unconfined aquifer within the estuarine-alluvial sediments at depths between 1 – 4 mbgs. Some variability in groundwater heights across the Project Area has historically been reported (ERM, 2012). The groundwater flow direction has generally been reported towards the south-east and east, following the riverbank contour of Duck River with some variation in the north-western and easterly boundaries of the Project Area showing a radial flow pattern.

Within the Project Area, sandy lenses, within the fill and estuarine units, and underground infrastructure are likely to create preferential pathways for groundwater flow. Hydrogeological data obtained from previous investigations indicates semi-confined conditions in the silts and sands at depths of approximately 4 – 8.5 mbgs. The hydraulic connectivity between the geological units is not fully understood, and previous investigations found no evidence of a deeper confined aquifer (refer to **Appendix C**).

Groundwater from the Project Area is not considered suitable for beneficial use (including drinking water) based on the industrial setting of the Site. A search of groundwater bores 500 m from the boundary of the Project Area found all registered bores were classified as monitoring bores. Historic assessments of on-site soil and groundwater impacts do not show evidence of off-site migration of groundwater impacts above the relevant adopted criteria (ERM, 2012; Shell letter to EPA (REF 170212 CTCP OEH Letter), 20 February 2012).

8.5.6 Contamination

8.5.6.1 Chemicals of potential concern

The long-term and historic use of the Site has resulted in contamination impacts to the soils and groundwater within this the Project Area. The current understanding of the nature and extent of the impacts within the Project Area is based on investigation works which were conducted between 1991 and 2018. Based on these investigations, chemicals of potential concern (COPC) within the Project Area include:

- total petroleum hydrocarbons (TPH)/TRH;
- BTEX;
- heavy metals;
- polycyclic aromatic hydrocarbons (PAHs);
- phenols;
- polychlorinated biphenyls (PCBs);
- tetraethyl lead; and
- per- and polyfluoroalkyl substances (PFAS).

Further, the Western Area’s historic use as a refinery means that other chemicals such as acids, ethanolamine, sodium hydroxide, and solvents may also be present in the Project Area’s drainage system.

There are also areas of buried waste/leaded sludges within the Project Area. Although not commonly detected in soil analytical data sets to date, there is also the potential for asbestos containing materials (ACM) within the Project Area.

8.5.6.2 TPH/TRH and BTEX

A summary of key TPH/TRH and BTEX contamination impacts are provided in this Section. The Conceptual RAP (**Appendix C**) provides further details.

Soil

Multiple soil impacts are present across the Project Area in the vicinity of previous operations. These impacts are predominantly within the former process areas within tank farms A1, A2, A3, C, H, and J, and also in the west of the Project Area in an area formerly leased to a third party for vehicle storage (refer to **Figure 8-2**).

Exceedances of the ESLs for commercial/industrial coarse soil are typically present shallower than 1 m in the north-west corner of the Project Area and exceedances of the management limits are typically present in the upper 2 m in the Tank Farm A2 area (refer to **Section 8.4**).

Groundwater

Light non-aqueous phase liquid (LNAPL) and Dissolved Phase Hydrocarbons are present in the groundwater in the Project Area. ERM conducted a statistical Mann-Kendall trend analysis as part of an Environmental Conditions Summary Report (ERM, 2012), which demonstrated that the groundwater impacts are stable or reducing.

Viva Energy undertakes groundwater monitoring within the Project Area and at the boundary of the Duck River. Monitoring well locations are shown on **Figure 8-2**. This monitoring has shown limited groundwater impacts at the Western Area boundary with Duck River. The only exception has been from monitoring well MW12/01 where LNAPL has been detected in the south-western portion of the Project Area. Dissolved phase concentrations in this area are highly attenuated and estimated to be an order of magnitude lower at the boundary, with attenuation likely to continue if impacts migrate off-site; degrading by approximately another order of magnitude prior to entering the Duck River (ERM, 2012).

Additionally, previous investigations have carried out plume analysis, which concluded that both the dissolved phase and LNAPL plumes in the Project Area are stable or decreasing and do not pose a significant residual risk to human health or ecological receptors (ERM, 2016).

LNAPL

LNAPL has been observed in thirteen separate locations within the Project Area at shallow depth, typically between 0.5 and 3 mbgs. Its lateral extent varies and is likely mostly present around the groundwater wells in the eastern side of the Project Area and at the southern end of the former leased area. Monitoring well locations are provided on **Figure 8-2**. The distribution of LNAPL in the vicinity of the drainage network is currently not confirmed.

8.5.6.3 Heavy metals

A range of heavy metals have been reported within the shallow soils and groundwater of the Project Area. These metals are typically at low concentrations and potentially associated with imported (previously impacted) fill materials. Detections in groundwater include lead, chromium, copper, nickel, and zinc. The levels of copper, nickel and zinc are representative of naturally occurring background levels. The key metals of potential concern for the Project Area include lead and chromium. These metals are discussed further below:

- Generally low trivalent and hexavalent chromium concentrations have been reported in a number of soil locations within the Project Area and have been detected in one groundwater monitoring well in the central Tank Farm A1 area. Previous investigations (ERM, 2012) reported that chromate (hexavalent chromium) was used in the cooling towers used in the Western Area until the mid-1990s as a corrosion inhibitor and biocide. While the source of the impact has not been confirmed, as trivalent and hexavalent chromium has not been detected in the other wells across the Project Area, the impacts are considered to be localised; and
- Low lead concentrations in soil have been reported across the Project Area. The lead impacts are possibly related to the historic placement/burial of lead impacted sludges in some areas. Lead concentrations in groundwater are generally low and are considered representative of background conditions.

The available lead and chromium in groundwater data suggests that heavy metals are not migrating onto the Project Area from adjacent sites on the Camellia Peninsula and there is no discernible increase in metal concentrations across the Project Area. Concentrations of heavy metals in groundwater are considered to be related to localised impacts on site.

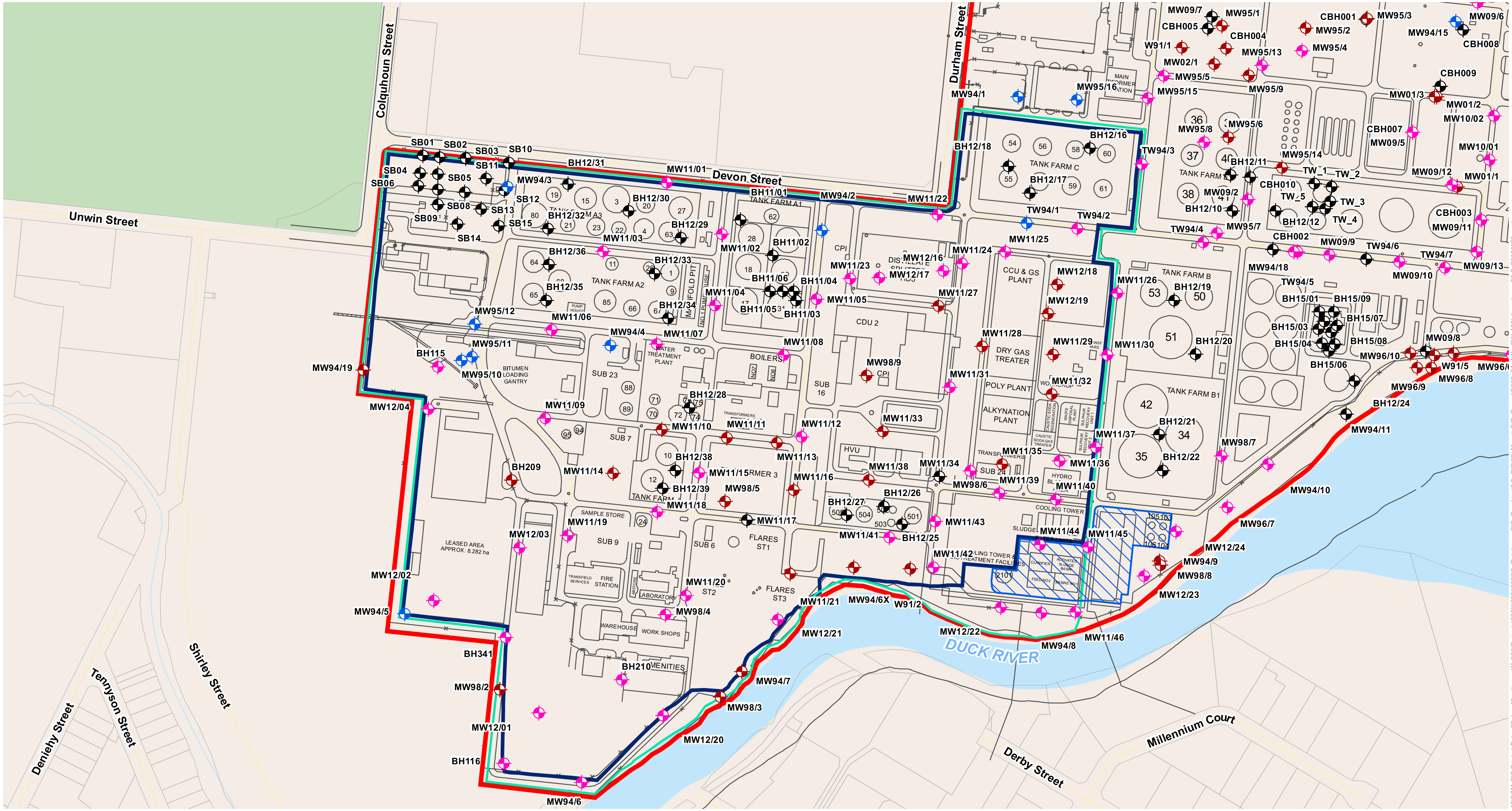

FIGURE 8-2: CLYDE REFINERY INFRASTRUCTURE AND GROUNDWATER MONITORING WELL LOCATIONS

AECOM

0 50 100 200 m

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Wastewater Treatment Plant (WWTP)
- Local road

Monitoring Wells

- Monitoring Well, Shallow
- Monitoring Well, Deep
- Lost/Destroyed Monitoring Well
- Other monitoring well/borehole

8.5.6.4 PFAS

Various aqueous film forming foam (AFFF) products which contain PFAS have been historically stored, handled and used at the Site during fire training exercises. The fire training area is situated outside of the Project Area (to the north-east).

Groundwater

The most recent groundwater data for PFAS from the Project Area includes targeted sampling undertaken by AECOM as part of the TSI in February 2018 (AECOM, 2018b) and sampling undertaken by ERM in June 2018 (ERM, 2018). From these investigations the concentrations of perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS) in the Project Area ranged from non-detect to 0.97 microgram per litre (µg/L) and for perfluorooctanoic acid (PFOA) from non-detect to 0.56 µg/L.

The concentrations reported in groundwater exceed the human health recreational values for PFOS/PFHxS of 0.7 µg/L (Heads of EPAs Australia and New Zealand (HEPA), PFAS National Environmental Management Plan, 2018) in three locations within the Project Area. Only one of the exceedances is from a monitoring well adjacent the Project Area's southern boundary (hydraulically down gradient).

The current industrial nature of the Project Area, the proposed commercial/industrial land use of the Western Area following the Project and the existing fishing restrictions on the Duck River[1] mean that PFAS in groundwater has not been considered further as a chemical of potential concern at this time due to the limited potential for human health risks.

Soils

Some soil sampling was conducted during the TSI (AECOM, 2018b) to target parts of the Project Area that were most likely to historically have handled products containing PFAS (namely sampling in the vicinity of the fire station in the south west portion) or areas which received waters that could have contained PFAS (namely the wastewater treatment plant (WWTP) areas). Maximum concentrations of the sum of PFOS/PFHxS was reported to be 0.001 mg/kg and PFOA was detected in one sample (0.0006 mg/kg).

The PFAS concentrations reported in soil are significantly below the human health commercial screening criteria for PFOS/PFHxS and PFOA (HEPA, 2018). The soil concentrations are also significantly below the HEPA (2018) interim soil ecological screening criteria for a commercial land use. As these concentrations are below both sets of criteria, PFAS in soil has not been considered further as a chemical of potential concern. In addition to this point, should PFAS contaminated soils be mobilised, the most likely pathway would be through dust emissions. These dust emissions would not present a risk noting that:

- NSW EPA (2017[2]) has previously stated that "*studies conducted by the NSW Government, in consultation with independent air quality experts, have found that the potential health risks posed by exposure to PFAS through air are not significant*" (noting that PFAS is not a volatile contaminant) and "*the health risk from exposure to PFAS via dust is low*"; and
- the inhalation of soil-derived dust is not considered to be a risk driving pathway for PFAS, with the dominant pathways being via ingestion of water and food produce.

Therefore the current targeted data set does not warrant consideration of PFAS as a COPC in soil (refer to the Conceptual RAP in **Appendix C** and the Human health risk assessment in **Appendix F**).

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[1] All methods of fishing are prohibited in the Duck River and Homebush Bay (NSW Department of Primary Industries, 2017).
[2] https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/community/williamtown-pfas-investigation-fact-sheet-air-monitoring.pdf

8.5.6.5 Drainage systems

Contamination within the formal drainage systems within the Western Area and the immediate surrounds have not been fully investigated at this stage. Anecdotal evidence indicates there are impacts in the drains/drain surrounds based on reported volumes of NAPL recovered during and post heavy rainfall events, such as:

- 60,000 L of crude after an East Coast Low (intense low-pressure weather system) in 2016; and
- 10,000 L of fuel was removed in 2017.

Skimming of the drains has been occurring since refinery operations ceased. In 2018, an exercise to remove LNAPL and sludge from the majority of drainage systems in the Western Area was undertaken.

The free phase and sludge associated with the drainage network would be a key component of the remediation works.

8.6 Impact assessment

8.6.1 Remediation (Stage 1 to Stage 5)

8.6.1.1 Soils and contamination

The Project aims to remediate predominantly hydrocarbon petroleum impacted soils and LNAPL to enable the future use of the land for permissible commercial/industrial development under the existing land use zoning. The Project also involves the ongoing management of impacted groundwater within the Project Area.

Investigations completed within the Western Area have shown that not all of the soil and groundwater within this area requires remediation or management. As such, the Project would involve the remediation of impacted soils and LNAPL, and the management of impacted groundwater within a number of targeted areas within the Project Area. As outlined in the Conceptual RAP (**Appendix C**) it is estimated that an in-situ total of 105,000 m^3 of contaminated soil would require remediation.

Remediation works would require the excavation and/or in-situ remediation of soils to a depth of up to 4 mbgs and would generally be focused on the top 2 m of the ground surface. The average depth of soil contamination, including LNAPL, is 2 mbgs.

Remediation activities, including biopiling, in-area soil mixing/landfarming and stabilisation/thermal desorption, would require the extensive movement and disturbance of contaminated soils within and around the Project Area. This movement of soils has the potential to result in the contamination of previously uncontaminated areas should unintentional spills or stockpiling occur outside of designated areas. In addition, the disturbance of soils during the Project has the potential to result in off-site impacts due to the mobilisation of sediment or via airborne dusts during high winds.

While there is the potential for asbestos to be present within the Project Area (refer to **Section 8.5.6**) it is anticipated to be limited to buried wastes. However, demolition waste has also been observed within the Project Area. As such, the management of asbestos in soils may also be required.

Due to localised impact of heavy metals on site and the non-volatile nature of these contaminants, the specific remediation of heavy metals (e.g. chromium, lead, etc.) is not anticipated to be required. The movement of heavy metal contaminated soils could potentially result in generation of dust or stormwater runoff resulting in the mobilisation of heavy metals. If mobilised, heavy metals could potentially result in adverse impacts to the surrounding community and/or aquatic environment. These potential adverse impacts would be mitigated by employing a number accepted soil, water and air quality controls during the works which would be detailed in the relevant Environmental Management Plans (EMPs) (refer to **Section 8.7**, **Section 9.7** and **Section 10.7**).

As noted in **Section 4.4.2.6**, where non-petroleum hydrocarbon chemicals of potential concern are present but cannot be treated through a particular remediation technology (e.g. due to their concentration, material/leaching characteristics and/or the presence of other chemicals of potential concern), the impacted soil would be managed off-site at an appropriately licenced facility. These chemicals of potential concern include heavy metals, PCBs, PFAS and asbestos.

Sludges present in on-site drainage infrastructure that are identified during the works would be separated, stored on-site and tested in accordance with the Detailed RAP to assess whether they could be remediated or treated on-site or whether they would be subject to off-site disposal. Due to the likely highly impacted nature of sludges from the drainage network, thermal desorption, stabilisation or off-site disposal would be the likely methods to be adopted.

As outlined in **Section 4.9**, various plant and equipment are required to complete the Project. The use of this equipment has the potential to result in unintentional additional contamination through spills and leaks of fuels and oils.

Environmental controls to avoid or mitigate these potential impacts and necessary monitoring requirements are discussed in **Section 8.7**.

8.6.1.2 Groundwater

As outlined in **Section 8.5.5**, groundwater within the Project Area is present at depths generally between 1 – 3 mbgs. Stage 2 and Stage 3 works would require excavation and/or in-situ remediation to a depth of up to 4 m and are therefore likely to intercept and expose potentially contaminated groundwater.

Existing groundwater monitoring data indicates that contamination plumes in the Western Area are stable and not posing a significant residual risk to human health or ecological receptors. Active remediation of groundwater is therefore not considered necessary to address residual petroleum hydrocarbon impacts in groundwater. Furthermore, it is anticipated that groundwater conditions are likely to improve further prior to, during and following Stage 2 and Stage 3 of the Project based on the following:

- Primary sources (e.g. above ground storage tanks) have or will be removed prior to the soil remediation commencing as part of the Clyde Terminal Conversion Project (SSD 5147), with the majority of remnant subsurface infrastructure (such as below ground pipework) to be removed during the Project.
- Shallow LNAPL impacts would be addressed as part of the Stage 2 and Stage 3 of the Project by the excavation of LNAPL impacted soil to the extent practicable. 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 WWTP for treatment and discharged in accordance with EPL 570.
- The soil and LNAPL 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).

The removal of existing infrastructure during Stage 2, including hardstand material within the Project Area, has the potential to result in increased infiltration of surface water within the Project Area. As outlined in **Section 8.5.5**, fill within the Project Area is generally limited to a permeable layer of approximately 500 mm in thickness overlaying relatively impermeable silty clays. This mitigates the vertical and lateral infiltration and migration of surface water to the underlying groundwater system. In addition, dissolved phase concentrations at the Project Area are highly attenuated and plume analysis indicates that both the dissolved phase and LNAPL plumes are stable or decreasing and do not pose a significant residual risk to human health or ecological receptors (ERM, 2016).

Excavations within the Project Area during Stage 3 would likely penetrate the relatively impermeable silty clays in areas. Runoff collected within bunded excavations would be transferred to the WWTP by temporary or existing infrastructure or would be collected and transported by vehicles (refer to **Chapter 9 Surface water, wastewater and flooding**). This would reduce the infiltration of surface water to groundwater by removing standing pools of water from within excavations. In addition, groundwater conditions would continue to be monitored to confirm the effectiveness of the controls being implemented. Mitigation and management measures are discussed further in **Section 8.7** and **Chapter 9 Surface water, wastewater and flooding**.

The Project Area is within the Sydney Basin Central Water Source of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011. The *NSW Aquifer Interference Policy* ((DPI, 2012) outlines the requirement for approval of 'aquifer interference activities' under the *Water Management Act 2000* (WM Act). As excavations and remediation activities would likely penetrate the aquifer associated with the Sydney Basin Central Water Source, an aquifer interference approval may be required under section 91 of the WM Act. This would be confirmed in consultation with the NSW Department of Industry. Additionally the pumping and removal of groundwater from excavations and subsequent treatment and discharge into the Duck River would involve the removal and movement of water from one water source to another and would therefore potentially require a water access licence under section 56 of the WM Act. It is understood that a water access licence, allowing for 'dewatering activities' would be required should groundwater extraction exceed 3 megalitres per year (ML/year), however rates of extraction are currently unknown and would be determined through further detailed design of the Project.

8.6.1.3 Acid Sulfate Soils

The Project would involve the excavation of contaminated soils to typically 2 mbgs with some areas extending to up to 4 mbgs. As described in **Section 8.5.4**, available mapping of ASS identified Class 2, Class 3 and Class 4 ASS within the Western Area and this is shown on **Figure 8-1**.

The majority of the Project Area is classified as Class 4 ASS where ASS is likely to be found beyond 2 mbgs and, as such, encountering ASS would be anticipated only in those excavations required below that depth.

The eastern portion of the Project Area is classified as Class 3 ASS where ASS is likely to be found beyond 1 mbgs. Remediation works within this area are therefore anticipated to result in the exposure of ASS. Isolated areas of Class 2 ASS are located in the southern portion of the Project Area where ASS may be present at surface level, however no excavation works are likely in these areas.

As outlined in **Section 8.5.4**, classes of ASS are based on the natural ground surface and such do not consider the fill layer which is present across the Project Area. This fill layer is present at varying depths across the Project Area and may result in ASS not being encountered until the fill layer has been excavated and works progress into the natural soils below.

Despite this, ASS are likely to be encountered. There is a risk of potential impacts to the nearby Duck River should surface water or groundwater come into contact with ASS and migrate into the river. Mitigation measures to manage this potential impact are provided in **Section 8.7**.

8.6.1.4 Imported soils

It is proposed that as part of the remediation works and in order to create the final landform within the Western Area, an additional 5,000 m^3 of off-site fill would be brought to the Project Area for remediation from other Viva Energy sites. In addition to this material, landforming works would likely require additional material to be brought to the Project Area to achieve the proposed surface levels. To ensure final fill material meets the required industrial standard, an extensive soil validation and analytical program would be undertaken of fill material prior to landforming activities commencing. Fill imported to the Project Area would require a NSW EPA specific Resource Recovery Order. The soils would be managed in line with this Order as well as a specific NSW EPA Accredited Site Auditor (Auditor) approved Validation Sampling and Analysis Quality Plan (SAQP), which would outline acceptance criteria, and sampling and analytical requirements. Once material is validated (using the criteria outlined in the Validation SAQP), the soil would be reused on-site under a NSW EPA approved Resource Recovery Exemption. This is discussed further in **Section 8.7**.

8.6.2 Ongoing operation

Following the completion of remediation and landforming works (Stage 3 and Stage 4), the Western Area would be fully disconnected from the Clyde Terminal's WWTP. Stormwater from the Project Area would be managed through overland flow, with appropriate erosion and sediment control measures employed. The final landform would include topsoil cover that meets the relevant commercial/industrial standards (refer to **Section 8.4**). The landform would also be managed with a suite of erosion and sediment control measures to further minimise potential erosion impacts to soils (refer to **Chapter 9 Surface water, wastewater and flooding**).

As the objective of the Project is to remediate contaminated soils within the Project Area to a level suitable for commercial/industrial land uses, it is expected that no significant contamination would remain within the Project Area. As remediation of groundwater is not a key driver of the Project, a passive approach to managing contaminated groundwater would be employed (refer to **Chapter 3 needs and alternatives considered**).

8.6.3 Summary

The key potential soils, groundwater and contamination impacts include:

- excavation of contaminated soil resulting in the exposure of acid sulfate soils having the potential to cause impacts to Duck River should surface water or groundwater come into contact with the ASS and migrate into the river;
- movement of and disturbance of contaminated soils around the Project Area resulting in the contamination of previously uncontaminated areas, including areas off-site through mobilisation of sediment or dust;
- spills and leaks of fuels and oils from plant and equipment resulting in unintentional additional contamination on-site and the potential for additional contamination to mobilise off-site;
- imported fill material not meeting the required industrial standard and causing additional contamination within the Project Area;
- excavations penetrating the impermeable silty clay layer leading to increased infiltration of surface water and therefore increased groundwater volumes and potential migration of contamination off-site;
- contamination of groundwater from contaminated soils, equipment, existing infrastructure, or leaks and spills;
- dewatering resulting in mobilisation of LNAPL or contaminated groundwater across the Site or to Duck River and associated riparian areas; and
- erosion impacts to soils (including new top soil) following completion of the Project.

8.7 Mitigation and management

8.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan (PMP), Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

Measures to address potential soil, groundwater and contamination impacts would be detailed in the REMP (in three sub-plans, refer to **Section 8.7.2**) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the ongoing operation. These plans would detail the environmental controls, mitigating measures, contingency measures and monitoring programs for during Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the soil, groundwater and contamination sub-plans, as well as the LTEMP are discussed in more detail in the following section.

Soil and groundwater monitoring at the Clyde Terminal is currently regulated by Condition U1 of EPL 570 (refer to **Section 8.3.1**) which outlines the reporting requirements of soil and groundwater monitoring and investigation activities. The submission of the yearly Annual Progress Report would continue for the operation of the Clyde Terminal following the completion of the Project. It is likely that the EPL would be modified to include the implementation of the Groundwater Monitoring Plan (GMP) for the Project, for a period of time as agreed with the Auditor, as discussed in **Section 8.6.2**.

8.7.2 Remediation

A REMP would be developed to manage potential impacts from contaminated soils and groundwater during the Project. The REMP would include a number of sections and sub-plans as required. The REMP and/or specific sub-plans may be updated periodically as the remediation works progress.

The REMP would include measures to minimise the potential impacts associated with contact with chemicals of potential concern and would include measures to mitigate or manage the human health and environmental risks associated with these activities.

Sub-plans to be included into the REMP would include:

- an Acid Sulfate Soils Management Plan (ASSMP) which would be prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines* (NSW Acid Sulfate Soils Management Advisory Committee, 1998) to guide the ongoing monitoring and management of ASS within the Western Area. The ASSMP would include:
    - measures to identify ASS impacted soils within the Project Area prior to undertaking excavation activities;
    - measures to manage ASS that need to be excavated from the Project Area in accordance with the *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014b); and
    - contingency measures to manage impacts that have the potential to occur if specified management strategies fail, and to outline remediation and restoration actions that may be required;
- a Soil and Water Management Plan (SWMP) that outlines:
    - erosion and sediment control requirements (developed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004) including:
        - the use of geotextile liners or temporary capping to reduce infiltration of surface water runoff;
        - installing silt fences around stockpiles to reduce erosion;
        - installing silt and sediment traps across stormwater drains in proximity to excavation areas;
        - placing stockpiles on impermeable sheeting to prevent infiltration, where possible; and
        - locating stockpiles away from council stormwater drainage systems;
    - control measures for the dewatering, storage, movement and treatment of groundwater encountered in excavations. This would include the following:
        - accumulated groundwater in excavated areas would be tested to confirm that it can be appropriately treated in the WWTP;
        - groundwater would be collected and sent to the on-site WWTP in accordance with the established Site wastewater management procedures and discharged in line with the requirements of EPL 570;
    - management measures required for the appropriate handling of soils containing asbestos;
    - requirement for inspection of erosion and sediment control structures;
    - potential chemical pollutants (e.g. fuels, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded areas to minimise the risk of spillages or mobilisation of these pollutants into soil and groundwater;
    - requirement for and location of spill kits for chemicals or fuels that could potentially be spilt or leak;
    - regular inspection of remediation equipment and plant to ensure leaks are minimised and rectified;

  - measures to remove incidental rainfall from bunded remediation areas and transfer it to the WWTP by the existing surface water system or via temporary pipeline;
  - requirements for monitoring of groundwater for the duration of the Project;
  - measure to require vehicles leaving the Project Area to utilise the wheel wash to reduce soil on roads, production of dust and the introduction of contamination to groundwater and/or the stormwater system. Maintenance requirements for the wheel wash would also be outlined; and
  - if significant impacts are identified below 4 mbgs (including LNAPL), an area-specific risk assessment would be prepared to assess the requirement for remediation (and/or management measures) and would be reviewed by the Auditor.
- A Validation Sampling and Analysis Quality Plan (SAQP) which would be prepared as required by Section 13.2 of the Conceptual RAP and would outline the validation criteria and testing requirements for the validation of remediated materials proposed for on-site reuse and for the acceptance of imported fill material to the Project Area.

Following the completion of the Stage 1 to Stage 5 works, a Validation Report would be prepared in accordance with the NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2011) and reviewed/approved by the Auditor, confirming that the Western Area is suitable for commercial/industrial land use. The Validation Report may include progressive validation reports for separate portions of the Western Area to enable progressive validation of these areas.

Additional measures regarding potential impacts on surface water during remediation are further discussed in **Chapter 9 Surface water, wastewater and flooding**. Further measures to manage erosion and dust generation are provided in **Chapter 10 Air quality**.

8.7.3 Ongoing operation

Following completion of Stage 1 to Stage 5 of the Project, the Western Area would be managed by a suite of sediment and erosion control measures to control surface waters, including vegetation. During this stage the activities would be undertaken in accordance with the LTEMP. This is detailed further in **Chapter 9 Surface water, wastewater and flooding**.

A GMP would be developed and implemented to confirm that natural attenuation processes are occurring for dissolved phase hydrocarbons in the Project Area. The GMP would be reviewed and approved by the Auditor as part of their review and approval of the LTEMP for the Project.

8.7.4 Summary

A summary of the REMP sub-plans, and mitigation and management measures to manage potentially contaminated soils and groundwater from the Project are outlined in **Table 8-4**. Additional measures regarding potential impacts on surface water, wastewater and flooding are further discussed in **Chapter 9 Surface water, wastewater and flooding**.

Table 8-4 Mitigation and management measures – soils, groundwater and contamination

Reference	Mitigation and management measures	Timing
SGC1	An Acid Sulfate Soils Management Plan (ASSMP) would be prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines* (NSW Acid Sulfate Soils Management Advisory Committee, 1998) to guide the ongoing monitoring and management of ASS within the Western Area. The ASSMP would include: • measures to identify ASS impacted soils within the Project Area prior to undertaking excavation activities; • measures to manage ASS that need to be excavated from the Project Area. These measures would be in accordance with the *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014b); and • contingency measures to manage impacts that have the potential to occur if specified management strategies fail, and to outline remediation and restoration actions that may be required.	Stage 1 to Stage 5
SGC2	A Soil and Water Management Plan (SWMP) would be prepared that outlines: • erosion and sediment control requirements (developed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004)) including: - the use of geotextile liners or temporary capping to reduce infiltration of surface water runoff; - installing silt fences around stockpiles to reduce erosion; - installing silt and sediment traps across stormwater drains in proximity to excavation areas; - placing stockpiles on impermeable sheeting to prevent infiltration, where possible; and - locating stockpiles away from council stormwater drainage systems; • control measures for the dewatering, storage, movement and treatment of groundwater encountered in excavations. This would include the following: - accumulated groundwater in excavated areas would be tested to confirm that it can be appropriately treated in the Wastewater Treatment Plant (WWTP); and - groundwater would be collected and sent to the on-site WWTP in accordance with the established Site wastewater management procedures and discharged in line with the requirements of EPL 570; • management measures required for the appropriate handling of soils containing asbestos; • requirement for inspection of erosion and sediment control structures; • potential chemical pollutants (e.g. fuels, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded and lined areas to minimise the risk of spillages or mobilisation of these pollutants into soil and groundwater; • requirement for and location of spill kits for chemicals or fuels that could potentially be spilt or leak; • regular inspection of remediation equipment and plant to ensure leaks are minimised and rectified; • measures to remove incidental rainfall from bunded remediation areas and transfer it to the WWTP by the existing surface water system or via temporary pipeline;	Stage 1 to Stage 5

Reference	Mitigation and management measures	Timing
	• requirements for monitoring of groundwater for the duration of the Project; • measure to require vehicles leaving the Project Area to utilise the wheel wash to reduce soil on roads, production of dust and the introduction of contamination to groundwater and/or stormwater system. Maintenance requirements for the wheel wash would also be outlined; and • if significant impacts are identified below 4 mbgs (including LNAPL), an area-specific risk assessment would be prepared to assess the requirement for remediation (and/or management measures) and would be reviewed by the NSW EPA accredited Site Auditor (Auditor).	
SGC3	Validation Sampling and Analysis Quality Plans (SAQPs) would be produced alongside the detailed RAP that outline the requirements for the validation of remediated materials proposed for on-site reuse and for the acceptance of imported fill material to the Project Area.	Stage 1 to Stage 5
SGC4	Following the completion of the Stage 1 to Stage 5 works, a Validation Report would be prepared in accordance with the New South Wales (NSW) Environment Protection Authority (EPA) Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2011) and reviewed/approved by the Auditor, confirming that the Western Area is suitable for commercial/industrial land use. The Validation Report may include progressive validation reports for separate portions of the Western Area to enable progressive validation of these areas.	Stage 1 to Stage 5
SGC5	The LTEMP would include a Groundwater Monitoring Plan (GMP) to be implemented to confirm that natural attenuation processes are occurring and residual hydrocarbon concentrations are not posing a human health or ecological risk. It would also include management of residual contaminated materials (as and if required).	Ongoing operation

It is concluded that with implementation of measures within the three REMP sub-plans described above and the LTEMP, the Project is expected to have no significant residual adverse impact on the soils and/or groundwater within the Western Area and is likely to have a beneficial impact on soils and groundwater overall.

Nevertheless a negligible residual adverse impact could potentially occur (e.g. through cross contamination of soils in the Project Area, through minor groundwater flows or small amounts of contamination mobilised through dust off-site).

The Project aims to remediate the Western Area to a commercial/industrial standard, thus addressing the contamination risks from the Project Area for the permissible land uses. Following completion of the Project, the final landform would be managed to minimise potential infiltration and erosion impacts. Notwithstanding this, monitoring of groundwater conditions within the Western Area (via implementation of a GMP) would continue to occur for a period agreed with the Auditor.

9.0 Surface water, wastewater and flooding

9.1 Introduction

This chapter provides a summary of the surface water, wastewater and flooding assessment undertaken for the Project. The detailed surface water, wastewater and flooding assessment was prepared by AECOM and is provided in **Appendix D**.

9.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 9-1**. **Table 9-1** also presents where in this chapter each of the requirements have been addressed.

Table 9-1 SEARs – surface water, wastewater and flooding

SEARs	Where addressed
Water and soils: • a detailed description of baseline surface and groundwater conditions;	**Section 9.5** and **Chapter 8 Soils, groundwater and contamination**
• an assessment of the potential surface and groundwater impacts of the remediation works;	**Section 9.6** and **Chapter 8 Soils, groundwater and contamination**
• justification (including data, assumptions and methodology) for proposed pollution control works;	**Sections 9.6, 9.7** and **Appendix D**
• details of treatment systems to ensure all discharges comply with the *Protection of the Environment Operations Act 1997*, avoid contaminated water entering Duck River and neighbouring premises and demonstrate the works will avoid harm to marine vegetation adjacent to the Site;	**Section 9.7** and **Appendix D**
• details of licensing requirements including the proposed location of discharge points presented on a plan;	**Section 9.5.2**
• volumes of surface and groundwater to be taken from each water source as defined by the relevant water sharing plan;	**Section 9.6** and **Chapter 8 Soils, groundwater and contamination**
• a detailed description of the mitigation and management controls that would be put in place to manage erosion and sediment, stormwater, groundwater and acid sulphate soils during and after remediation works;	**Section 9.7** and **Chapter 8 Soils, groundwater and contamination**
• details of proposed surface and groundwater monitoring, including on-going and long-term management; and	**Section 9.7** and **Chapter 8 Soils, groundwater and contamination**
• a flood impact assessment and consideration of the effects of coastal hazards.	**Section 9.6.1.4**

The NSW Environment Protection Authority (NSW EPA), NSW Office of Environment and Heritage (OEH) and Department of Industry, also provided input to the SEARs. Where applicable to this chapter, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

9.3 Legislation and planning policy

To assess the impacts of the Project on surface water, wastewater and flooding, the following relevant legislation, guidance and standards were considered.

9.3.1 State legislation, policies and plans

Water Management Act 2000

The *Water Management Act 2000* (*NSW*) (WM Act) establishes a framework for managing water in NSW. The Site and Western Area are within the jurisdiction of the Water Sharing Plan for the *Greater Metropolitan Region Groundwater Sources 2011* and the *Greater Metropolitan Region Unregulated River Water Sources Water Sharing Plan 2011*. **Section 5.4.1** further describes the purpose of the WM Act.

Protection of the Environment Operations Act 1997

The Site holds two environment protection licences for various scheduled activities. NSW Environment protection licence number 570 (EPL 570) applies to the majority of the Site and applies to the Western Area. It authorises and regulates the carrying out of two scheduled activities: waste processing; and chemical storage. It also contains a number of conditions in relation to the discharge and management of water. Licenced discharge point NSW EPA Identification number (EPA ID No.) 1 (Biotreater effluent discharge) is most relevant to the Western Area because during Stage 1 to Stage 5 of the Project surface water would continue to discharge via this point after treatment within the WWTP. Other licenced discharge points are not impacted by the Project. The licenced discharge points for the Site, including discharge point EPA ID No. 1 are shown on **Figure 9-1**[1].

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The Western Area falls within the boundary of the ‘Foreshore and Waterways area’ and is therefore subject to the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Harbour SREP). The Sydney Harbour SREP outlines a number of planning principles for the Foreshore and Waterways area and requires that these principles are considered, and where possible, achieved for environmental studies and masterplans.

The Sydney Harbour SREP designates certain parts of the Western Area adjacent to the Duck River as a ‘Wetlands Protection Area’ (refer to **Figure 5-1**). This designation requires that a number of ‘matters’ are taken into consideration by the consent authority prior to granting development consent under Part 4 of the *Environmental Planning and Assessment Act 1979 (NSW)*. These considerations are provided in **Section 5.2.3**.

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[1] Licenced discharge point EPA ID No. 2 is located in close proximity to discharge point EPA ID No. 1; however this discharge point EPA ID 2 is considered to not be impacted by the Project as it is an emergency discharge point, separate from discharge point EPA ID No. 1 and relates to the Clyde Terminal.

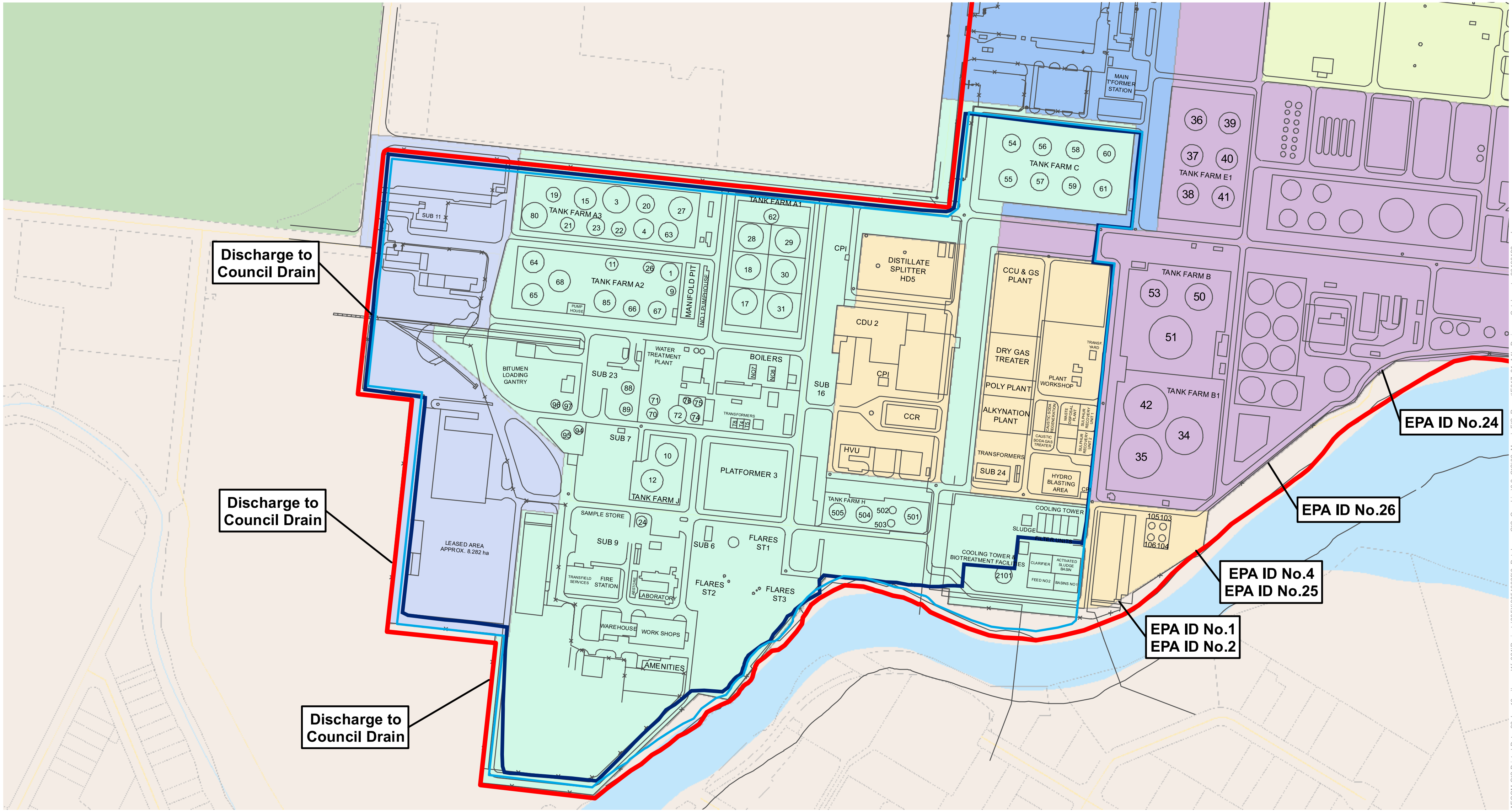

FIGURE 9-1 - LICENCED DISCHARGE POINTS AND DRAINAGE CATCHMENT AREAS

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Local road

Catchment Areas

- Catchment Area 2
- Catchment Area 3
- Catchment Area 4
- Catchment Area 5
- Catchment Area 6
- Catchment Area 7

AECOM

0 50 100 200 m

State Environmental Planning Policy (Coastal Management) 2018

The *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) outlines four 'coastal areas' which aim to promote an integrated and coordinated approach to land use planning in coastal areas in a manner consistent with the objects of the *Coastal Management Act 2016* (*NSW*). Parts of the Western Area adjacent to the Duck River fall under three of the four coastal areas. These areas consist of (refer to **Figure 5-2**):

- Coastal wetland and littoral rainforests area;
- Coastal environment area; and
- Coastal use area.

Specific requirements for consideration by the consent authority within each coastal area are provided in **Section 5.2.4**.

Parramatta Local Environmental Plan 2011

The southernmost boundary of the Western Area falls within an area designated as Riparian Land and Waterways in the Parramatta Local Environmental Plan 2011 (Parramatta LEP). Assessment of the Project therefore requires consideration of potential adverse impacts of the Project on receiving waters as outlined in Clause 6.5 of the Parramatta LEP. Relevant considerations of the Parramatta LEP are provided in **Section 5.2.6**.

9.3.1.1 Parramatta Development Control Plan 2011

As outlined in **Section 5.2.2**, Development Control Plans (DCPs) are not directly applicable to the Project; however, for certain aspects, where appropriate, the Project has considered the Parramatta Development Control Plan 2011 (City of Parramatta Council, 2011) (Parramatta DCP).

Appendix 7, Water Sensitive Urban Design (WSUD) and Parramatta River Estuary Coastal Zone Management Plan (Cardno, 2013) of the Parramatta DCP adopts the Sydney Metropolitan Catchment Management Authority's recommended stormwater pollution reduction targets (SMCMA, 2011). **Table 9-2** outlines the stormwater pollution reduction targets that could be applied to the Project.

Table 9-2 **Stormwater pollution reduction targets – Parramatta Development Control Plan**

Stormwater pollutant	Pollution reduction targets
Gross Pollutants	90%
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	40%

These stormwater pollution reduction targets in the Parramatta DCP have been used to assess the pollution reduction compliance of the proposed final landform. They provide a benchmark for industry practice.

The New South Wales Wetlands Policy

The *New South Wales Wetlands Policy* (DECCW, 2010) (the Wetlands Policy) identifies the role of vegetation buffers in helping to combat the effects of climate change and associated sea level rise on wetlands themselves. To support protection of wetland areas, the Wetlands Policy outlines the principle of 'no net loss' for developments in areas containing wetlands. The *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012) further explains that for third order streams such as Duck River, an ideal riparian buffer zone is 30 m.

The Project has been reviewed against the Wetlands Policy and the *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012) (Refer to **Section 9.6.1**).

Duck River Catchment Floodplain Management Study and Plan

The Duck River Catchment Floodplain Risk Management Study (Molino Stewart, 2012a) and subsequent Duck River Catchment Floodplain Risk Management Plan (Molino Stewart, 2012b) do not include specific management measures for application for the Project. However, the study and plan provide general floodplain management measures relevant to the areas surrounding the Duck River. This includes maintaining the riparian vegetation on the Duck River. The Project has been designed to avoid direct and indirect impacts to this vegetation.

9.4 Method of assessment

The assessment is predominantly qualitative in nature; however some quantitative data has been used where applicable. This assessment has been informed by:

- a review of legislation, guidance and standards relevant to the Project Area;
- a review of existing information about the Project Area; and
- a site visit.

9.4.1 Existing environment

The existing surface water, wastewater and flooding environment as described in the Clyde Terminal Conversion Project Environmental Impact Statement (EIS) (AECOM, 2013) was used, in part, as the basis for describing the existing environment for this assessment. The following documents were also reviewed to inform this description:

- Parramatta River Catchment Group: Strategic Analysis of Water Quality in the Parramatta River Technical Analysis (Jacobs, University of NSW, 2016);
- Parramatta River Catchment Group: Parramatta River Catchment Ecological Health Project (CT Environmental, 2016);
- Flood Assessment for the Proposed Benzene Reduction Unit (SKM, 2004) (SKM Flood Assessment);
- Duck River and Duck Creek Flood Study Review: Final Report (WMA, 2012) (WMA Final Report). This assessment included an assessment of the possible effects of climate change in accordance with the *Floodplain Risk Management Guideline – Practical Consideration of Climate Change* (DECC, 2007);
- Shell Clyde Terminal Conversion SSD 5147 Flood Assessment Report (WMA Water, 2016);
- City of Parramatta Duck River and Duck Creek Flood Study (WMA Water, 2012);
- City of Parramatta, Auburn City Council, Blacktown City Council Duck River Catchment Floodplain Risk Management Study (Molino Stewart, 2012);
- City of Parramatta, Auburn City Council, Blacktown City Council Duck River Catchment Floodplain Risk Management Plan (Molino Stewart, 2012);
- Camellia Precinct – Drainage and Flooding Study Stage 2 Report (Cardno, 2015); and
- City of Parramatta Development Control Plan 2011 Appendix 7 Water Sensitive Urban Design (WSUD), Parramatta River Estuary Coastal Zone Management Plan (Cardno, 2013).

9.4.2 Impact assessment

Surface water and wastewater

To determine potential impacts resulting from Stage 1 to Stage 5 of the Project, the concept design was reviewed (refer to Conceptual Remedial Action Plan in **Appendix C**), taking into account the ability of the existing controls within the Western Area to manage the existing surface water and wastewater. The predicted impacts of the Project were then derived.

To determine the potential impacts of the Project following the development of the final landform, and during ongoing operation, estimates were made of the existing surface water discharges and the potential surface water discharges from the final landform using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) modelling. MUSIC predicts the quality of stormwater runoff from catchments with various land uses and was used to predict stormwater pollutant reductions for the Western Area following completion of Stage 4 of the Project.

This modelling was then used to assess whether the Project aligned with the Parramatta DCP pollution reduction targets (as a benchmark) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality[2] (ANZECC, 2000).

Potential surface water and wastewater impacts on neighbouring properties were also considered.

Water use

Water use has been estimated for the Project, and compared to the water use during the operation of the Clyde Refinery and Clyde Terminal to determine if sufficient potable water would be available.

Flooding and coastal processes

Detailed flood modelling has not been undertaken; however an assessment of the likely impacts of the Project during Stage 1 to Stage 5, as well as during operation, on flood levels within Duck River has been made based on the flood extents and depth indicated in the recent Shell Clyde Terminal Conversion SSD 5147 Flood Assessment Report (WMA Water, 2016).

The following factors have been considered to predict potential impacts to flood levels in Duck River as a result of the Project:

- the potential reduction of the 1% Annual Exceedance Probability (AEP) cross sectional area which may reduce flow conveyance; and
- loss of floodplain storage within the Western Area.

An assessment of the floodplain storage provided within the Western Area, during the Project and following completion of the Project (operation) was made by approximating the flood area and flood depth to determine a flood volume.

To consider the impact of the Project on coastal hazards, MUSIC modelling was used to predict the total average annual volumetric runoff during the Project. A comparison was made to determine the total reduction in runoff volume and pollutant loads to determine if the Project would lead to a reduction in estuary water quality resulting from increased sediment or nutrient loads. Furthermore, preliminary hydraulic calculations were undertaken to assess likely flow velocities to determine if changes in flow velocities may result in embankment degradation. Sea level rise has also been considered.

9.5 Existing environment

9.5.1 Parramatta sub-catchment

The Site is located at the confluence of the Duck and Parramatta rivers, within the Parramatta River sub-catchment, one of eight sub-catchments in the Sydney catchment. The Parramatta River is a fourth order stream and the main tributary of Sydney Harbour, extending from Blacktown Creek in the west to the confluence of Lane Cove River in the east. Duck River is a third order perennial stream and southern tributary of the Parramatta River and ranges from 2 – 4 m Australian Height Datum (AHD) in elevation.

The Parramatta River is one of the most urbanised catchments in Australia. Historical land uses have highly modified the river and its banks, with a range of sediments and pollutants entering the watercourse which have impacted on water quality and habitat values.

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[2] The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC, 2000) outline the water quality objectives and long-term goals to be considered when assessing the impact of proposed developments on the surrounding water catchment and receiving waters. These are long term attainment goals for urban development areas. As part of the process to meet these goals, criteria such as those in Parramatta DCP (**Table 9-2)** are being adopted and implemented by councils and other public bodies.

There are currently a number of environmental concerns with regards to the general health of the Parramatta River sub-catchment including turbid water, sickness from primary contact with the water, excessive algal and weed growth, unhealthy fauna, gross pollutants in waterways, oil and grease presence in the water and loss of creek habitats including vegetation and fauna shelters.

Table 9-3 details the factors affecting water quality of the Parramatta River sub-catchment between 1990 and 2007. Subsequent studies (Jacobs, University of NSW, 2016) have shown similar results.

Table 9-3 Factors affecting water quality in the Parramatta sub-catchment between 1990 and 2007 (Laxton et al, 2008 and NGH, 2009)

Environmental factor	Impact on water quality
Nitrogen and phosphorous presence	Nitrogen and phosphorous concentrations in the Parramatta River range between 0.5 – 2 milligrams per litre (mg/L) and 0.05 – 0.25 mg/L respectively. High nutrient concentrations have resulted in increases in weed and algal growth. There were wide fluctuations of nutrient levels in all the water bodies sampled between 1992 and 2002.
Turbidity	During wet weather, turbidity within the Parramatta River is considered to be poor. Water clarity was generally higher than usual in tidal sections of the upper Parramatta and Duck rivers.
Faecal coliforms	Levels are generally safe for secondary contact during dry weather, but conditions are unsafe during wet weather due to significant sewer overflows.
Sediment	Sediment levels are higher than what would be expected in a natural system.
Oils	Oil concentrations are considered to be significant as a result of uncontrolled runoff from many roads and hardstand areas.
Heavy metals	Heavy metal concentration is not considered to be detrimentally affecting water quality; however, levels are up to 12 times higher than acceptable limits in bottom sediments.

Available studies however provide little information on the water quality within Duck River. The Jacobs report (Jacobs University of NSW, 2016) does however contain the observation that contaminated stormwater enters the Duck River from the Silverwater Industrial Estate. The Duck River is described as highly eutrophied based on elevated Chlorophyll-a due to the highly industrialised and urbanised catchments.

9.5.2 The Site and Western Area

Site catchments

The Site is divided into seven catchment areas based on the need for various water capture and processing infrastructure. These seven catchment areas are detailed in **Table 9-4** and shown on **Figure 9-1**. The Western Area and Project Area primarily comprise Catchment areas 4, 5 and 6. Two small sections of Catchment 3 and Catchment 7 also fall within the Western Area. These areas would be incorporated into the Western Area through removal of infrastructure during Stage 2 of the Project. This would isolate these areas from the Clyde Terminal catchments.

Table 9-4 The Site catchment areas

Area No.	Description
1	Encompasses the Parramatta Terminal.
2	In the north-eastern section of the Site, bordering the Parramatta River. It includes some areas that are currently under lease to third parties.
3	In the south-eastern section of the Site, adjacent to Duck River. It contains the majority of the Clyde Terminal infrastructure.
4	Two select areas in the mid-section of the Western Area.
5	The bulk of the western section of the Site, where refinery related infrastructure has been demolished, and where a future land use has yet to be established. Catchment area 5 is bounded by Duck River in the south.

Area No.	Description
6	The westernmost section of the Terminal, containing land that was previously leased. It is also an area where refinery related infrastructure has been demolished to make way for future land use.
7	Contains Viva Energy's NSW State Office Car Park and related infrastructure.

Water management infrastructure and monitoring

The Site has been heavily modified through the historical use of fill. A significant portion of the Site is sealed and an extensive above and below ground surface water drainage network is present across the Site (refer to **Figure 9-2**). Accidentally Oil Contaminated (AOC) and Continually Oil Contaminated (COC) drainage systems direct water from various locations around the Site to the on-site wastewater treatment plant (WWTP) for treatment before release at discharge points in accordance with EPL 570 (refer to **Figure 9-1**).

As outlined in **Section 9.3.1** licenced discharge point EPA ID No 1 is relevant to the Western Area. Wastewater is treated in the biotreater system and discharged via licenced discharge point EPA ID No 1.

During significant rainfall events, excess stormwater (to the biotreater capacity) passes through the main interceptor and overflows directly to Duck River. This is not considered a licenced discharge.

Other non-licenced discharges that occur specifically within the Western Area include:

- discharges from catchment 6 to the stormwater drain to the west (untreated other than some stormwater pits); and
- stormwater from the southern margins of the Western Area via overland flow through the wetlands to the Duck River.

Sampling of discharged water from licenced discharge points is undertaken in accordance with the frequency and sampling methodology as required by EPL 570. Monthly monitoring results from 2014 to August 2018 are summarised in **Table 9-5** and demonstrate that discharges have complied with the EPL 570 discharge criteria.

Table 9-5 Compliance monitoring EPL 570 licence discharge No 1[2]

Constituent	Compliance criteria	2015	2016	2017	2018 (to October)
BOD	45/95 mg/L (50%/90%)	<5	<5	<5	<5
Fluoride	25/40 mg/L (50%/90%)	1.8-16	0.84-3.9	0.89-2.1	1.3-5.2
Ammonia nitrogen	6/30 mg/L (50%/90%)	0.02-0.2	<0.01-0.43	<0.01-0.22	<0.01-3
Oil and grease	8/10 mg/L (50%/90%)	<5	<5	<5	<5-7
pH	6-9	7.2-8.1	7-7.9	6.7-7.8	6.8-8
Phenols	0.5 mg/L	0.02-0.19	<0.01-0.07	<0.05	<0.05
Total nitrogen	35/100 mg/L (50%/90%)	0.8-6.3	0.2-5.4	0.6-10	0.65-17
TPH					
C6-C9	No criteria	<0.04-0.87	<0.04-0.68	<0.04-<0.2	0.04-<0.2
C10-C14	No criteria	<0.05	<0.05-0.58	<0.05-0.084	<0.06
C15-C28	No criteria	<0.2-0.51	<0.2-1.1	<0.2-0.68	<0.2
C29-C36	No criteria	<0.2	<0.2	<0.2-0.42	<0.2
Total phosphorus	1.5/6 mg/L (50%/90%)	0.08-131	<0.05-0.7	0.09-0.92	0.22-0.92
Total suspended solids	30/60 mg/L (50%/90%)	<5-8	<5-41	<5-19	<5-7

Constituent	Compliance criteria	2015	2016	2017	2018 (to October)
Max daily discharge	4,000 kL/d	NR	NR	1,178-2,134[1]	991-2,099
Average daily discharge	4,000 kL/d (monthly basis)	NR	NR	875-1,072[1]	290-1,363

Notes:
1 July – December.
2 Monitoring is only required during pumped discharge for the main interceptor overflow. Except for discharge monitoring in February 2015 (which demonstrated compliance) there have been no other monitoring days/discharges.

Development consent for the Shell Clyde Terminal Conversion Project (SSD 5147) (the 'Conversion Project') was granted on 14 January 2015 and has allowed Viva Energy to:

- consolidate the terminal operations at the Site;
- undertake a number of construction works to upgrade the terminal operations;
- to convert certain tanks to finished product service;
- to demolish and remove redundant refinery equipment and infrastructure; and
- to operate solely as a finished petroleum products terminal into the future.

The Conversion Project is almost complete and much of the redundant refinery infrastructure within the Western Area has been demolished and removed. During the Conversion Project, surface water and wastewater generated on the Site have been managed via the Site's water management system as outlined above. Discharges have flowed to the existing WWTP via the existing surface water and oily wastewater systems.

The cessation of refining operations has resulted in an overall reduction in discharges to the Duck River due to the removal of refinery generated wastewater. Current discharges from the Site mainly comprise treated stormwater and some tank dewatering.

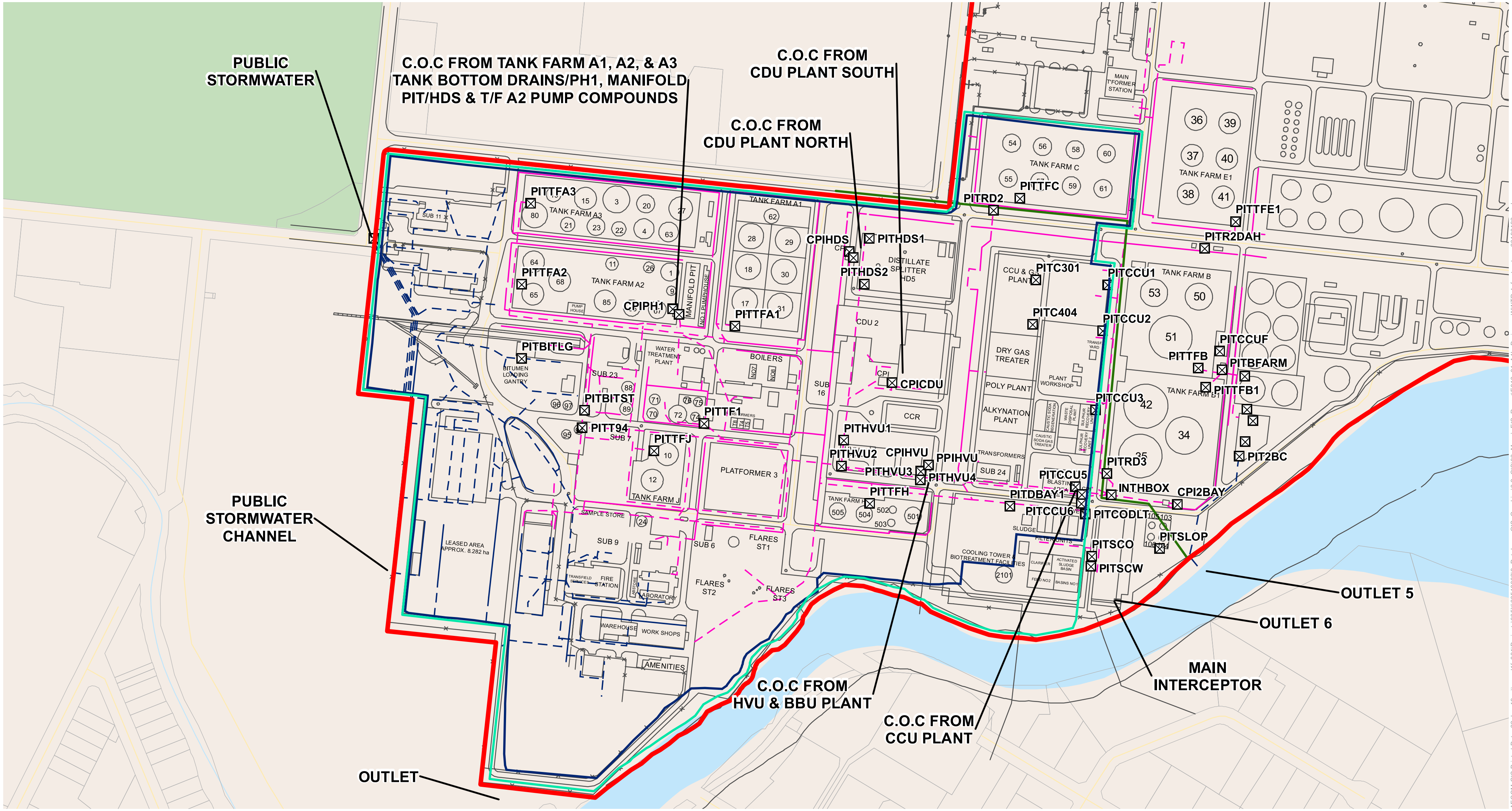

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FIGURE 9-2 - SITE DRAINAGE INFRASTRUCTURE MAP

KEY

- Western Area Boundary
- Project Area boundary
- Site boundary
- Local road
- Council "James Hardie" Drain

Site Drainage Infrastructure

- Clean drains line (underground)
- Clean drains line (above ground)
- Continuously oil contaminated (above ground)
- Continuously oil contaminated (underground)
- Pit

AECOM

0 50 100 200 m

Water use

The Site does not extract water from the Duck River or Parramatta River. No groundwater extraction currently occurs from the Western Area.

Industrial and potable water within the Site is supplied by Sydney Water; however there is currently no potable water use within the Western Area.

Riparian vegetation

The riparian vegetation along the border (outside) of the Project Area is generally in good condition and is around 30 m wide. As outlined in **Section 9.3.1**, the NSW Wetlands Policy (DECCW, 2010) identifies the role of vegetation buffers in helping to combat the effects of climate change and associated sea level rise on wetlands. The current riparian zone along Duck River generally meets the prescribed 30 m riparian width criterion for third order streams outlined in the *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012).

Flooding and coastal processes

Flood potential of the Site was undertaken as part of the Conversion Project (WMA Water, 2016). This study indicated that there is some flood inundation of the Western Area for the 1% AEP event which is predominantly contained to the pipe trench routes and the riparian area along the southern boundary. Depths of flooding across the Western Area for a 1% AEP event are expected to reach a maximum of 1.0 m within pipe trenches with some isolated areas along the southern boundary riparian area exceeding 1.5 m.

The extent and depth of flooding is indicated in **Figure 9-3** as presented in the WMA Water (2016) report.

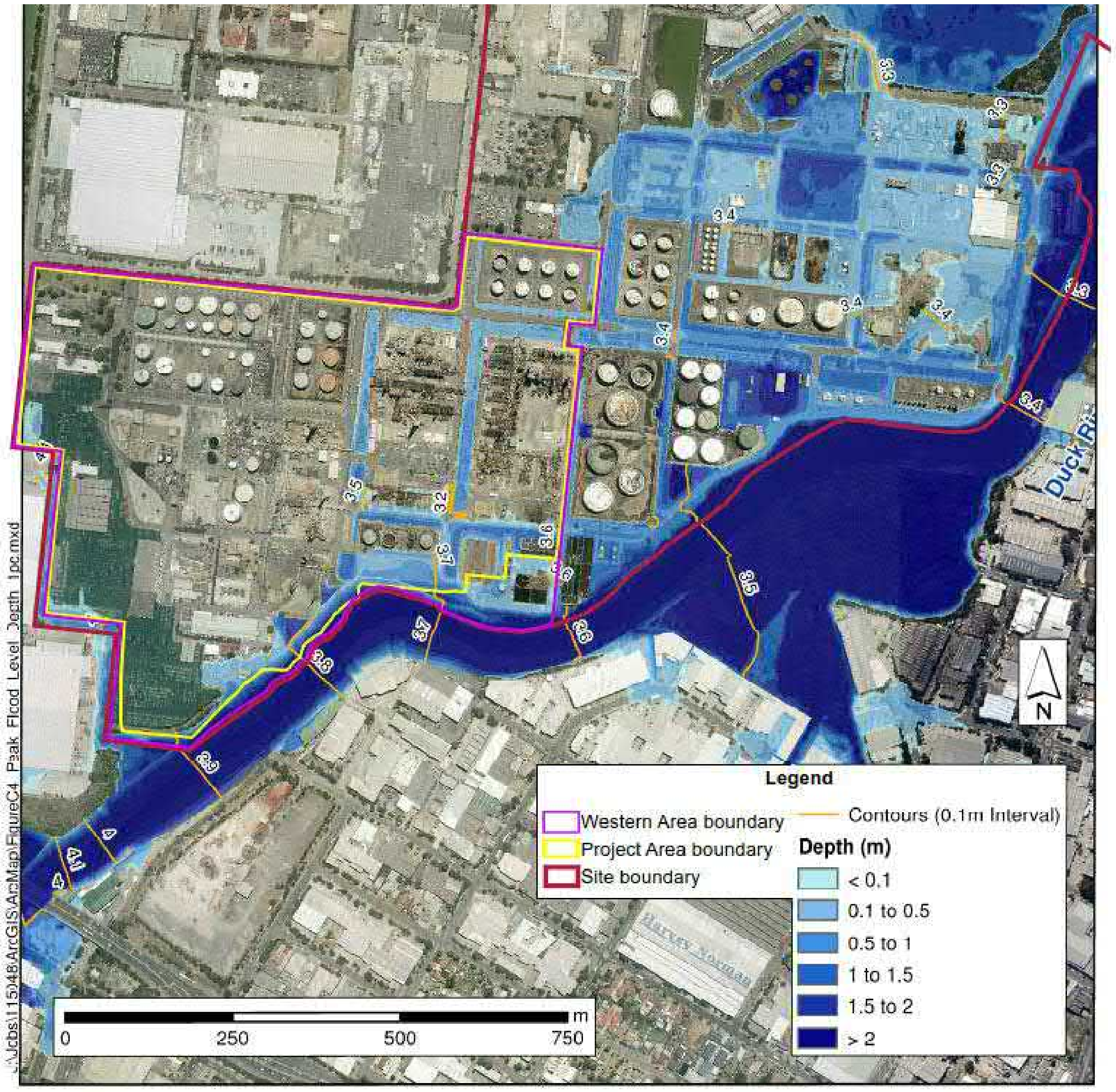

Figure 9-3 1% AEP Flood Depth and Extent

Note: This figure is sourced from WMA Water report (2016)

9.6 Impact assessment

9.6.1 Remediation (Stage 1 to Stage 5)

9.6.1.1 Surface water and wastewater

Stage 1, Stage 2 and Stage 3

During Stage 1 (preparation works), the existing surface water management systems would remain in place and surface water from the Project Area would continue to be managed in line with current practices. Stage 2 (removal of redundant infrastructure and waste) and Stage 3 (remediation), would be undertaken with an iterative approach across the Project Area, generally from the north to the south and the west to the east so as to maintain downstream drainage infrastructure. Throughout these works, water would be directed to the on-site WWTP or would be collected (e.g. in a tanker/vacuum truck) and be transported to the WWTP for treatment.

Stage 2 would require the progressive removal of existing stormwater and wastewater management infrastructure from Catchments 4, 5 and 6 and small sections of Catchment 3 and Catchment 7. These small sections of Catchment 3 and 7 would be incorporated into the Western Area catchment once the infrastructure has been removed. This would isolate these areas from the Clyde Terminal catchments.

During Stage 3, contaminated soils would be progressively excavated and moved to the remediation treatment areas. The remediation treatment areas have been designed to utilise existing stormwater infrastructure. Specifically, biopiles would be established within an existing bunded area. The area would be lined, and the biopiles covered with an impermeable layer. The biopiling base would be graded towards a collection point.

Where water is generated within the Project Area, it would be directed to the WWTP. In addition to rainfall runoff, it has been estimated that up to an additional 20 kL/day of incident rainfall and groundwater inflow into excavations would be removed and transported to the WWTP during Stage 1 to Stage 3.

Stage 1, 2 and 3 could result in potential impacts to surface water quality as well as to potential changes to the operation and functioning of surface water catchments in the short and longer term (i.e. catchment hydraulics) which would need to be managed.

During Stage 1, 2 and 3, surface water quality could be potentially impacted by:

- erosion and entrainment of dust, soil and other material in surface water from areas where ground disturbance works and excavation are required;
- leaks of fuel and hydraulic fluid from various plant items required for Stage 2 and 3;
- leaks of residual matter from within redundant pipework prior to removal;
- the interaction of surface water with contaminated soils potentially exposed by excavation works;
- poor stockpile management resulting in contaminated leachate; and
- leaks from materials stored and used on-site as part of the remediation works.

Based on the use of the existing surface water and wastewater management systems, it is anticipated that there would be no deterioration in discharge characteristics that would lead to non-compliance with licenced discharge conditions. The potential chemicals of concern arising from the Project would not be different from those formerly treated in the WWTP during the operation of the Clyde Refinery, during the Conversion Project, or that are capable of being treated by the WWTP currently. Given that surface water and wastewater would continue to be largely discharged via existing systems, no adverse impacts are anticipated at neighbouring properties.

However, to manage the potential impacts outlined above, mitigation and management measures would be implemented during Stage 1 to Stage 3 of the Project. These are provided in **Section 9.7**.

Stage 4 and Stage 5

Stage 4 (landforming) and Stage 5 (completion works and demobilisation), would involve the establishment of the final landform with all roads and drainage channels to be made similar to current ground levels. As outlined above, the Western Area would be progressively disconnected from the Site's surface water and wastewater systems and WWTP.

Generally the Western Area would be broadly flat with a slight gradient towards the south and surface water drainage directed as overland flow directly towards the Duck River. The final landform would employ appropriate erosion and sediment controls (e.g. swales and vegetation) in order to minimise potential contamination of runoff into the Duck River. The longitudinal swales, as shown in **Figure 9-4** would drain to a depressed zone parallel to Duck River where runoff would pond before overflowing into the Duck River via the mangroves as dispersed overland flow. Also, as shown on **Figure 9-4**, a small catchment along the western boundary of the Western Area would discharge to the existing open council drain that follows the Western Area and discharges to Duck River.

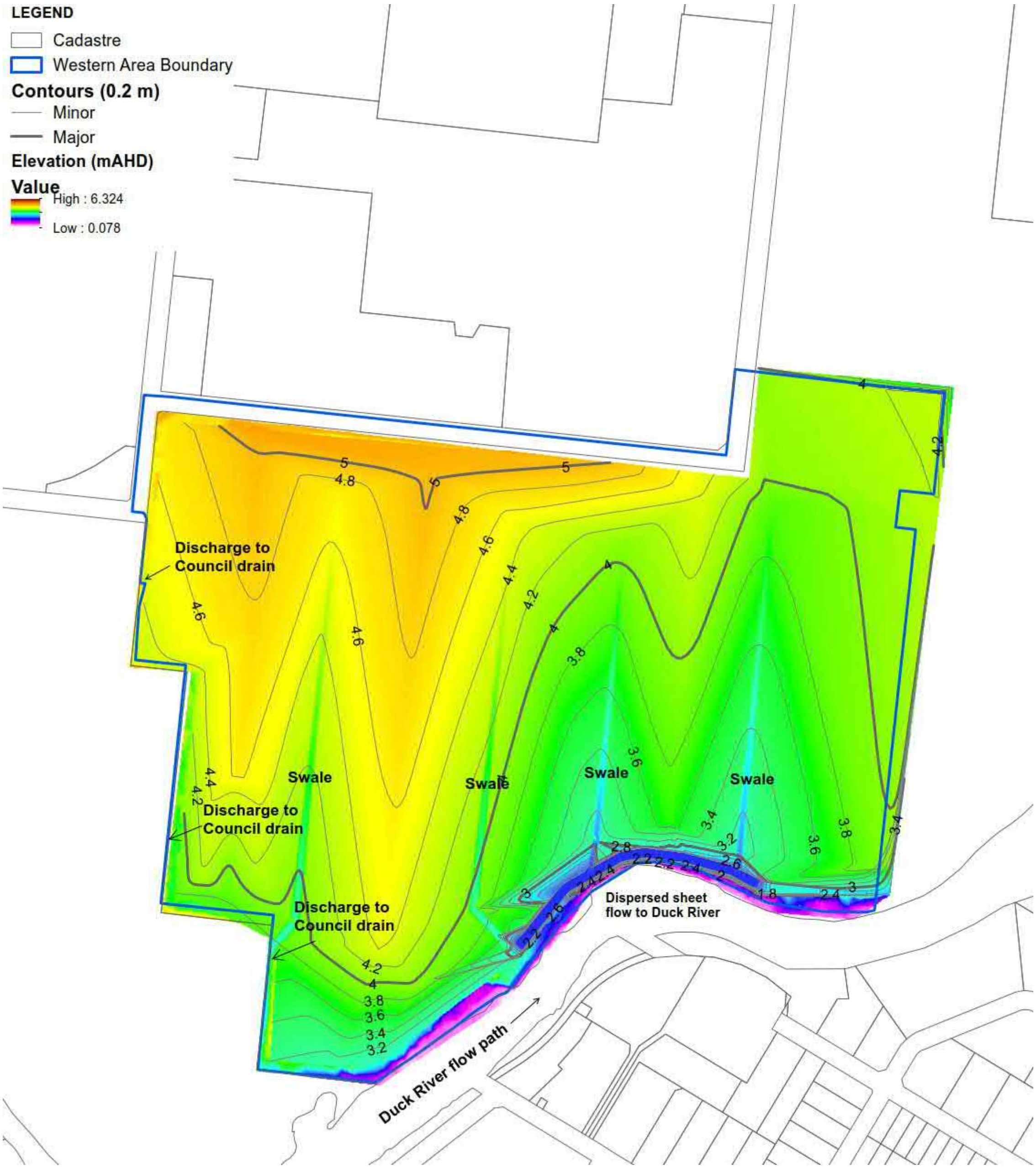

Figure 9-4 Conceptual final landform

To establish the final landform, a layer of un-impacted topsoil with a thickness of 100-150 mm would be progressively laid across the Western Area. This would provide a barrier between the underlying fill and stormwater runoff and would provide a substrate for vegetation (grasses).

The change in impact from the current Western Area to the final landform was assessed based on the outputs from the MUSIC modelling to estimate the current discharge from the Western Area to the predicted discharge from the final landform.

The Western Area can be divided into two sub catchments:

- the central and eastern area (Catchment 4 and 5 which is most of the Western Area) that discharges via the existing drainage system to the WWTP where it is treated together with stormwater and tank drainage from the Clyde Terminal, and
- the most westerly area (Catchment 6), formerly leased to AutoNexus, that flows via some existing drains and overland to the council drain.

The MUSIC results provided in **Table 9-6** demonstrate that the overland flow from the Western Area would, following completion of the final landform, be of significantly improved quality compared to the existing Western Area and exceed the DCP pollution reduction targets.

Table 9-6 Percentage reduction in stormwater pollutants

Stormwater pollutant	DCP Pollution reduction targets	% Reduction – Catchment 4 & 5	% Reduction – Catchment 6
Gross pollutants	90%	100%	100%
Total suspended solids	80%	87%	86%
Total phosphorus	60%	76%	78%
Total nitrogen	40%	71%	70%

This improvement can be attributed to:

- reduced impervious surfaces;
- reduced contamination in soils and fill;
- proposed topsoiling and vegetation; and
- use of swales to covey runoff.

The reduction in impervious surfaces benefits water quality by reducing volumetric runoff and associated pollutants. The replacement of impervious surfaces with vegetation, including on the swales, promotes the uptake of nutrients and improved water quality.

9.6.1.2 Water use

The Project would utilise the existing potable water supply system and would be supplemented by tankered water as necessary. The main use would be potable water supply for the workforce. Secondary uses would include the vehicle wheel wash, dust suppression and biopile moisture control.

The operational refinery required the use of up to 4,000 kL/day of potable water. Following the conversion of the Clyde Refinery to a Terminal the water usage fell to approximately 240 kL/day.

A conservative worst case for the remediation would require the use of 250 kL/day with the potential for reduction through water reuse for dust suppression and biopile moisture control. On this basis there is more than sufficient potable water available, and the proposed use would be an order of magnitude lower than when the Clyde Refinery was operational.

9.6.1.3 Riparian vegetation

As outlined in **Section 9.3.1**, the *NSW Wetlands Policy* (DECCW, 2010) identifies the role of vegetation buffers in helping to combat the effects of climate change and associated sea level rise on wetlands. The current riparian zone along Duck River generally meets the prescribed 30 m riparian width criterion for third order streams outlined in the *Guidelines for Riparian Corridors on Waterfront Land* (NOW, 2012). It is not proposed to remove any wetlands or riparian vegetation as part of the Project.

9.6.1.4 Flooding and coastal processes

During Stage 1 to Stage 5, it is not anticipated that the Project would impact on the flooding potential in the Project Area. The Project Area would be gradually remediated and drainage network removed (where required), and then back-filled following remediation of the soils in Stage 3.

The final landform (developed in Stage 4) has been conceptually designed so that:

- no fill is placed within the existing 1% AEP flood extent so there is no net loss of floodplain storage;
- swales would provide sufficient flood storage volume so that the volume below the 1% AEP flood level in Duck River is not reduced by the change in landform (refer to **Figure 9-5**);

- based on preliminary hydraulic calculations undertaken, during a 1% AEP flood event, discharge from the Western Area would have a velocity sufficiently low to prevent erosion; and
- there is no modification of the profile of Duck River and would therefore maintain flow conveyance.

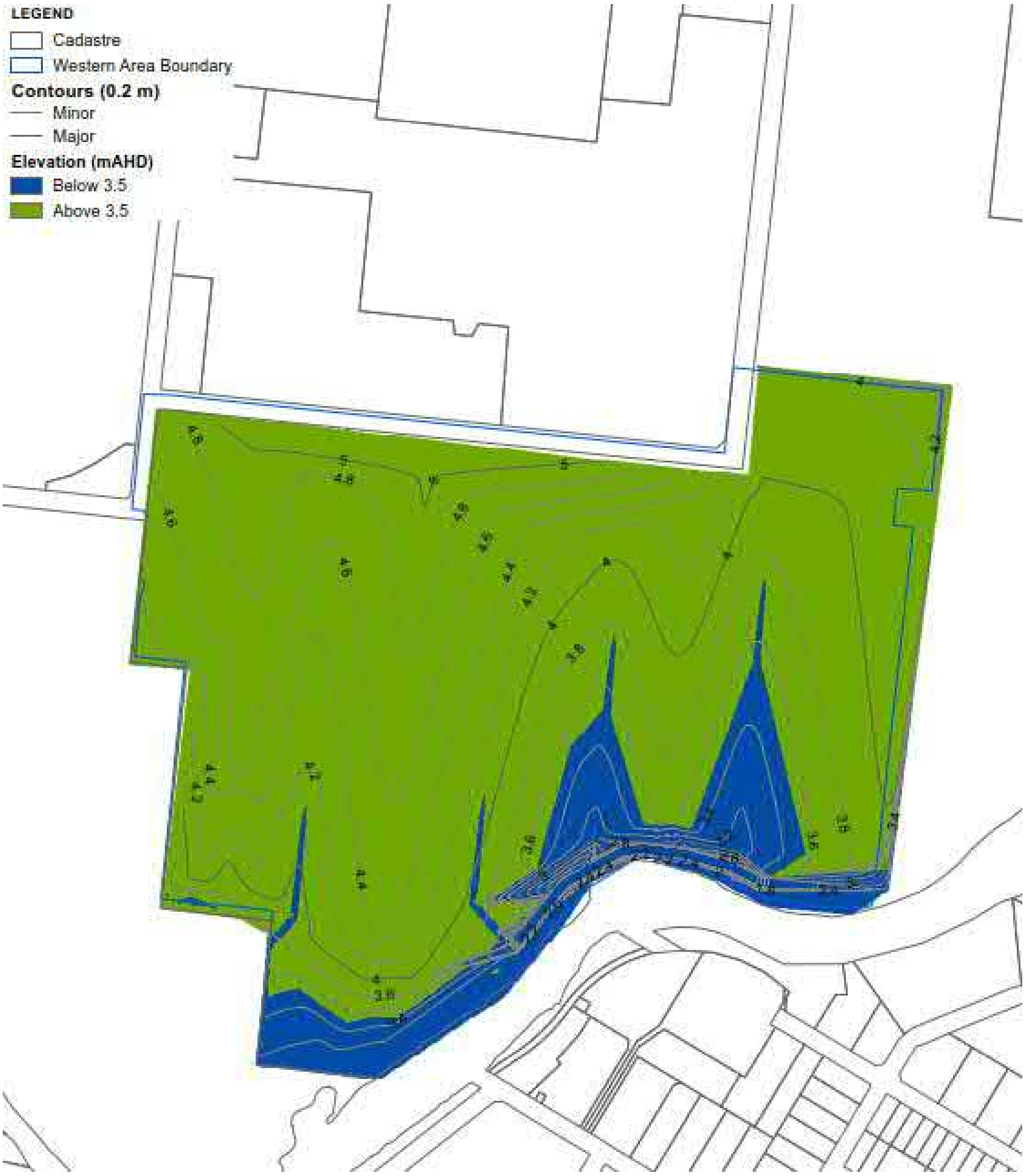

Figure 9-5 1% AEP flood depth and extent for final landform

On this basis it is unlikely that there would be an impact to flood levels or flow conveyance within Duck River or on neighbouring properties as a result of Stage 1 to Stage 5 of the Project, including the establishment of the proposed final landform.

In relation to coastal processes, the Project would result in a reduction in total runoff volume/velocity and pollutant loads (refer to **Section 9.6.1.1**). Furthermore, increases in sea levels as a result of climate change would not significantly impact the Western Area as the terrain is sufficiently higher than existing and projected future sea levels. The impact of sea level rises on the Project Area would not be exacerbated by the Project as the final landform has been developed to largely maintain surface levels and retain floodplain storage.

The Project would not impact on the riparian vegetation along the Duck River. Retaining this vegetation can also potentially minimise flood and coastal process impacts by slowing down flood waters and helping them to spread around the floodplain (DECCW, 2010).

9.6.2 Ongoing operation

Following completion of the Project, ongoing management of the Western Area would be detailed in the Long Term Environmental Management Plan (LTEMP). This would include:

- management and inspection requirements for the erosion and sediment controls and the stormwater system as described in Stage 4; and
- other ongoing management and mitigation measures, such as noxious weed management.

Discharge from surface water runoff would not be through point sources but a diffuse source into the Duck River. Given the proposed stormwater management for the Project Area, no adverse impacts are anticipated at neighbouring properties.

There would be no ongoing requirement for potable water use within the Project Area.

Given the topsoiling and grassing of the finished surface of the final landform, use of erosion and sediment controls (swales) and an ongoing operational inspection and maintenance regime, a reduction is anticipated in sediments and nutrients generated from the Western Area and no adverse impacts on the receiving water or the mangroves are predicted.

The potential impacts of the final landform on flood levels are mitigated by the concept design which does not reduce flow conveyance of Duck River and maintains floodplain storage volumes.

9.7 Mitigation and management

9.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this EIS in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and LTEMP.

Measures to address potential surface water, wastewater and flooding impacts of the Project would be detailed in the REMP (in a Soil and Water Management Plan) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the surface water, wastewater and flooding management sub-plan, as well as the LTEMP are discussed in more detail in the following section.

9.7.2 Remediation (Stage 1 to Stage 5)

Surface water flows would be managed by segregating surface water runoff from impacted water and preventing the inflow of surface water to excavation areas using surface bunds, silt fences and drainage diversions.

Surface water would be collected from remediated and undisturbed areas of the Western Area. This surface water runoff would continue to follow existing drainage patterns, unless diversion from active remediation treatment areas or excavation areas is warranted. Surface water drainage would also be arranged so that surface water runoff from disturbed or contaminated areas does not enter remediated or undisturbed areas.

Surface water collected from remediated or undisturbed areas would be retained on-site and used to the maximum extent possible for dust suppression or wheel washing. Excess surface water would be discharged to stormwater systems in accordance with the discharge conditions for the Site.

To assist in the collection of surface waters from undisturbed areas of the Western Area, temporary sediment basins may be constructed in a suitable location to be determined during detailed design.

Contaminated water would be minimised by directing surface water away from excavations, depressions, pits and stockpiles by constructing drainage works such as bunds and diversion drains. These measures would minimise the flow of undisturbed surface water into other areas of the Project Area that contain contaminated materials.

The generation of impacted surface water would be minimised by:

- covering the biopiles to reduce the amount of contaminated water produced from runoff;
- completing the remediation in a staged manner so as to minimise the extent of excavations at any one time that could collect water and require dewatering and processing at the WWTP; and
- liquids produced during the planned excavations of the drainage system, impacted surface water runoff, leachate from the excavated soils within the biopiles, and impacted groundwater infiltrating into excavations would either be sent via the existing stormwater management systems to the WWTP or would be collected (e.g. in a tanker/vacuum truck) and be transported to the WWTP for subsequent treatment.

During Stage 1 to Stage 5, all potential chemical pollutants (e.g. diesel, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded and lined areas to minimise the risk of spillages, or mobilisation of these pollutants into aquatic environments in the event that a storm surge or flood event impacts the Project Area.

These measures would all be included within a Soil and Water Management Plan that would form a sub-plan to the REMP.

9.7.3 Ongoing operation

Following completion of Stage 1 to Stage 5 of the Project, the Western Area would have a topsoil cover and would have been vegetated. Sediment and erosion control measures would be in place. During this stage the activities to be undertaken in accordance with the LTEMP would include:

- routine inspection to determine that:
  - vegetation is maintained;
  - erosion/sediment mobilisation controls are operating effectively;
  - channelling is not occurring; and
  - the discharge locations (i.e. the swales and overland flow into Duck River) are operating effectively; and
- inspection of swales after large flood event to confirm they are still intact;
- periodic inspection of mangroves and surface water discharges to note observable changes in the condition of vegetation, which may indicate lower water quality;
- weed management; and
- maintenance of erosion and sediment controls.

9.7.4 Summary

A summary of the mitigation and management measures to manage potential surface water, wastewater and flooding impacts from the Project are outlined in **Table 9-7**. Specific measures relating to the management of soils, groundwater and contamination, including the implementation of a LTEMP, are provided in **Chapter 8 Soils Groundwater and Contamination**.

Table 9-7 Mitigation and management measures – surface water, wastewater and flooding

Reference	Mitigation and management measures	Timing
SW1	The Soil and water management plan (sub-plan to the REMP) would outline the following: • stormwater around excavations would be diverted and directed to existing stormwater/wastewater management systems and WWTP; • discharges from the WWTP would be within existing EPL 570 limits; • reuse of water for dust suppression or wheel washing, where appropriate; • incorporation of temporary erosion and sediment controls such as settling ponds, silt fences etc. to manage stormwater runoff where existing systems have been removed; • appropriate storage of materials being utilised for the Project, away from Duck River and the surface water drains; • ongoing monitoring of licenced discharge points, in line with EPL 570, to confirm compliance during the Project; • incorporation of runoff/sediment controls, including progressive covering and vegetation of remediated areas; and • routine inspections would be incorporated in to the plan to monitor the implementation of the measures outlined above, including: - routine inspections of excavations to instigate the pump out of water accumulating in excavations; and - inspections of bunding would occur during and following periods of heavy rainfall to confirm that water is being directed to the WWTP as required.	Stage 1 to Stage 5
SW2	Potential chemical pollutants (e.g. fuels, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded and lined areas to minimise the risk of spillages, or mobilisation of these pollutants into aquatic environments in the event that a storm surge or flood event impacts the Project Area.	Stage 1 to Stage 5
SW3	The Long Term Environmental Management Plan would outline: • routine inspection requirements to determine that: - vegetation is maintained; - erosion/sediment measures are operating effectively; - channelling is not occurring; - the discharge locations (i.e. the swales and overland flow into Duck River) are operating effectively; and • inspection of swales after large flood event to confirm they are still intact; • periodic inspection of mangroves and surface water discharges to note observable changes in the condition of vegetation, which may indicate lower water quality; • weed management; and • maintenance of erosion and sediment controls.	Ongoing operation

With the mitigation and management measures outlined above in place, the Project is likely to have no significant residual impact on water quality and therefore a cumulative impact is not anticipated. This is discussed further in **Chapter 19 Cumulative impacts**.

In the unlikely event that a discharge event occurs that contravenes the water quality or volume limits of EPL 570, Viva Energy would notify the NSW EPA and would continue to monitor the relevant discharge point as required under the EPL to confirm the extent of this exceedance.

The Project Area would continue to be flood prone, as has historically been the case, however the Project would not result in a residual adverse impact to the flooding potential of the land. Future development of the Project Area would consider the flood risk of the Project Area as part of the requirements of a future development application.

10.0 Air quality

10.1 Introduction

This chapter provides a summary of the Air Quality Impact Assessment (AQIA) undertaken for the Project. The detailed AQIA was prepared by AECOM and is provided in **Appendix E**.

10.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 10-1**. **Table 10-1** also presents where in this chapter each of the requirements have been addressed.

Table 10-1 SEARs – air quality

SEARs	Where addressed
Air quality and odour:	
• identification of all emissions and pollutants of concern and details of all discharge points and their characteristics;	**Section 10.6.1**
• quantitative assessment of the potential air quality, dust and odour impacts of the remediation works including consideration of background levels and cumulative impacts;	**Section 10.6 Appendix E**
• details of all air quality and odour control equipment and monitoring for all discharge points and fugitive emissions; and	**Section 10.7**
• an air quality management plan detailing measures (including contingencies) to manage emissions from remediation activities, combustion from equipment and vehicles, fugitive dusts and odours from contaminated materials.	**Section 10.7**

The NSW Environment Protection Authority (NSW EPA) also provided input to the SEARs. Where applicable to this chapter, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

10.3 Legislation and planning policy

10.3.1 Protection of the Environment Operations Act 1997 (NSW)

The *Protection of the Environment Operations Act 1997 (NSW)* (PoEO Act) sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises and a range of air pollution offences and penalties. The PoEO Act is supported by a number of regulations including the *Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW)* which contains provisions to regulate emissions from, motor vehicles, fuels and industry amongst other things.

10.3.2 Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW)

The *Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW)* (PoEO Clean Air Regulation 2010 under the PoEO Act 1997 prescribes the requirements for a number of air pollutant generating activities in NSW. Requirements include domestic solid fuel heater certification, controlled burning, and installation of pollution control devices on certain motor vehicles, petrol supply standards, emission standards for industry groups and control storage and transport of volatile organic compounds.

Under Part 5: Air Impurities Emitted from Activities and Plant of the Regulation 'Industry' has an obligation to ensure compliance with the requirements specified in the Regulation and refers to the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2017) as recommended methodology for AQIA.

10.3.3 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2017) (Approved Methods) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It is referred to in Part 5: Air Impurities Emitted from Activities and Plant in the PoEO Clean Air Regulation 2010. Industry has an obligation to ensure compliance with the requirements specified in the PoEO Clean Air Regulation 2010.

This document provides guidance for assessment of potential air quality impacts with regards to:

- preparation of emissions inventory data;
- preparation of meteorological data;
- methods for accounting for background concentrations and dealing with elevated background concentrations;
- dispersion modelling methodology;
- interpretation of dispersion modelling results; and
- impact assessment criteria for:
  - nitrogen dioxide (NO_2), particulate matter with diameter of 2.5 micrometre (µm) or less and 10 µm or less (referred to as $PM_{2.5}$ and PM_{10} respectively), total suspended particulates (TSP), deposited dust, carbon monoxide (CO);
  - individual and complex mixtures of toxic air pollutants; and
  - individual and complex mixtures of odorous air pollutants.

10.4 Method of assessment

The AQIA was undertaken by:

- reviewing meteorological data, Site specific monitoring data, various standards and emissions manuals and AQIA reports and associated documentation for similar projects to determine existing conditions and emissions rates;
- estimating air emission rates from Project activities (refer to **Section 10.4.2**);
- calculating the nitrogen dioxide emissions (NO_2) (refer to **Section 10.4.3**);
- estimating potential VOC emissions (refer to **Section 10.4.4**); and
- conducting air dispersion modelling (refer to **Section 10.4.5**) using a worst case scenario.

10.4.1 Reviewing meteorological data

Meteorological data from the Bureau of Meteorology (BOM) monitoring station at Sydney Olympic Park for the period of January 2017 to December 2017 was used to estimate the dispersion of air pollutants through the following ways:

- ambient temperature is used to incorporate thermal buoyancy effects when calculating the rise and dispersion of pollutant plumes;
- wind direction determines the direction in which pollutants will be carried;
- wind speed influences the dilution and entrainment of the plume into the air continuum;
- atmospheric stability class is a measure of atmospheric turbulence and the dispersive properties of the atmosphere. Most dispersion models utilise six stability classes, ranging from A (very unstable) to F (stable/very stable); and
- vertical mixing height is the height at which vertical mixing occurs in the atmosphere.

10.4.2 Air emission sources

Due to the extensive variety of potential emissions sources as a result of the different stages of the Project, air emissions from the various Project activities have been separated into the following types:

- general activities (inclusive of excavation, pipeline and concrete slab removal and most dump truck movements);
- in-area soil mixing;
- land farming;
- biopiling;
- DTD unit and stabilisation plant operation;
- concrete crushing;
- land forming; and
- odour emissions from all activities.

A number of sources have been used to estimate emission rates from the Project and include:

- Site specific monitoring data for (AECOM, 2018b):
  - odour emissions;
  - soil volatile organic compound (VOC) vapour emissions; and
  - soil VOC concentrations;
- Emission Estimation Manuals including:
  - *NPI Emission Estimation Technical Manual for* Combustion Engines (DEWHA, 2008);
  - NPI Emission Estimation Technical Manual for Mining (DSEWPC, 2012);
  - *AP-42 Compilation of Air Emission Factors* (US EPA, 1995); and
  - *Estimation of Air Impacts for the Excavation of Contaminated Soil* (US EPA, 1992);
- US EPA Tier 3 and EU Stage III *A Non-road Diesel Engine Emission Standards*;
- AQIA reports and associated documentation for similar projects including:
  - Caltex Sustainable Soil Regeneration Facility (URS, 2015); and
  - Orica Car Park Waste Encapsulation Project (HLA, 2007, and EPL No. 13263).

Emission estimates also included emission controls such as stockpile watering, exposed areas and haul route watering, application of odour and VOC suppressant foam and compliance with US EPA Tier 3 and EU Stage III *A Non-road Diesel Engine Emission Standards* for all mobile equipment (as outlined above).

10.4.3 Nitrogen oxide

Nitrogen oxides (NO_x) are produced in most combustion processes and are formed during the oxidation of nitrogen in fuel and nitrogen in the air. During high-temperature processes, a variety of oxides are formed, including nitric oxide (NO) and nitrogen dioxide (NO_2).

One of the challenges of modelling NO_x emissions is how to determine the amount of NO_2 at a receptor given that NO reacts (oxidises) in the atmosphere to form NO_2 over time. The US EPA *Ozone Limiting Method* (OLM) was used to predict ground-level concentrations of 1-hour NO_2 as part of the AQIA. The OLM is based on the assumption that approximately 10% of the initial NO_X emissions are emitted as NO_2. If the ozone (O_3) concentration is greater than 90% of the predicted NO_X concentrations, all the NO_X is assumed to be converted to NO_2,otherwise NO_2 concentrations are predicted using the equation $NO_2 = \{0.1 * NO_X + 46/48 * O_3\}$.

The 2017 background O_3 data from the NSW Office of Environment and Heritage (OEH) air quality monitoring station at Chullora was used to calculate the modelled NO_2 concentrations in accordance with the NSW EPA Approved Methods.

10.4.4 VOC emission rate calculations

The *Pore Space Emissions Rate Equation* used as a component of the *Short-Term Average Emission Rate Equation* (US EPA, 1992), assumes that the entire soil pore space is occupied by a single pollutant and as such is considered to be overly conservative. In an effort to correct the over-conservatism in this equation, Site specific soil vapour data has been used to provide an estimate of the percentage of soil pore space occupied by each modelled VOC species.

Estimation of the percentage of soil pore space occupied by individual VOC species was calculated from on-site monitoring data using the average percentage concentration of each pollutant as a fraction of total VOCs identified as potential chemicals of concern in the TSI report (AECOM, 2018b).

10.4.5 Air dispersion model

Air dispersion modelling conducted for this assessment was undertaken using the CALPUFF modelling suite with prognostic meteorological data derived from The Air Pollution Model (TAPM). CALPUFF is the NSW EPA model of choice for areas that are affected by coastal breezes, coastal fumigation or complex terrain. The Site is located in a coastal area and, hence, the CALPUFF model was selected.

A single modelling scenario was used to assess the potential worst case air quality impacts from the Project. The modelled scenario assumes that all Stage 2 to Stage 4 dust generating activities would occur concurrently. The settings for the model were chosen in accordance with the following documents:

- *Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Barclay & Scire, 2011); and*
- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW EPA, 2017).*

10.4.6 Air quality impact assessment assumptions

The predicted air quality impacts presented in this chapter and **Appendix E** are highly conservative and based on a number of assumptions including:

- modelling is based on the assumption that all Stage 2 to Stage 4 dust generating activities are occurring concurrently;
- activities with a lifecycle duration less than 12 months have been modelled over a 12 month period with their weekly calculated emissions extrapolated out for a full year;
- works would occur over a six day week with activity rates calculated on a six day week with the emissions modelled conservatively at that same calculated rate for seven days per week;
- the Direct Thermal Desorption (DTD) unit is assumed to operate continuously at maximum capacity and all pollutants from stack emissions have been modelled using the proposed stack concentration limit;
- modelling emission rates have allowed for maximum throughput volumes on a per activity basis resulting in over estimation of the total volume of contaminated fill to be treated and handled on-site;
- all mobile and stationary equipment would be compliant with *US EPA Tier 3 and EU Stage III A Non-road Diesel Engine Emission Standards*;
- the following mitigation measures have been included in the emission rates used in the model:
  - water sprays on excavation areas, landfarming and exposed biopile areas and crushed concrete stockpiles;

- water sprays with chemical suppressants on other stockpiles and exposed landfarming areas as well as a three sided enclosure for the DTD unit pre-treatment area[1];
- watering of haul roads; and
- continuous application of odour suppressant with 95% control efficiency or higher on DTD unit pre-treatment area stockpiles and night time application on exposed untreated biopiles.

10.5 Existing environment

10.5.1 Meteorology

The nearest BOM weather station to the Site is located at Sydney Olympic Park, approximately 2.8 kilometres (km) to the south-east of the Site. A summary of long term data recorded at this station is provided below (BOM, 2018a).

The warmest temperatures occur between December and March, with the warmest average maximum temperatures occurring in January (31.6ºC). The coldest temperatures are recorded in the winter months, with the lowest average minimum temperature occurring in July (5.0ºC).

The highest average rainfall is recorded in March (363.2 millimetres (mm)), with July and September being the driest months (0.4 mm). Humidity in the area ranges from 14-100%, averaging 72%. Average wind speeds range from <0.5 – 35 kilometres per hour, and are typically higher at 3:00 pm compared to 9:00 am. Winds are predominantly from the north-west at 9:00 am, with frequent winds from the east and south-east. Winds are predominantly from the east at 3:00 pm, with frequent winds from the south and south-east.

10.5.2 Air quality

OEH monitoring data

The closest OEH air quality monitoring stations to the Site are located at North Parramatta and Chullora, approximately 4.3 km to the north-east and 6.9 km to the south-east respectively. However, due to a lack of historical data at the North Parramatta station, data from the Chullora station has primarily been used for this assessment. The background concentrations for 2017 recorded at Chullora have been used in this assessment and are summarised in **Table 10-2** (OEH, 2018a).

Table 10-2 Ambient pollutant concentrations, OEH Chullora Monitoring Station

Pollutant	Averaging period	Background concentration[2]	NSW EPA AQIA criteria
TSP	Annual average	50.1 $\mu g/m^3$ [1]	90 $\mu g/m^3$
PM_{10}	Maximum 24-hour average	**63.0** $\mu g/m^3$	50 $\mu g/m^3$
	Annual average	20.0 $\mu g/m^3$	25 $\mu g/m^3$
$PM_{2.5}$	Maximum 24-hour average	**44.6** $\mu g/m^3$	25 $\mu g/m^3$
	Annual average	**9.4** $\mu g/m^3$	8 $\mu g/m^3$
CO	Maximum 1-hour average	2.3 mg/m^3	30 mg/m^3
	Maximum 8-hour average	1.5 mg/m^3	10 mg/m^3
NO_2	Maximum 1-hour average	123.0 $\mu g/m^3$	246 $\mu g/m^3$
	Annual average	25.0 $\mu g/m^3$	62 $\mu g/m^3$

Note:

1. No measurements of local TSP ambient air quality concentrations were available. In the absence of existing annual TSP concentration data, the annual PM10 concentration can be assumed to be 40% of the annual TSP concentration. This is a conservative approach as reported by the NSW Minerals Council (2000) for the measurement of PM10 in TSP in the Hunter Valley and is considered to be applicable to the study area.
2. Values shown in bold text exceed NSW EPA AQIA criteria.

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[1] The pre-treatment area is the location of the untreated stockpiles at the DTD unit; refer to **Plate 3** of **Chapter 4 Project description**.

Clyde Terminal monitoring

As part of the Clyde Terminal Conversion Project (State Significant Development (SSD) 5147), air quality monitoring activities have been undertaken in accordance with the Operational Air Quality Monitoring Program (Viva Energy, 2015). Monitoring activities included both boundary monitoring for selected volatile petroleum hydrocarbons analytes (including total VOC and benzene) and an odour survey of the perimeter of the Site. The results of VOC monitoring on-site for each of the monitoring locations (CT01 to CT04) are shown in **Table 10-3**.

Table 10-3 Measured VOC concentrations at the Clyde Terminal (AECOM, 2018b)

Pollutant	Concentration at sampling location (µg/m³)				NSW EPA 1 hour 99.9th percentile criteria. (µg/m³)
	CT01	CT02	CT03	CT04	
Benzene	5.4	3.5	1.9	1.2	29
Cyclohexane	5.5	4.7	2.5	2.0	19,000
Ethylbenzene	14.0	9.4	3.9	4.8	8,000
n-Hexane	5.3	3.9	1.8	1.1	3,200
Naphthalene	1.4	1.4	1.0	1.1	440
Toluene	87.0	62.0	19.0	23.0	360
Xylenes	46.0	25.8	16.0	18.6	190

An odour survey was undertaken in May 2018 along the perimeter of the Site. Odours were rated, from *Not Perceptible* to *Extremely Strong*, based on the German standard Olfactometry Determination of Odour Intensity (VDI, 1992). The odour survey identified a number of potential minor and localised sources of odour within the Site including on-site slops and sludge processing areas and other industrial operations external to the Clyde Terminal facility. On-site odour emissions from sludge processing and slops tanks were considered localised and unlikely to be identified off-site.

10.5.3 Terrain

The terrain surrounding the Project Area is generally low lying with an approximate elevation of 4-10 mAHD. The Parameter River runs west to east approximately 830 m to the north of the Site and is bound by Duck River; a tributary of the Parramatta River on the south-eastern border.

10.5.4 Land use

The Site is surrounded by a mixture of land uses but is primarily an industrial setting and is zoned as IN3 Heavy Industrial under the *Parramatta Local Environmental Plan 2011*.

Significant transport infrastructure is located within the surrounding area including the M4 Western Motorway, James Ruse Drive and the T6 Carlingford suburban passenger railway line. Surrounding transport infrastructure is described further in **Chapter 14 Traffic, transport and access**.

To the west are the Rosehill Gardens Racecourse and a mix of industrial and commercial development. To the south is Duck River, beyond which there is the industrial and commercial development of Silverwater. Industrial development within the suburb of Rosehill is adjacent to the north and west of the Site. Duck River runs along the south-eastern boundary of the Site.

The nearest residential properties are located approximately 360 m to the south of the Site within the suburb of Silverwater while additional residential properties are located approximately 800 m to the west and 1 km to the north-east in the suburbs of Rosehill and Rydalmere respectively.

10.6 Impact assessment

The following section outlines the predicted air dispersion modelling results for the Project. Potential key sources of air emissions include:

- dust emissions from:
  - materials handling associated with excavation, remediation and landforming activities;
  - wind generated dust from stockpiles and exposed surfaces;
  - wheel generated dust from on-site truck movements;
  - crushing and screening of contaminated fill; and
  - concrete crushing;
- combustion emissions from:
  - mobile plant equipment using diesel fuel; and
  - stationary plant equipment using diesel fuel,
- VOC and odour emissions from:
  - materials handling of contaminated soil;
  - remediation activities (e.g. land farming and biopiles during construction) and
  - soil vapour emissions from exposed soil,
- stack emissions (VOCs) from:
  - operation of the DTD unit; and
  - operation of the biopile aeration system.

A full list of potential emission sources is provided in the AQIA in **Appendix E**.

10.6.1 Air pollutants

Potential pollutants of concern

Potential pollutants of concern during the Project assessed in the AQIA included, TSP, PM_{10}, $PM_{2.5}$, $NO_{x,}$ CO, VOCs including: n-Hexane, cyclohexane, benzene, toluene, ethyl benzene, xylene, naphthalene, and dioxins and furans.

Other minor potential pollutants of concern and why they have not been directly assessed in the AQIA are discussed in Section 2.2.2 of the AQIA in **Appendix E**.

Modelling results

A total of 710 sensitive receptors were included in the dispersion modelling for the AQIA. These included industrial, recreational and residential receptors. Each receptor was given a four number reference. Further information is provided in **Appendix E**.

The results of the dispersion modelling for TSP, PM_{10}, $PM_{2.5}$, CO and NO_2 are presented in **Table 10-4** and demonstrate predicted maximum pollutant contribution with Stage 2 to Stage 4 occurring concurrently. Cumulative pollutant concentrations, which represent the Project contribution plus the background pollutant concentrations, are provided for all pollutants where data was available. The NSW EPA AQIA criteria for the pollutants TSP, PM_{10}, $PM_{2.5}$, CO and NO_2 apply at the closest off-site sensitive receptor location.

Table 10-4 Predicted off-site ground level maximum and annual average concentrations for air pollutants

Pollutant	Averaging period	Criteria ($\mu g/m^3$)[1]	Background ($\mu g/m^3$)[2]	Predicted concentration ($\mu g/m^3$)	
				Incremental	Cumulative[2]
TSP	Annual average	90	50.1	9.1[3]	59.1
PM_{10}	Maximum 24-hour average	50	**63.0**	43.9	**83.3**
	Annual average	25	20.0	12.0	**32.1**
$PM_{2.5}$	Maximum 24-hour average	25	**44.6**	4.4	**45.6**
	Annual average	8	**9.4**	1.1	**10.6**
CO	Maximum 1-hour average	30,000	2,300	44.5	2,344.5
	Maximum 8-hour average	10,000	1,500	14.2	1,514.2
NO_2	Maximum 1-hour average	246	123	28.4	151.4
	Annual average	62	25	1.2	26.2

Note:
1. NSW EPA's environmental impact assessment criteria for the pollutants (NSW EPA 2017).
2. Values shown in bold text exceed NSW EPA AQIA criteria.
3. The annual TSP concentration of 9.1 $\mu g/m^3$ is lower than the reported annual PM_{10} concentration of 12 $\mu g/m^3$. This is attributed to deposition being included in the modelling as required to provide data for **Appendix F** Human Health Risk Assessment. Due to similarities in emission rates for TSP and PM_{10} for a large number of sources (e.g. for combustion sources) the differences in assigned default geometric mass mean diameters (1.15 microns for TSP and 0.45 microns for PM_{10}) combined with differences in the default geometric standard deviation (2 microns for TSP and 7 microns for PM_{10}) have resulted in a lower TSP value; based on a higher rate of deposition for TSP.

The results indicate that the predicated incremental concentrations of TSP, PM_{10}, $PM_{2.5}$, CO and NO_2 were all below the NSW EPA criteria. When the background concentration is added to the predicated incremental concentration, the resulting cumulative concentration was below the NSW EPA criteria for TSP, CO and NO_2.

Due to the background concentrations of PM_{10} and $PM_{2.5}$ exceeding the NSW EPA criteria an additional particulate emission assessment was undertaken, based on the Approved Methods methodology. The outputs of this assessment for PM_{10} and $PM_{2.5}$ are presented in **Table 10-4**. This assessment aimed to determine whether any additional exceedances had occurred due to the addition of the incremental particulate concentrations from the Project and the corresponding background concentrations.

The assessment concluded that the highest cumulative concentrations for both 24-hour PM_{10} and $PM_{2.5}$ at receptors 1935 and 1939 (refer to contour plots **Figure 10-1** and **Figure 10-2**) are largely attributed to high background concentrations, particularly where the background concentration exceeds the NSW EPA criterion without contribution from the Project. In addition, predicted incremental PM_{10} concentrations may contribute a significant concentration of PM_{10} to the potential air shed exceedances; while predicted incremental $PM_{2.5}$ concentrations are notably smaller than recorded background contributions.

Figure 10-1 and **Figure 10-2** show that the largest incremental 24-hour particulate concentrations occur largely within industrial and recreational land uses surrounding the Site, where a lower level of amenity would generally be expected (industrial sites) and where people would not be expected to reside for long periods of time (recreational sites).

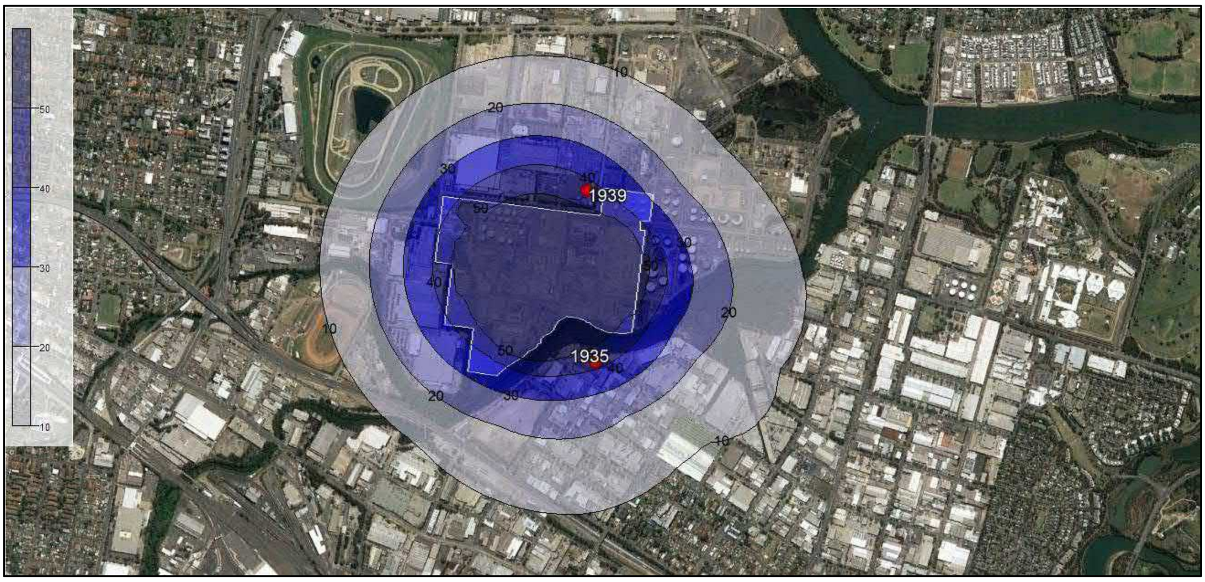

Figure 10-1 Predicted maximum incremental 24-hour PM_{10} concentration contours

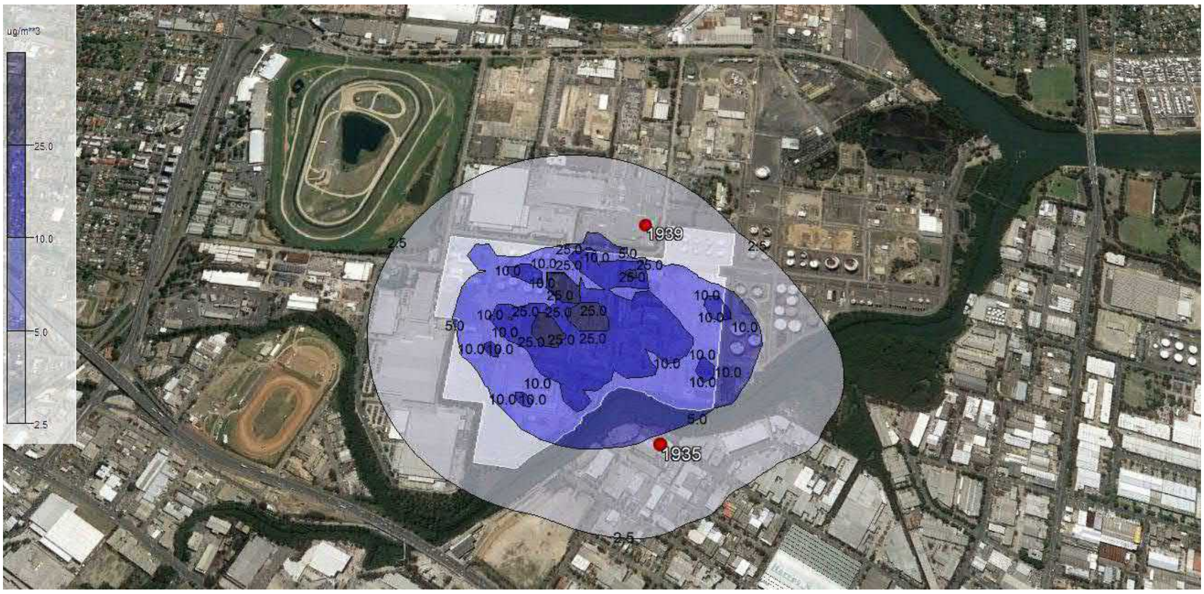

Figure 10-2 Predicted maximum incremental 24-hour $PM_{2.5}$ concentration contours

In summary, while there is the potential for some off-site exceedances of PM_{10} and $PM_{2.5}$ concentrations to occur, there is also a high level of conservatism built into the model, which means that it is likely that potential air quality impacts would be less than predicted.

Despite this, a review of the emissions inventory was undertaken. This review revealed that the largest $PM_{2.5}$ contributors from the DTD and stabilisation operations are the DTD plant screen and the mobile crushing plant. Each contributes approximately 73% and 6% of emissions respectively on an activity basis.

Based on this review the following control measures would be implemented to help reduce $PM_{2.5}$ emissions from the DTD plant screen and the mobile crushing plant:

- an enclosure would be placed on the DTD plant screen with water sprays placed on the outlet, resulting in a 90% reduction in dust emissions; and
- use of a particulate filter on the mobile crushing plant reducing emissions by approximately 99%.

Based on the above source contributions and recommended mitigation measures, an estimate of the post mitigation predicted annual average concentration at the worst affected receptor (receptor 1939) is provided in **Table 10-5**.

Table 10-5 Annual average $PM_{2.5}$ contribution on and activity basis pre and post mitigation at receptor 1939.

Additional DTD mitigation	$PM_{2.5}$ Annual average concentration (µg/m^3)						
	General excavation activities[1]	Biopiling	Landfarming	DTD & stabilisation	Concrete crushing	Landforming	Total
Pre-mitigation	0.12	0.03	0.05	0.73	0.03	0.17	1.13
Post-mitigation	0.12	0.03	0.05	0.15	0.03	0.17	0.55

Note:
1 Inclusive of excavation, pipeline and concrete slab removal and most dump truck movements.

At a Project contribution basis, the additional mitigation measures would result in a predicted incremental annual average $PM_{2.5}$ concentration of 0.55 µg/m^3. This is less than half the originally estimated modelled value and approximately 7% of the NSW EPA criterion of 8 µg/m^3.

In further analysing these results, it should be acknowledged that the Project is temporary and its objective is to remediate the contaminated soils in the Western Area to facilitate future development of the land.

Additional measures to manage potential air quality impacts are discussed in **Section 10.7**

10.6.2 Individual toxic air pollutants

Predicted incremental off-site 1-hour 99.9th percentile concentrations for VOCs, dioxins and furans are presented in **Table 10-6**. This table also presents cumulative concentrations for VOCs. The cumulative concentrations take account of the existing operations at the Clyde Terminal based on monitoring data undertaken in May 2018.

Table 10-6 Predicted off-site ground level 1-hour 99.9th percentile concentrations for air toxics

Pollutant	Criteria (µg/m^3)	Predicted concentration (µg/m^3)	
		Incremental	Cumulative
Benzene	29	8.3	13.7
Cyclohexane	19,000	117.6	123.1
Ethylbenzene	8,000	9.3	23.3
n-Hexane	3,200	49.7	55.0
Naphthalene	440	8.8	10.2
Toluene	360	12.0	99.0
Xylene	190	12.4	58.4
Dioxin and furans	$2.0x10^{-6}$	$9.2x10^{-11}$	No data

It can be seen from **Table 10-6** that predicted off-site 1-hour 99.9th percentile concentrations for all air toxic pollutants are well below the relevant criterion.

10.6.3 Odour

Predicted maximum incremental 1-hour 99th percentile ground level concentrations for odour at sensitive receptors based on broad land use categories are presented in **Table 10-7**. A contour plot showing the predicted ground level 99th percentile odour concentrations from the Project is shown in **Figure 10-3**.

Predicted maximum 99th percentile odour concentration is 10.7 OU and exceeds the NSW EPA AQIA criteria of 2 OU at both industrial and recreational receptors. The highest predicted off-site concentrations would occur to the northwest of the Project Area over industrial facilities and the south-eastern corner of Rosehill Gardens Racecourse. High ground level odour concentrations are also predicted to the south-east of the Site, at the Silverwater Industrial Estate.

The highest contributor to odour from the Project would be exposed surfaces during excavation; and to a lesser extent remediation activities, where large quantities of contaminated material would be exposed or subject to materials handling activities such as biopiling and landfarming. However, off-site odour emissions are likely to be highly variable based on the level of contamination of exposed surfaces and the age of exposed material at any given point in time.

Nevertheless, to ensure a conservative assessment of odour, modelled emissions only considered the application of odour mitigation (e.g. odour suppressants) to the pre-treatment stockpile area within the DTD unit area and overnight for exposed biopiles. The application of odour suppressants more to other activities would mitigate potential off-site odour impacts. Mitigation is discussed further in **Section 10.7**.

Table 10-7 Predicted off-site ground level 1-hour 99.9th percentile concentrations for odour

Sensitive receptor type	Predicted incremental concentration (Max 99.9th percentile) (OU/m^3)
Residential	2.6
Mixed use	0.5
Industrial	10.7
Recreation	10.4
NSW EPA AQIA Criteria	**2.0**

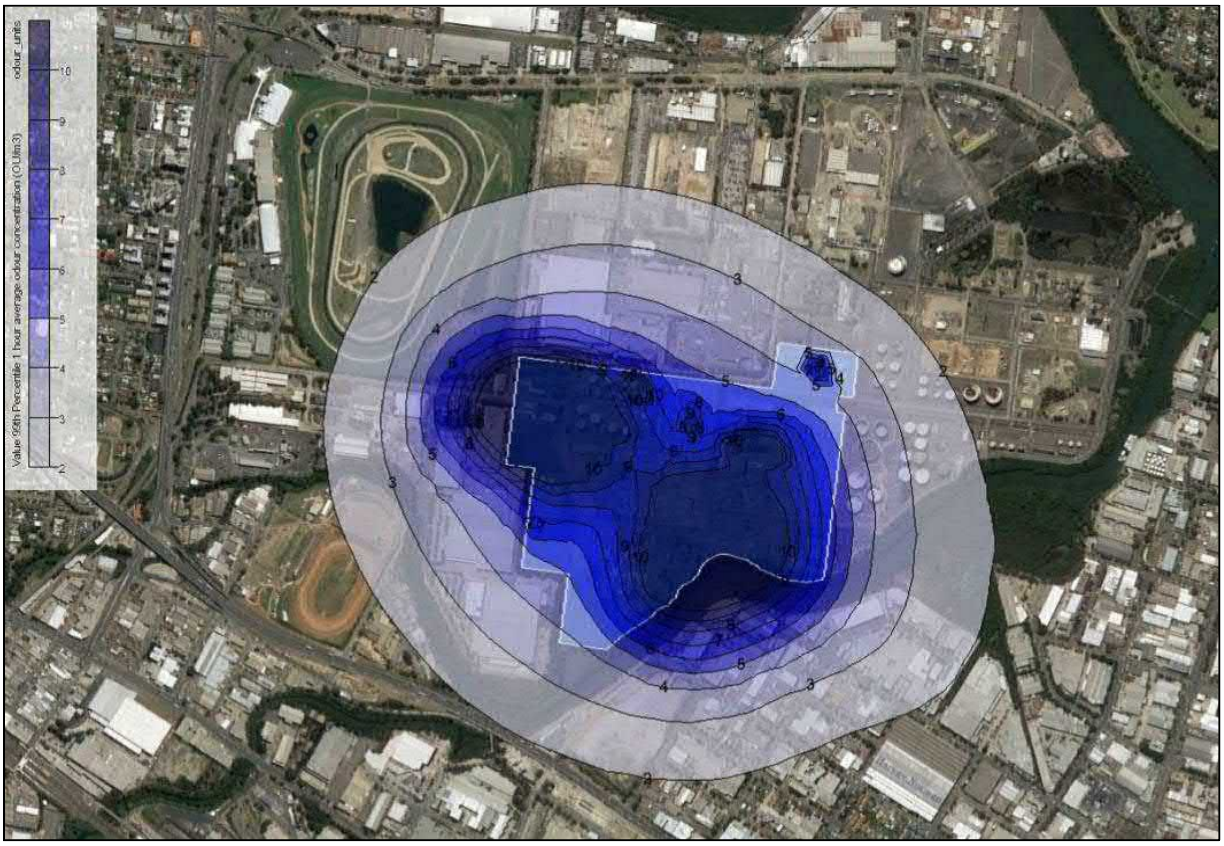

Figure 10-3 **Predicted ground level 99th percentile concentration contours for odour (OU)**

10.6.4 Ongoing operation

The ongoing operation of the Western Area is not expected to have a significant impact on air quality as soils would have been remediated. The remediation of the Western Area would reduce vapour and odour emissions from soils, and as the final landform would include a layer of topsoil and vegetation, the works would reduce the amount of exposed surfaces therefore reducing potential dust impacts. As such no air quality impacts are expected during the ongoing operation of the Western Area.

10.7 Management and mitigation measures

10.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan (PMP), Remediation Environmental Management Plan (REMP) and a Long Term Environmental Management Plan (LTEMP).

Measures to address potential air quality impacts would be detailed in the REMP (in the air quality management sub-plan) for works undertaken during Stage 1 to Stage 5 of the Project. This plan would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for the Project.

No mitigation and management measures for air quality are proposed for the LTEMP.

10.7.2 Stage 2 to Stage 4

The results of the AQIA indicated that both incremental and cumulative impacts for all pollutants with the exception to PM_{10}, $PM_{2.5}$ and odour were below the relevant NSW EPA criteria. In the instances where predicted exceedances were observed the following information was noted:

- The highest cumulative concentrations for both 24-hour PM_{10} and $PM_{2.5}$ are largely attributed to high background concentrations; particularly where the background concentration exceeds the NSW EPA criterion in isolation.
- Predicted incremental PM_{10} concentrations may contribute a notable portion to potential air shed exceedances, while predicted incremental $PM_{2.5}$ concentrations are notably smaller than recorded background contributions.
- The largest incremental 24-hour particulate concentrations occur largely within industrial and recreational land uses surrounding the Western Area, where a lower level of amenity would generally be expected (industrial sites) and where people would not be expected to reside for long periods of time (recreational sites).
- The predicted maximum 99th percentile odour concentrations that exceed the NSW EPA 2 OU criteria occurred largely at industrial and recreational receptors. Predicted maximum 99th percentile odour concentration at residential and mixed-use receptors (with the exception of residential properties located within the Silverwater Industrial Estate), where a greater level of amenity would generally be expected, are below the 2 OU criteria.
- Off-site odour emissions are likely to be highly variable based on the level of contamination of exposed surfaces and the age of exposed material at any given point in time.
- Odour emissions have been derived from monitoring data which targeted areas where notable odours were observed to capture worst case emissions.

To mitigate these potential impacts the following measures would be implemented.

Design mitigation

As outlined in **Chapter 4 Project description**, a range of controls (design mitigations) were included in the design of the remediation technologies for the Project. The key measures included are:

- level 2 watering (>2 litres/m^2/h) for dump trucks carrying soil and concrete (NPI Mining, 2012);
- watering with or without dust suppressants on exposed areas and stockpiles;
- application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on untreated stockpiles in the DTD area and on exposed untreated biopiles (i.e. during construction of the biopile) over night;
- application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on exposed excavation areas where both required and practical;

- biopiles would be covered during operation and off-gas from biopiles would be passed through air filters to remove volatile hydrocarbons;
- the DTD unit pre-treatment area stockpile would be enclosed within a three sided bay;
- all mobile and stationary diesel engines would be compliant with US EPA Tier 3 and EU *Stage III A Non-road Diesel Engine Emission Standards*;
- off-gas from the DTD unit would be treated before it is discharged to the atmosphere through a stack;
- where possible stockpiles would be covered;
- enclosing the DTD screening area and placing water sprays on the outlet; and
- ensuring a particulate filter is used on the mobile crushing plant.

Air Quality Management Plan

While the design mitigation measures above are considered to be effective in the control of emissions, given the results discussed in **Section 10.6**, a suite of additional management measures would be put in place to further minimise potential emissions. These reactive management measures may be required during times when background pollutant concentrations are high or when Stage 2 to Stage 4 activities may be at a maximum resulting in elevated emissions that may migrate off-site resulting in an exceedance of the NSW EPA criteria.

As outlined in **Section 10.7.1** an Air Quality Management Plan (AQMP) would be prepared as a sub-plan of the REMP. Measures would be included in the AQMP to minimise the potential air quality impacts associated with the Project. The AQMP would include measures to be implemented during remediation activities to ensure emissions are reduced. It would include:

- performance objectives to guide the monitoring and management of potential air quality impacts;
- timeframe for implementation of all identified emission controls;
- key performance indicator(s) for emission controls;
- monitoring method(s), including location, frequency and duration;
- response mechanisms to mitigate potential off-site impacts;
- responsibilities for demonstrating and reporting achievement of key performance indicator(s);
- record keeping and complaints response register;
- compliance reporting; and
- a Reactive Air Quality Management Program (RAQMP), including meteorological data and pollutant monitoring if required (such as PM_{10}, particulates) for management purposes, fit for purpose odour monitoring, and the implementation of appropriate triggers to further develop the reactive management strategy for air pollution mitigation.

Measures to enable emissions to be reduced to the maximum extent achievable for air pollutant generating activities, beyond those identified in **Chapter 4 Project description**, would include:

- additional water sprays from a water cart to reduce dust emissions from stockpiles;
- additional watering of the haul roads to further decrease haul emissions;
- application of water sprays from other dust generating activities such as conveying and loading and unloading from stockpiles;
- additional application of odour and VOC suppressant of 95% control efficiency or higher on potentially odours exposed surface areas;
- covering of highly dusty material with tarpaulins or other relevant means; and
- erection of wind breaks for dusty areas, e.g. along dusty haul roads, low dusty stockpiles etc..

These would also be outlined in the AQMP.

Odour reactive management

The AQMP would also put in place measures to address potential off-site odour impacts. Measures to manage odour would include:

- an operator-run odour complaints management system would be developed as a reactive management tool to monitor air quality performance during potential odour generating activities associated with excavation and remediation of contaminated material;
- in the event of an odour complaint; information should be obtained regarding the character of the odour, frequency, duration and intensity of odour observations and whether impacts of offensive odours are currently occurring. An investigation of the odour complaint should be conducted as soon as practicable after an odour complaint has been received; beginning with the suspected source of offensive odours; and
- if odour impacts are immediately occurring; action should be undertaken to reduce odour impacts; this may include:
  - spraying odour and VOC suppressant on 95% on exposed surface areas and/or stockpiles;
  - covering stockpiles;
  - limiting excavation works and materials handling of highly contaminated fill while upwind of sensitive receptors.

Reactive Air Quality Management Program

There may be times when the activities within the Project Area result in concentrations of pollutants such as PM_{10} above the NSW EPA criteria. A Reactive Air Quality Management Program (RAQMP) would be prepared as part of the AQMP to understand the scale and frequency of the exceedance and to ensure appropriate management practices are implemented in a timely manner without unnecessarily impacting on the Project.

A pollutant monitoring system monitoring pollutants such as PM_{10} can provide an early warning of potential criteria exceedances and provide warnings to enable works to be scaled back or stopped. The measured pollutant concentrations can be assessed through comparison with a series of trigger levels which dictate the timing of additional measures targeted at sources of dust from the Project Area or the scaling back of activities. This system can be used to minimise potential adverse impacts on the environment and provide a feedback loop for management of elevated pollutant concentrations.

A conceptual PM_{10} RAQMP has been developed for the Project and is based on a multi-stage approach to dust mitigation (refer to **Appendix E** for details of the plan). In summary the RAQMP would:

- outline how data monitoring stations at the boundary of the Project Area would be established, including location and number;
- outline the process for collecting data from the monitoring stations;
- establish and calculate trigger values;
- outline the response if trigger values are reached, e.g. investigate, implement contingency measures, review effectiveness of contingency measures and/or stop work.

The final RAQMP would be completed closer to the commencement of the remediation activities during the drafting of the Detailed Remedial Action Plan for the Project

10.7.3 Summary

A summary of the management and mitigation measures to manage potential air quality impacts from the Project are outlined in **Table 10-8**.

Table 10-8 Management and mitigation measures – air quality

Reference	Management and Mitigation Measures	Timing
AQ1	Air quality management controls would be implemented as part of the design of the Project including: • level 2 (>2 litres/m^2/h) watering of on-site haul roads; • watering with or without dust suppressants on exposed areas and stockpiles; • application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on untreated stockpiles in the DTD area and on exposed untreated biopiles (i.e. during construction of the biopile) over night; • application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on exposed excavation areas where both required and practical; • biopiles would be covered during operation and off-gas from biopiles would be passed through air filters to remove volatile hydrocarbons; • the DTD unit pre-treatment area stockpile would be enclosed within a three sided bay; • all mobile and stationary diesel engines would be compliant with US EPA Tier 3 and EU Stage III *A Non-road Diesel Engine Emission Standards*; • off-gas from the DTD unit would be treated before it is discharged to the atmosphere through a stack; • where possible stockpiles would be covered; • enclosing the DTD screening area and placing water sprays on the outlet; and • ensuring a particulate filter is used on the mobile crushing plant.	Detailed design/ Stage 1 to Stage 5
AQ2	An Air Quality Management Plan (AQMP) would be prepared and implemented for the Project. The AQMP would include: • ambient air quality monitoring requirements; • a Reactive Air Quality Management Program (RAQMP) for: - particulates, specifically PM_{10} and $PM_{2.5}$; and - odour. • mitigation measures listed in AQ1 particularly for Stage 2 to Stage 4 where air pollutant emissions are likely to be highest. The AQMP would also include the following details: • performance objectives to guide the monitoring and management of potential air quality impacts; • timeframe for implementation of all identified emission controls; • key performance indicator(s) for emission controls; • monitoring method(s), including location, frequency and duration; • response mechanisms to mitigate potential off-site impacts; • responsibilities for demonstrating and reporting achievement of key performance indicator(s); and • record keeping and complaints response register; and compliance reporting.	Detailed design/ Stage 1 to Stage 4

Reference	Management and Mitigation Measures	Timing
AQ3	The AQMP would outline the requirement for stack emissions testing to validate the potential air quality impact against predicted impacts in the AQIA, ensure ongoing performance of ventilation systems and comply with other required limits. Stack emissions testing would include: • emissions testing of the DTD stack during commissioning and periodically post commissioning to confirm pollutant concentrations and ensure ongoing compliance; and • periodic emission testing of the biopile aeration system to ensure total VOC concentration is below 10 parts per million (ppm) and identify when air filters used to remove VOCs need to be replaced. Stack emissions testing would be carried out in accordance with the NSW EPA's *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales* (DEC, 2007).	Stage 3
AQ4	The RAQMP would be prepared and implemented in accordance with: • The NSW EPA's *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007);* • *AS 3580.9.8-2008 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter - PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser;* • *AS/NZS 3580.9.11:2008 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter - PM_{10} beta attenuation monitors;* • *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment;* and • *AS 2923-1987 Ambient air - Guide for measurement of horizontal wind for air quality applications.*	Detailed design/ Stage 1 to Stage 4
AQ5	The RAQMP (PM_{10} and $PM_{2.5}$) would: • outline how monitoring stations at the boundary of the Project Area would be established, including location and number; • outline the process for collecting data from the monitoring stations; • establish and calculate trigger values; and • outline the response if trigger values are reached, e.g. investigate, implement contingency measures, review effectiveness of contingency measures and/or stop work.	Detailed design/ Stage 1 to Stage 4

Reference	Management and Mitigation Measures	Timing
AQ6	The RAQMP (odour) would include: • an operator-run odour complaints management system (as part of the wider Project complaints management procedure) to maintain and monitor air quality performance during potential odour generating activities associated with excavation and remediation of contaminated material; • in the event of an odour complaint; information would be obtained regarding the character of the odour, frequency, duration and intensity of odour observations and whether impacts of offensive odours are currently occurring; • an investigation of the odour complaint would be conducted as soon as practicable after an odour complaint has been received; and • if odour impacts are immediately occurring; action would be undertaken to reduce odour impacts; this may include: - spraying odour/VOC suppressant on exposed surface areas and/or stockpiles; - covering stockpiles; and - limiting excavation works and materials handling of highly contaminated fill while upwind of sensitive receptors during unfavourable weather conditions (e.g. dry and windy conditions).	Detailed design/ Stage 1 to Stage 3

The remediation works are likely to result in various emissions, including dust, combustion, VOC and stack emissions. The AQIA concluded that all pollutants with the exception of PM_{10}, $PM_{2.5}$ and odour would be below the relevant NSW EPA criteria incrementally and inclusive of the existing background levels. Provided recommended mitigation measures to minimise the Project's pollutant contribution to the local air shed and a reactive air quality management program is implemented to minimise off-site particulate and odour impacts, no significant impacts are likely during the Project. Nevertheless, emissions would be released from the Project and would result in negligible adverse air quality impacts at nearby industrial and residential receivers during Stage 2 to Stage 4.

No air quality impacts are likely during the ongoing operation of the Western Area.

10.8 Cumulative impact assessment

There are two relevant cumulative projects within close proximity to the Project Area, which are likely to coincide with Project. These include:

- operation of the Clyde Barging Facility, located approximately 860 m north-east of the Project Area boundary; and
- construction of the Parramatta Light Rail, specifically the removal and conversion of the Sandown freight line; approximately 780 m to north of the Project Area and demolition/construction of the stabling maintenance facility site.

A summary of each project; including timeframes and potential air quality impacts is provided in **Chapter 19 Cumulative impacts**. **Chapter 19 Cumulative impacts** also considered the potential minor air quality impacts of the proposed Wentworth Point Marina (DA644/2017), however due to the minor potential for air quality impacts from this project, it has not been considered in the AQIA in **Appendix E**, or in this summary chapter.

In summary, potential cumulative air quality impacts with the Project and the above two projects include:

- Clyde Barging Facility: Site establishment, operations and decommissioning works all have the potential to generate dust and would generate vehicle emissions. During operation materials handling by the barge and truck movements along the access road have the potential to generate dust.

- Parramatta Light Rail: During construction, potential air quality impacts would be primarily associated with the generation of dust and emissions from the operation of on-site machinery, excavation works, materials handling and material storage. Vehicle movements within the project disturbance footprint would also contribute to emission loads.

For the purpose of this cumulative impact assessment the key air quality emission from the cumulative projects listed above relates to dust and particulates. Odour was not identified as a concern for the cumulative projects.

The Project is proposing to implement a RAQMP. This program would monitor dust from the Project as well as dust in the surrounding airshed. As dust concentrations increased reactive management measures would be implemented until certain works would need to cease. The use of the RAQMP means that potential cumulative impacts resulting from dust and particulates with the projects listed above would be avoided. Therefore no significant cumulative air quality impacts are likely.

11.0 Human health risk assessment

11.1 Introduction

This chapter provides a summary of the human health risk assessment undertaken for the Project. The detailed Human Health Risk Assessment (HHRA) was prepared by AECOM and is provided in **Appendix F**.

11.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the information presented in **Table 11-1**. **Table 11-1** also presents where in this chapter each of the requirements have been addressed.

Table 11-1 SEARs – Human health risk

SEARs	Where addressed
Human health risk:	
• an assessment of the potential human health risks (on-site[1] and off-site[2]) associated with each remediation method, including consideration of background levels and cumulative impacts.	**Section 11.6**
• details of mitigation and management measures to be implemented during the remediation works to minimise human health risks and ensure the safety of workers and nearby residents.	**Section 11.7**

Note:
1. The on-site worker risks have not been evaluated as their potential exposures are addressed via the implementation of appropriate occupational health and safety procedures and management plans. Refer to **Section 11.7**.
2. Off-site is considered to comprise all land beyond the Site boundary. On-site comprises the land within the Site boundary as presented on **Figure 1-1**.

The HHRA presents an assessment of potential human health risks that may result from the Project based on the assessment of worst case off-site air quality impacts presented in the Air Quality Impact Assessment (AQIA) (refer to **Chapter 10 Air quality**).

Predicted air quality impacts presented in **Chapter 10 Air quality**, on which this HHRA is based, are highly conservative and are based on a number of assumptions including:

- all Stage 2 to Stage 4 dust generating activities are occurring concurrently;
- activities with a duration of less than 12 months have been modelled over a 12 month period;
- although works would only occur six days per week, emissions were modelled conservatively for seven days per week;
- the Direct Thermal Desorption (DTD) unit is assumed to operate continuously at maximum capacity;
- modelled emission rates have allowed for maximum throughput volumes on a per activity basis resulting in over estimation of the total volume of contaminated fill to be treated and handled on-site;
- all mobile and stationary equipment would be compliant with US EPA Tier 3 and EU Stage III *A Non-road Diesel Engine Emission Standards*; and
- mitigation measures to reduce air quality impacts have been used in the modelled emission rates.

11.3 Legislation and planning policy

The HHRA was undertaken in accordance with relevant nationally adopted guidelines for a health risk assessment, including:

- *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards*, Department of Health and Ageing and enHealth Council, Commonwealth of Australia (enHealth, 2012a update);
- *Australian Exposure Factor Guide*, Department of Health and Ageing and enHealth Council, Commonwealth of Australia (enHealth, 2012b);
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM), National Environment Protection Council (NEPC), as amended and in force on 16 May 2013 (NEPC, 2013); and
- *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Office of Solid Waste, US Environmental Protection Agency (US EPA, 2005).

Additionally, the HHRA was also prepared to be consistent with the NSW EPA Guidelines for the NSW Site Auditor Scheme (3rd Edition) (NSW EPA, 2017).

11.4 Method of assessment

The HHRA, in accordance with the guidelines outlined in **Section 11.3** (specifically enHealth 2012a and ASC NEPM), included the following five steps:

11.4.1 Step 1: Issues identification

A typical approach adopted in contaminated land HHRAs (and this HHRA) is to use published generic assessment criteria relevant to the land use(s) being assessed to screen out chemicals that present a negligible risk. This allows chemicals of potential concern (COPC) that require quantitative assessment in the HHRA to be identified (i.e. COPC that need to be taken forward to be quantitatively assessed in Step 2 to Step 5). This screening assessment is commonly referred to as a ‘Tier 1’ assessment and has been derived based on the protection of human health.

Step 1/the Tier 1 assessment involved a review of existing information to establish the site context and identify relevant COPC for the HHRA that have the potential to significantly contribute to risks to human health.

COPC were then screened by assessing the annual average ground level concentrations at each receptor and the grid maximum concentration against the relevant enHealth criteria. Amongst other data sources, this work utilised the worst-case scenario modelling results from the AQIA[1] (refer to **Chapter 10 Air quality**). Consideration was also given to the ability of a COPC to bioaccumulate. This consideration remained relevant for Step 2 to Step 5 of the assessment.

Step 1 also included the development of a Conceptual Site Model (CSM) for the Project. The CSM identified the potential Project to receptor pathways for consideration. This included reviewing potential off-site human receptors that could be impacted.

11.4.2 Step 2: Hazard identification

Step 2 identified the potential hazards associated with the COPC that had been identified as requiring further assessment during Step 1 (i.e. exceed the relevant criteria (refer to **Appendix F**) and those that are considered to bioaccumulate). This was done through characterising the types and duration of adverse health effects that might be caused by exposure to the COPC.

[1] The AQIA considered the background and cumulative concentrations of the COPCs.

11.4.3 Step 3: Dose-response assessment

Step 3 examined the quantitative relationship between exposure to the identified COPC in Step 1 and Step 2 and associated potential health effects. The assessment took into consideration background exposure that the identified potential human receptors may currently experience. Background exposure is the extent to which the exposed population is exposed to the COPC in food, drink, ambient air and consumer products as part of their daily lives.

11.4.4 Step 4: Exposure assessment

Step 4 assessed the exposure magnitude, frequency, extent, character and duration for the identified human receptors and the potential for an exposure pathway to the COPC as a result of the Project. The exposure assessment assumed that the concentration of vapours and particulates inside a building was 100% of the level predicted in outside air.

11.4.5 Step 5: Risk characterisation

Risk characterisation is the quantitative estimate outcome of the HHRA. Step 5 provided the nature and potential incidence of adverse health effects to identified human receptors. This was determined based on a comparison of the estimated potential contaminant intake or exposure to relevant toxicity as a result of the Project, based on the outcomes of the above steps.

If the risk acceptability criteria for non-threshold (carcinogenic) and threshold (non-carcinogens) COPC were exceeded, a more detailed and critical evaluation of the risk was conducted, or appropriate risk management measures were recommended.

11.5 Existing environment

11.5.1 Contamination

A number of historical ecological, surface water, soil and groundwater investigations have been conducted at the Site to support various environmental assessments and regulatory compliance requirements. An overview of the contamination environment within the Site and Western Area is provided in **Chapter 8: Soils, groundwater and contamination** and **Appendix C Conceptual Remedial Action Plan**.

The Western Area, due to long term and historic use for petroleum refining and storage, is subject to significant contamination impacts to the soils and groundwater. Secondary contamination may also be present due to imported fill used for historical levelling works.

Based on previous investigations, COPC within the Project Area include:

- Total Petroleum/Recoverable Hydrocarbons (TPH/TRH);
- Benzene, Ethyl-benzene, Toluene and Total Xylenes (BTEX);
- Heavy metals;
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Phenols;
- Polychlorinated Biphenyls (PCBs);
- Tetraethyl Lead; and
- Per- and Polyfluoroalkyl Substances (PFAS).

Further, the Site's historic use as a refinery means that other chemicals such as acids, ethanolamine, sodium hydroxide, solvents and trichloroethylene may also be present in the Western Area's drainage system. There are also areas of buried waste/leaded sludges beneath the Western Area (western and southern boundaries) and there is the potential for asbestos containing materials to be present.

11.5.2 Surrounding area

The Site is surrounded by a mixture of land uses but is primarily in an industrial setting and is zoned as IN3 Heavy Industrial under the *Parramatta Local Environment Plan 2011*. Following a review of the Site and its surrounding context the following potential off-site human receptors were identified:

- off-site residents;
- off-site commercial workers; and,
- off-site recreational users of open space.

The locations of the predicted maximum annual average ground level concentrations for each category of potential off-site receptor are presented in **Table 11-2**. These locations are derived from modelling undertaken for the AQIA (refer to **Chapter 10 Air quality**).

Table 11-2 Receptor locations

Receptor	Description of Location
Commercial	Adjacent to the southern boundary of the Project Area within a heavy industrial area.
Residential	Low density single family housing located approximately 960 m west of the Project Area.
Recreational	Duck River, located adjacent to the south of the Project Area, noting existing fishing restrictions on Duck River[1].

Note:

1. All methods of fishing are prohibited in the Duck River and Homebush Bay (NSW Department of Primary Industries, 2017).

11.6 Impact assessment

The objective of the HHRA for this Project is to assess the human health risks to surrounding residents, commercial workers and recreational user's resulting from the exposure to air emissions that may be generated during the Project. The following sections outline the process taken to determine the potential risk to surrounding commercial, residential and recreational off-site receptors.

Reference should also be made to **Chapter 4 Project description** and **Chapter 10 Air quality** which outline the proposed remediation technologies and provide details on the modelling methodology for the AQIA on which the HHRA is based.

11.6.1 Air quality impacts

The AQIA for the Project (refer to **Chapter 10 Air quality**), conservatively modelled all works associated with the Project as being undertaken concurrently to provide a worst-case assessment for sensitive receptors. The AQIA identified the following key potential sources of air emissions:

- dust emissions from materials handling associated with excavation, remediation and land forming activities, windblown dust, wheel generated dust and crushing and screening activities;
- combustion emissions from mobile and stationary plant equipment;
- Volatile Organic Compounds (VOCs) and odour from soil vapour emissions and materials handling of contaminated spoil; and
- stack emissions (VOCs) including combustion emissions from operation of the DTD unit, and emissions from operation of the biopile aeration system.

Results of the dispersion modelling in the AQIA indicated that both incremental and cumulative impacts for all pollutants with the exception to PM_{10}, $PM_{2.5}$ and odour, were below the relevant NSW EPA criteria.

The COPC considered as part of this HHRA were sourced from the AQIA (refer to **Chapter 10 Air quality**), which reported the results of air dispersion modelling for the following air toxics COPC:

- Benzene, Toluene, Ethylbenzene, Total Xylenes, Naphthalene (BTEXN), n-Hexane, Cyclohexane, and

- Dioxins and furans as polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF).

In addition to the air toxics, the following pollutants and acid gases have been modelled as part of the AQIA, for use in the HHRA:

- Particulate matter (PM), emitted as TSP, PM_{10} and $PM_{2.5}$;
- sulfuric acid mist expressed as H_2SO_4;
- oxides of nitrogen (NOx) (expressed as NO_2);
- Carbon monoxide (CO); and
- Hydrogen fluoride (HF).

The AQIA concluded that there was some potential for off-site exceedances of particulates and odour to occur, however predicted impacts have a high level of built-in conservatism (all activities occurring concurrently which is unlikely to occur). As a result, actual impacts are likely to be lower than predicted.

11.6.2 Step 1: Issues identification

11.6.2.1 Exposure pathways

In order for a human receptor to be exposed to a COPC derived from a site and be therefore subject to adverse human health risks, a complete exposure pathway must exist. An exposure pathway describes the route that a chemical or physical agent takes from its source to the exposed individual (or receptor). This generally includes the following elements:

- a source and mechanism for the release of the chemical;
- a retention or transport medium (or media where chemicals are transferred between media);
- a point of potential human contact with the contaminated media; and,
- an exposure route (e.g. inhalation or direct contact) at the point of exposure.

Where one or more of the above elements is missing, the exposure pathway is considered to be incomplete and no further assessment is required.

Off-site pathways that have been considered to be complete for the Project and therefore were assessed in the HHRA include:

- Inhalation Pathway Assessment:
  - inhalation of vapours and particulates in indoor and outdoor air (acute and chronic assessments).
- Multiple Pathway Assessment:
  - inhalation of soil-derived dust in indoor and outdoor air (chronic assessment);
  - direct contact (i.e. incidental ingestion and dermal contact) with deposited dust (chronic assessment);
  - ingestion of home-grown fruit and vegetables grown on the deposited dust (chronic assessment);
  - ingestion of eggs from home-grown chickens residing on the deposited dust (chronic assessment); and
  - ingestion of breast milk by infants based on mother's intake and maternal transfer (chronic assessment).

Pathways that have been considered to be incomplete for the Project and therefore were not assessed in the HHRA include:

- ingestion of home-grown meat or home-grown milk; and

- ingestion of drinking water. Given the distance of the Prospect Reservoir from the Project (approximately 11 km), emissions from the Project are unlikely to impact the drinking water supply for the Parramatta region. Therefore, the ingestion of drinking water was not considered to be a complete pathway in this assessment.

The inhalation pathway assessment and multiple pathway assessment are discussed further below.

Inhalation pathway assessment

A number of gaseous phase compounds were identified as COPC including CO, HF, NO_2, H_2SO_4, BTEXN, n-Hexane and Cyclohexane. Given the nature of these compounds and their potential presence in ambient air at receptor locations (based on dispersion modelling provided in the AQIA), these COPC were assessed via the inhalation pathway. None of these COPC were above the enHealth criteria for off-site human receptors.

Suspended particulate matter ($PM_{2.5}$ and PM_{10}) was also demonstrated to be present in ambient air at receptor locations and therefore has been assessed via the inhalation pathway. However, the predicted worst case (maximum) predicted concentrations of PM_{10} and $PM_{2.5}$ are below the ASC NEPM and enHealth criteria for off-site human receptors. Particulate matter emissions from the remediation activities were therefore considered low and acceptable and not considered further in the HHRA.

The inhalation pathway was therefore not further assessed in this HHRA.

Multiple pathway assessment

In order to assess the overall potential 'body burden' from exposure to chemicals from the Project, a multiple pathway assessment was undertaken for chemicals which are persistent and bioaccumulative. **Table 11-3** presents a summary of COPCs for the Project which are identified as bioaccumulative and have been considered further as part of this HHRA with respect to chronic exposures.

Table 11-3 COPC pathway summary

Specific air toxics	Volatile – Inhalation Pathway only	Dust Deposition Potential – Multiple Exposure Pathway
Benzene	✓	×
Toluene	✓	×
Ethylbenzene	✓	×
Total Xylenes	✓	×
Naphthalene	✓	×
Dioxins and Furans as PCDD and PCDF	✓	✓
n-Hexane	✓	×
Cyclohexane	✓	×

Dioxins and furans as PCDD and PCDF are the only COPC for the Project that are regarded as persistent in the environment and have the potential to bioaccumulate. Human health risks associated with other COPC are considered low and acceptable based on concentrations being below the Tier 1 screening assessment criteria. In addition, the compounds are not considered bioaccumulative and were therefore not taken forward as part of the quantitative assessment.

Dioxins and furans as PCDD and PCDF may be emitted as particulates that deposit on soil and plants. Once present within the soil or on plants, the chemicals have been considered for the following pathways:

- uptake by edible plants within roots, stems and leaves which are consumed by residents;
- uptake by backyard chickens who lay eggs which are consumed by residents;

- direct contact by residents of surficial soils during gardening (an assessment of incidental ingestion and dermal contact has been undertaken); and
- uptake via all pathways detailed above by breast feeding residential mothers and exposures to infants.

Due to the possibility of exposure and their bioaccumulative and persistent nature, a multiple pathway assessment was completed for dioxins and furans as PCDD and PCDF.

11.6.3 Step 2 and 3: Hazard identification and dose response assessment

The hazard identification process requires a review of existing toxicological information from a variety of appropriate sources to describe the capacity of COPC to produce adverse health effects. The only COPC taken forward to the quantitative assessment (as outlined in **Section 11.6.2**) are for dioxins and furans as PCDD and PCDF.

Dioxins and furans as PCDD and PCDF are considered to be potential non-carcinogens and have therefore been assessed against tolerable daily intake (TDI) criteria. If the TDI criteria is not exceeded, then exposure is considered to have no adverse human health effects in humans. The TDI criteria relates to intakes from all sources (i.e. the Project related intakes as well as background impacts (where relevant)). The assessment against the TDI criteria for this COPC is utilised in Step 5 (refer to **Section 11.6.5**).

11.6.4 Step 4: Exposure assessment

Exposure assessment involves the estimation of magnitude, frequency, extent, and duration of exposure of human receptors to COPC. This involves an estimation of the concentration of the relevant Project COPC (i.e. dioxins and furans as PCDD and PCDF) in environmental media. This concentration is commonly termed exposure point concentration (EPC). The EPCs form part of the calculation for potential exposure concentrations and include a number of factors including, duration and frequency of exposure, body weight and soil ingestion rate. The following exposure pathways were calculated for dioxins and furans as PCDD and PCDF utilising this information:

- indoor and outdoor inhalation of vapour;
- incidental ingestion of surficial soils following dust deposition;
- dermal contact with surficial soils following dust deposition;
- ingestion of home-grown fruit and vegetables following dust deposition and root uptake;
- ingestion of eggs from home-grown chickens; and
- ingestion of breastmilk by infants (<6 months).

This information is utilised in Step 5 (refer to **Section 11.6.5**).

11.6.5 Step 5: Risk characterisation

The toxicity data for each COPC outlined in Step 3 and the exposure pathways derived in Step 4 were used to estimate potential human health risks of the Project.

To assess the overall potential for adverse health effects posed by exposure to the relevant COPC (dioxins and furans as PCDD and PCDF) the hazard quotients (air concentration over tolerable concentration)[2] for each chemical and exposure pathway relevant to a receptor are summed. The resulting sum is referred to as the hazard index (HI). If the HI is less than one, then cumulative exposure to the COPC is considered unlikely to result in an adverse effect. If the sum is greater than 1.0, a more detailed and critical evaluation of the hazards may be required, or appropriate risk management measures at the Project may need to be implemented (enHealth, 2012a).

Using the maximum annual average ground level concentrations and grid maximum predicted concentrations, the HI was well below the adopted acceptable HI of 1.0 for all assessed pathways (refer to **Appendix F**). Overall the estimated health risks are considered low and acceptable.

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[2] A potentially unacceptable chemical intake/exposure is indicated if the exposure adjusted air concentration exceeds the tolerable concentration in air (i.e. if the hazard quotient is greater than 1.0).

11.7 Management and mitigation measures

11.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan (PMP), Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

11.7.2 Remediation (Stage 1 to Stage 5)

The PMP would include and Occupational Health and Safety Plan that would outline the Personal Protective Equipment (PPE) and Occupational Health and Safety (OH&S) measures for the on-site Project and Clyde Terminal workers.

Mitigation beyond the Site is not considered to be required as human health risks are considered to be low and acceptable, as identified in **Section 11.6**.

Chapter 10 Air quality outlines measures for controls to manage potential air quality impacts from PM_{10} and $PM_{2.5}$.

11.7.3 Ongoing operation

The HHRA considered the remediation (Stage 1 to Stage 5) only. Future management of the Western Area would be managed in line with the LTEMP. As outlined in the Conceptual Remedial Action Plan (**Appendix C**), the LTEMP would include:

- the type and location of contamination present (detailed via survey plan);
- persons responsible for administering the LTEMP;
- potential occupational health and safety requirements associated with management of the materials;
- materials handling/disposal requirements associated with excavation of materials at the Project Area, if required.

Mitigation measures in **Chapter 20 Mitigation and management** require this plan to be implemented. No further mitigation measures are proposed for the ongoing management of the Project Area specific to this chapter.

11.7.4 Summary

A summary of the management and mitigation measures to manage potential human health risks from the Project are outlined in **Table 11-4**.

Table 11-4 Management and mitigation measures – human health risk assessment

Reference	Environmental management measures	Timing
HH1	The Occupational Health and Safety Plan within the PMP would outline the personal protective equipment and occupational health and safety measures to manage potential risks to on-site workers.	Detailed design/ Stage 1 to Stage 5

12.0 Waste management

12.1 Introduction

This chapter provides an assessment of the potential waste management issues relating to the Project. This chapter identifies, quantifies and classifies the various waste streams generated by the Project. Mitigation and management measures for effective storage, reuse/recovery, treatment and/or disposal in accordance with applicable standards and regulatory requirements have been provided.

12.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 12-1**. **Table 12-1** also presents where in this chapter each of the requirements are addressed.

Table 12-1 SEARs – waste management

SEARs	Where addressed
Waste: • accurate estimates of the quantity and classification of the potential liquid and non-liquid waste streams of the remediation works;	**Section 12.6**
• a description of storage, treatment (including immobilisation of contaminants), transport, disposal and reuse for all waste generated including any hazardous waste;	**Section 12.7**
• details of any waste materials brought on-site for the treatment and reuse, including type, quantity and classification and proposed remedial method;	**Section 12.6** and **12.7.2.1**
• a waste management plan detailing how each waste stream will be managed; and	**Section 12.7**
• details of transport, handling, storage and use of dangerous goods, chemical and products on-site, including measures to minimise leakage and migration of pollutants.	Refer to **Chapter 18 Hazards and risks**

The NSW Environment Protection Authority NSW (EPA) also provided input to the SEARs. Where applicable to this chapter, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A** of the Environmental Impact Statement (EIS).

12.3 Legislation and planning policy

12.3.1 Commonwealth legislation

National Waste Policy: Less Waste, More Resources (EPHC 2009)

The *National Waste Policy: Less Waste, More Resources* (EPHC, 2009) builds on the 1992 National Strategy for Ecologically Sustainable Development (ESD) (COAG, 1992) commitments to improve the range, variety and quality of environmental resources and reduce the environmental impacts of waste disposal. This Policy drives streamlined and accurate business reporting to the National Pollutant Inventory (and under a national product stewardship framework in the future).

The Policy is currently being reviewed and is expected to be released at the end of 2018. The revised Policy would be reviewed and incorporated into relevant mitigation and management measures during the preparation/finalisation of the Waste Management Plan (WMP) for the Project.

12.3.2 State legislation policies and plans

Waste Avoidance and Resource Recovery Act 2007

The *Waste Avoidance and Resource Recovery Act 2007* (WARR Act) includes the majority of NSW's over-arching objectives and guiding principles to encourage beneficial reuse and resource recovery.

The WARR Act promotes waste avoidance and resource recovery by providing a framework for the development of strategies and programs. It defines the waste hierarchy which is a set of priorities for the efficient use of resources which underpin the objectives of the WARR Act. The waste hierarchy ensures that resource management options are considered against the following priorities:

- **Avoidance** including action taken to reduce the amount of waste generated, to maximise efficiency and avoid unnecessary consumption;
- **Resource recovery** including reuse, recycling, reprocessing and energy recovery. Where avoiding and reducing waste is not possible, the next most preferred option is to reuse the materials without further processing, avoiding the costs of energy and other resources required for recycling; and
- **Disposal** including management of all disposal options in the most environmentally sensitive manner. Disposal is the least preferred option, and is appropriate for materials such as asbestos that cannot be safely reused or recycled.

The Project would embed the waste hierarchy into remediation activities. This is discussed in **Section 12.7**.

Waste Avoidance and Resource Recovery Strategy 2014

The NSW Government's *Waste Avoidance and Resource Recovery Strategy* (NSW EPA, 2014c) (WARR Strategy) provides the strategic direction for future waste management and resource recovery activities in NSW. The priorities for waste reform were determined by the NSW Government in the *NSW 2021: A plan to make NSW number one*.

The WARR Strategy aims to drive the efficient use of resources, reduce the environmental impact of waste and improve the well-being of the NSW environment, community and economy. The WARR Strategy sets out long-term targets and provides a framework for the development of various implementation plans. The WARR Strategy sets the following targets for 2021–22 which are applicable to the Project:

- increasing waste diverted from landfill; and
- managing problem wastes better.

The WARR Strategy recognises the importance of the waste hierarchy to guide effective resource management. It acknowledges, however, that different materials require different approaches. The choice of approach, including reuse, recycling and energy from waste, would depend on a balance of factors including economic and environmental considerations.

The Project would aim to meet the objectives of the WARR Strategy and implement measures to manage waste in a way which minimises the potential impact on the environment.

Protection of Environment Operations Act 1997

The *Protection of Environment Operations Act 1997* (PoEO Act) defines 'waste' for regulatory purposes and establishes management and licensing requirements along with offence provisions to deliver environmentally appropriate outcomes. The Act also establishes the ability to set various waste management requirements via the regulation.

The PoEO Act also provides for the issue of an Environment Protection Licence (EPL) for premises based scheduled activities pursuant to section 48 of the PoEO Act, and non-premises based scheduled activities pursuant to section 49 of the PoEO Act. The Site holds two EPLs for various scheduled activities (EPL numbers 570 and 660). EPL 660 does not apply to the Project.

EPL 570 applies to the majority of the Site and applies to the Western Area. It authorises and regulates the carrying out of two scheduled activities: waste processing; and chemical storage. It provides discharge and emission limits for a number of potential pollutants. It also prescribes reporting requirements for Viva Energy. The Project would be carried out in line with the conditions stipulated in EPL 570.

The Project would be considered a scheduled activity under the PoEO Act. As such the relevant EPL (EPL 570) would be varied to allow the remediation activities to occur.

Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation 2014* (PoEO Waste Regulation) sets out provisions covering the way waste is managed in terms of storage and transportation as well as reporting and record keeping requirements for waste facilities. The regulation also makes special requirements relating to asbestos and clinical waste.

The PoEO Waste Regulation sets out provisions for tracking certain wastes as they are transported throughout NSW and interstate. Some wastes managed by the Project, such as contaminated soils, are likely to be identified under Schedule 1 of the PoEO Waste Regulation as being required to be tracked when transported off-site and disposed of. These waste tracking requirements relate to record keeping that must be undertaken by consigners, transporters and receivers when these types of wastes are transported.

Asbestos waste is required to be securely packaged, be in a sealed container, be wetted down, or be covered in a leak-proof vehicle for transportation off-site (clause 78). Waste transporters and the receiving waste facility are also required to provide information to the NSW EPA to track the movement of any load of asbestos within NSW of more than 10 square meters of asbestos sheets or 100 kilograms (kg) of asbestos waste (clause 79).

All wastes received or removed from the Project Area would be stored, transported and disposed of in accordance with PoEO Waste Regulation requirements and tracked via implementation of material tracking measures.

These regulations enable NSW to issue ‘resource recovery orders and exemptions’ that allow for the beneficial ‘reuse’ of wastes via land application or for use as a fuel. These regulations support the principle of ‘wastes to resources’ where the wastes are fit for beneficial reuse.

Applicants must demonstrate that the waste reuse is genuine, beneficial, and will cause no harm to the environment or human health.

NSW can issue both general and specific resource recovery orders and exemptions. A general exemption can be issued for commonly recovered, high-volume and well-characterised waste materials. These exemptions may be used by anyone, without seeking approval from the NSW EPA, provided all conditions of an order and exemption are met for the reuse of the resource recovery waste to be lawful.

If a general resource recovery order or exemption is not currently available for the intended use of a waste material, an application can be made to the NSW EPA for an order and exemption specific to the proposed activity.

Where soils are brought from other sites for use as fill for the Project a NSW EPA specific Resource Recovery Order and Exemption would be required.

Environmentally Hazardous Chemicals Act 1985

The *Environmentally Hazardous Chemicals Act 1985 (NSW)* (EHC Act) provides the NSW EPA with the power to regulate the use of certain chemicals and chemical wastes by issuing Chemical Control Orders (CCOs). Two CCOs have been made by the NSW EPA under the EHC Act to control the use of Polychlorinated Biphenyl (PCB) materials and wastes and scheduled chemical wastes, which includes the management of such materials at the Clyde Terminal. The CCO outlines controls on the generation, processing, storing, conveying and disposal of PCB and scheduled chemical materials or wastes. Any PCB or scheduled wastes generated as part of the Project above the limits provided in the CCOs, would be required to be managed according to the CCO.

NSW Waste Classification Guidelines 2014

Waste classification helps those involved in the generation, treatment and disposal of waste, ensure the environmental and human health risks associated with their waste is appropriately managed in accordance with the PoEO Act and its associated regulations. Part 1 of the *NSW Waste Classification Guidelines* (NSW EPA, 2014a) (the 'Waste Classification Guidelines') provides advice and directions on classifying waste so that appropriate management of all waste types is achieved.

Waste material generated from the Project would be classified in accordance with these guidelines. The following waste classifications are relevant to the Project:

- special waste;
- liquid waste; and
- pre-classified waste, including:
  - general solid waste (putrescible);
  - general solid waste (non-putrescible);
  - restricted solid waste; and
  - hazardous waste.

Parramatta Development Control Plan 2011

The Clyde Terminal is located within the Camellia and Rydalmere Strategic Precinct as stated in the *Parramatta Development Control Plan 2011* (City of Parramatta Council, 2011) (Parramatta DCP). As outlined in **Chapter 5 Statutory planning context**, Development Control Plans (DCPs) do not apply to the Project. However, for certain aspects, where appropriate, the Project has also considered the Parramatta DCP.

Relevant for consideration for the Project are the requirements of the *Waste Management Guidelines for New Development Applications 2016* included in Appendix 8 of the Parramatta DCP. The DCP includes the following waste management objectives:

- to reduce the quantity of waste and encourage the recycling of waste generated by demolition and construction of new developments;
- to ensure that waste can be effectively collected and managed;
- to assist in achieving Federal and State Government waste minimisation and resource recovery (landfill diversion) targets; and
- to minimise the overall environmental impacts of waste, in line with the principles of Ecologically Sustainable Development.

These objectives have been considered in the preparation of the Waste Management Strategy outlined in **Section 12.7**.

12.4 Method of assessment

The waste management assessment involved an analysis of the Project to identify potential or likely waste streams and volumes arising from the removal of redundant infrastructure and wastes, remediation, landforming and completion and demobilisation. The assessment has been completed using the requirements of legislation and policy outlined in **Section 12.3** and **Appendix C Conceptual Remedial Action Plan** (RAP).

12.5 Existing environment

12.5.1 Overview

The Clyde Terminal currently operates under EPL 570, which provides for a number of scheduled activities including waste processing by non-thermal treatment of hazardous and other waste. In particular, condition L5 of the EPL provides for the receipt, generation, storage, processing and disposal of certain wastes scheduled under the PoEO Waste Regulation from the following off-site facilities:

- wastes from Viva Energy's Parramatta Terminal adjacent to the Clyde Terminal (EPL 660);
- wastes from Viva Energy's Gore Bay Terminal (EPL 661);
- waste oil water, hydrocarbons/water mixtures or emulsions from the Sydney Metropolitan Pipeline as per EPL 1969 and the Joint User Hydrant Installation;
- waste oil water, hydrocarbons/water mixtures or emulsions from the Park Fuels Port Kembla facility (EPL 654); and
- waste basic solutions or bases in solid form from Viva Energy's Geelong Refinery in Victoria (Victorian EPA licence number 46555).

Waste tracking requirements under the PoEO Waste Regulation are not applicable to waste received at the Clyde Terminal from the Gore Bay Terminal, Gore Bay/Clyde Pipeline or Joint User Hydrant Installation. However, records must be kept of the wastes received at the Clyde Terminal from the Gore Bay Terminal.

Waste at the Clyde Terminal is generally managed in accordance with the Waste and Resource Recovery Plan (WRRP) prepared for the Clyde Terminal Conversion Project (State Significant Development 5147), NSW and Commonwealth legislation, and Viva Energy standards.

The Western Area is not currently an operational site. There is redundant infrastructure including pipework, foundations, services, utilities and waste (e.g. soil and rubble stockpiles) currently present which would be removed as part of the Project.

12.5.2 Sensitive environments

Ineffective waste management has the potential to impact on sensitive environments in the vicinity of the Project Area. These sensitive environments adjacent to the Project Area include:

- surface waters, i.e. the Wetland, the Parramatta and Duck rivers, including ecological and human receivers;
- groundwater beneath the Project Area and downgradient, including ecological and human receivers; and
- surrounding residential and industrial land uses.

12.6 Impact assessment

This section presents the results of the waste management impact assessment undertaken for the Project.

12.6.1 Waste streams

12.6.1.1 Remediation (Stage 1 to Stage 5)

Potential waste streams that may be produced as part of the Project, as defined in the Waste Classification Guidelines, include liquid waste, general solid waste, restricted solid waste, hazardous waste and special waste. Waste streams expected to be generated during each stage of the Project are provided in **Table 12-2**.

Equipment and facilities which would be hired for the duration of the Project such as the Direct Thermal Desorption (DTD) unit and project and first aid offices and amenities would be returned to the hire company when no longer required and have therefore not been considered as a waste stream for the Project.

Table 12-2 Estimated Project waste generation during remediation (Stage 1 to Stage 5)

Waste type	Estimated quantity	Classification[1]	Primary source
Stage 1 – preparation works			
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics) from workers[2]	67 kg/day	General solid waste (putrescible)	Site workers (estimated peak workforce – 80 per day)
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, cardboard) from workers[2]	22 kg/day	General solid waste (non-putrescible)	Site workers (estimated peak workforce – 80 per day)
Wastes from toilets and bathrooms[2]	9 kilolitres (kL)/day	Liquid	Site workers (estimated peak workforce – 80 per day)
Stage 2 – removal of redundant infrastructure and waste[3]			
Excavated soil	10,000 cubic meters	General, restricted and/or hazardous solid waste (non-putrescible)	Excavated during the removal of the drainage network and other subsurface infrastructure
Concrete/bitumen	40,000 cubic meters	General solid waste (non-putrescible)	Building slabs, pipe drainage network and concrete/bitumen stockpiles associated with the former Clyde Refinery plant
Metals	Minor	General solid waste (non-putrescible)	Pipework
Reinforcement bar (rebar)	Minor	General solid waste (non-putrescible)	Building slabs, pipe drainage network and concrete/bitumen stockpiles associated with the former Clyde Refinery plant
Asbestos	Unknown	Special waste	Building structures/soil
Contaminated wastewater[4]	Minor	Liquid waste	Pumped out of drainage pipes prior to excavation, wheel wash bay
Used disposable Personal protective equipment (PPE)	Minor	General solid waste (non-putrescible)	Site workers (estimated peak workforce – 8 per day)
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics) from workers[2]	7 kg/day	General solid waste (putrescible)	Site workers (estimated peak workforce – 8 per day)
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, cardboard) from workers[2]	2 kg/day	General solid waste (non-putrescible)	Site workers (estimated peak workforce – 8 per day)
Wastes from toilets and bathrooms[2]	1 kL/day	Liquid	Site workers (estimated peak workforce – 8 per day)

Waste type	Estimated quantity	Classification[1]	Primary source
Stage 3 and 4 – Remediation and landforming			
Excavated soil	105,000 cubic meters	General, restricted and/or hazardous solid waste (non-putrescible)	Impacted remediation areas
Soil from off-site	5,000 cubic meters	General, restricted and/or hazardous solid waste (non-putrescible)	Additional fill brought to the Project Area for landforming. Off-site fill may include: • contaminated soils from other Viva Energy sites that would be remediated as part of the Project; • fill that has been validated and meets commercial/industrial criteria; and/or • fill that is appropriate for use based on a NSW EPA approved Resource Recovery Exemption.
Carbon filters	225 tonnes (t) per biopile (total 1,800 t)[5]	Hazardous waste or General solid waste (non-putrescible)	**Biopiles** GAC filters
Containers, drums or bags contaminated with sodium persulphate or sodium hydroxide residues	Approximately 220 t of sodium persulphate and approximately 234 kL of sodium hydroxide (to be confirmed in the Detailed RAP)	Hazardous or restricted waste (non-putrescible)	**In-area soil mixing** Oxidant and activator
Oily rags and gloves	Minor quantities	General solid waste (non-putrescible)	**Biopiles** Maintenance activities
Leachate	Minor quantities	Liquid waste	**Biopiles** Operation of the biopile
Slag deposits	Minor quantities	Hazardous waste or General solid waste (non-putrescible)	**Thermal desorption** Slag deposits from the thermal oxidiser
Fabric filters	Minor quantities	Hazardous waste or General solid waste (non-putrescible)	**Thermal desorption** Filters from the baghouse
General waste (e.g. grease cartridges, rags, PPE)	Minor quantities	Hazardous waste or General solid waste (non-putrescible)	**Thermal desorption** General operation of the thermal desorption unit
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics) from workers[2]	9 kg/day	General solid waste (putrescible)	Site workers (estimated peak workforce – 10 per day)

Waste type	Estimated quantity	Classification[1]	Primary source
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, cardboard) from workers[2]	3 kg/day	General solid waste (non-putrescible)	Site workers (estimated peak workforce – 10 per day)
Wastes from toilets and bathrooms[2]	1 kL/day	Liquid	Site workers (estimated peak workforce – 10 per day)
Stage 5 – completion works and demobilisation			
PVC pipes and polypropylene covers	1,778 metres (m) of pipes. Cover would span the 85 x 50 m footprint of the biopiles.	Hazardous waste or General solid waste (non-putrescible)	Removal of biopiling infrastructure
Clay lining	4,250 cubic meters[5]	Hazardous waste, Restricted waste or General solid waste (non-putrescible)	Removal of biopiling infrastructure
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics) from workers[2]	51 kg/day	General solid waste (putrescible)	Site workers (estimated peak workforce – 60 per day)
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, cardboard) from workers[2]	16 kg/day	General solid waste (non-putrescible)	Site workers (estimated peak workforce – 60 per day)
Wastes from toilets and bathrooms[2]	7 kL/day	Liquid	Site workers (estimated peak workforce – 60 per day)

Notes:
1 Waste classification would be confirmed prior to disposal in accordance with the Waste Classification Guidelines.
2 Generation rate based on 11 hour working days. It is noted that the thermal desorption unit would operate 24 hours per day this is not expected to impact waste generation by employees significantly.
3 For the purposes of this assessment it is assumed that the waste already present on-site consists of stockpiles and rubble and these are included in waste streams listed for Stage 2.
4 Generation and management of wastewater is discussed in the **Chapter 9 Surface water, wastewater and flooding**.
5 Estimated quantity based on two biopiles with the following dimensions 85 m (long) by 50 m (wide). The clay lining is assumed to be 0.5 m deep.

12.6.1.2 Ongoing operation

The ongoing operation of the Project is not expected to generate significant quantities of waste due to the nature of a vacant lot. There would not be any site facilities located in the Western Area following remediation. The main waste stream likely to be generated during ongoing operation is greenwaste from vegetation and weed management activities. This is summarised in **Table 12-3**.

Table 12-3 Estimated Project waste generation during ongoing operation

Waste type	Estimated quantity	Classification	Primary source
Greenwaste	Minor	General solid waste (non-putrescible)	Vegetation maintenance and weeding activities

12.6.2 Summary of potential impacts

If not managed responsibly, waste generated by the Project, as outlined in **Table 12-2** and **Table 12-3** has the potential to cause the following impacts:

- land and water (surface water and groundwater) pollution to sensitive environments in the vicinity of the Project Area resulting in human health and environmental impacts;
- land and water (surface water and groundwater) pollution to sensitive environments during transportation and resulting in human health and environmental impacts; and
- inefficient use of resources.

Mitigation and management measures to manage these potential impacts are discussed in **Section 12.7**.

Management strategies developed for each waste stream for the Project have been designed to be consistent with the waste management hierarchy, meet relevant legislation and policy, and to minimise the environmental impact of the Project.

12.7 Mitigation and management

12.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this EIS in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan (PMP), Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

The Project has been designed to minimise environmental impacts, for example remediating soils avoids disposal which is in line with the waste hierarchy. Project design measures would be outlined within the PMP.

Measures to address potential waste management impacts of the Project would be detailed in the REMP (in a waste management sub-plan (WMP)) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for Stage 1 to Stage 5 and during operation, respectively.

The waste management hierarchy has been used to help identify mitigation and management measures for waste generated and managed during the Project. The waste management hierarchy is a framework for prioritising waste management practices to achieve the best environmental outcome. The preferred order of adoption is as follows:

1. **Avoid** by identifying appropriate materials and procuring.
2. **Reduce** waste by optimising remediation and operation methods.
3. **Reuse** waste by identifying sources that can utilise the waste.
4. **Recycle** waste by identifying facilities that are able to recycle waste.
5. **Recovery** of waste materials.
6. **Disposal** of waste at an appropriate facility.

The underlying objective of effective waste management is to minimise the impacts on the environmental and social values and to implement sustainability principles.

To deliver effective waste management across the Project, a number of strategies would be adopted in accordance with the waste hierarchy. The Project aims to avoid waste by reducing the amount of waste generated and avoiding unnecessary consumption. The Project reduces the amount of waste generated by remediating the soils from the Western Area and off-site sources which may otherwise have been disposed of at landfill. Reuse, recycling, recovery and disposal of waste is discussed in **Section 12.7.2**, as well as the waste strategies and the specific mitigation and management measures to implement these strategies.

12.7.2 Remediation (Stage 1 to Stage 5)

The WMP would be prepared prior to commencement of the Project to manage the potential environmental impacts associated with waste management, and to help the Project meet the waste management hierarchy. The WMP would include:

- estimates of the quantity and classification of potential liquid and non-liquid waste streams from the Project;
- details of how each waste stream would be managed including storage, transport and reuse/disposal.

Table 12-4 outlines the proposed Waste Management Strategy, which includes details on storage, handling and/or disposal methods for each of the primary waste streams expected to be generated by the Project. The Waste Management Strategy and the waste management hierarchy would inform the development of the WMP.

12.7.2.1 Resource reuse/recycling/recovery

It is intended that waste generated from the Project would be managed appropriately and where possible, recycled and/or reused. The Project aims to minimise the volume of waste generated by the Project requiring off-site treatment and/or disposal. Excavated soils, concrete, and drainage pipes would be reused on-site where possible as discussed in **Table 12-4**.

12.7.2.2 Waste disposal

The disposal of waste materials would be considered where other options are not feasible. Viva Energy would employ licensed waste management companies to manage the identified waste streams arising from the Project that require disposal. **Table 12-4** identifies the waste streams that may be disposed of to landfill during the Project.

12.7.2.3 Waste monitoring and auditing

Infrastructure and waste materials removed during the Project would be tracked in line with material tracking measures outlined in the WMP. Documentation (such as receipts) for the transport and disposal of waste and recycling materials from the Project Area would be retained.

As discussed in **Chapter 4 Project description**, additional fill would be required to be brought to the Project Area from off-site sources to develop the final landform. The soils would be remediated (if required) and/or managed through the biopiling and landfarming process. These soils would require a NSW EPA specific Resource Recovery Order. The soils would be managed in line with this Order as well as a specific Validation Sampling Analysis Quality Plan (SAQP), which would outline acceptance criteria, and sampling and analytical requirements. Once material is validated (using the criteria outlined in the Validation SAQP), the soil would be reused on-site under a NSW EPA approved specific Resource Recovery Exemption.

The management approach of soils from off-site would be confirmed as part of the detailed design of the Project.

The imported fill would be stockpiled and tracked separately to the on-site materials and tested/validated to confirm the fill meets the criteria to be reused on the Project Area (refer to the Conceptual RAP in **Appendix C**).

The Waste Management Strategy for imported fill is summarised in **Table 12-4**.

Table 12-4 Waste Management Strategy – remediation Stage 1 to Stage 5

Waste type	Classification[1]	Waste Management Strategy			
		Storage/treatment	Reuse/recycle - on-site	Reuse/recycle - off-site	Off-site disposal
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics) from workers	General solid waste (putrescible)	General waste would be collected on-site in designated waste collection bins. No recyclable or contaminated materials are to be placed in these bins.	-	-	A waste contractor would pick up the bin(s) and take them off-site as required to a licensed landfill for disposal.
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, cardboard) from workers	General solid waste (non-putrescible)	Paper, cardboard, glass and plastic waste would be collected on-site in designated recycling collection bins. No general waste (putrescible) or contaminated materials are to be placed in these bins.	-	A waste contractor would pick up the bin(s) and take it off-site to a licensed recycling facility.	-
Wastes from toilets and bathrooms	Liquid	Connected to the existing sewerage systems or would be provided with storage/pump out systems. Refer to **Section 4.2.2**.	-	-	Connected to the existing sewerage system or a waste contractor would pump out the waste and take if off-site for disposal to a licenced facility.
Concrete/bitumen	General solid waste (non-putrescible)	A concrete/demolition Waste processing area would be established on-site to allow for the processing of subsurface materials that are not suitable for biopiling such as concrete, rebar and drainage lines. The processing area would remain on-site for the duration of the	Concrete would be stockpiled, crushed, validated and eventually used as back-fill (Stage 4). It is proposed that the concrete would be crushed for reuse during ten periods over the proposed two year remediation period (10 days per event)	Concrete that is contaminated or surplus to the requirements for landforming (Stage 4) would be sent off-site for recycling or disposal to landfill.	Concrete that is contaminated or surplus to landforming requirements (Stage 4) would be sent off-site for recycling or disposal to landfill.

Waste type	Classification[1]	Waste Management Strategy			
		Storage/treatment	Reuse/recycle - on-site	Reuse/recycle - off-site	Off-site disposal
Reinforcement bar (rebar)	General solid waste (non-putrescible)	Project. The likely location of the concrete/materials processing area would be south of Tank Farm A2 as shown in **Figure 4-1**. Once excavated, materials would be sorted and stockpiled. Rebar would be crushed using an excavator and concrete crusher to separate concrete from steel.		Separated steel would be sent off-site to a metals recycler.	Rebar which was not able to be separated into concrete and steel may be disposed of to landfill if reuse is not practicable.
Metals	General solid waste (non-putrescible)	Stockpiled separately at the concrete/demolition Waste processing area.	-	Send off-site for recycling	-
Asbestos	Special waste	There is the potential for unexpected asbestos finds during excavation works. The storage and handling of asbestos containing materials must be conducted by an NSW EPA licensed contractor. These activities must be conducted in accordance with the requirements of SafeWork NSW, the Work Health and Safety Act 2011 and supporting Regulations 2017, the PoEO (Waste) Regulation and NSW EPA Waste Classification Guidelines (NSW EPA, 2014a).	-	-	The removal and transport of asbestos containing materials must be conducted by an NSW EPA licensed contractor, and the materials must be disposed of at an appropriately licensed facility. These activities must be conducted in accordance with the requirements of SafeWork NSW, the PoEO (Waste) Regulation and NSW EPA Waste Classification Guidelines (NSW EPA, 2014a).

Waste type	Classification[1]	Waste Management Strategy			
		Storage/treatment	Reuse/recycle - on-site	Reuse/recycle - off-site	Off-site disposal
Contaminated wastewater from drainage pipes	Liquid waste	Wastewater from below ground drainage pipes would be pumped out and directed to the wastewater treatment plant (WWTP).	-	-	Wastewater that cannot be treated in the WWTP would be disposed off-site to a licensed contractor.
Excavated soil	General, restricted and/or hazardous solid waste (non-putrescible)	Soils would be excavated progressively and taken directly to the appropriate location for remediation. Once the soils have been remediated they would either be used immediately for backfill or stockpiled in the contingency treated stockpile area until they can be used as backfill.	Remediated soils would be used as backfill during landforming.	-	Where it is not feasible to remediate the soils with the technologies described in the **Appendix C**, they would be disposed off-site in accordance with the Waste Classification Guidelines, to an appropriately licenced facility.
Soil from off-site	General, restricted and/or hazardous solid waste (non-putrescible)	Soils from off-site would be transported directly to the appropriate location for remediation. Once the soils have been remediated they would either be used immediately for backfill or stockpiled in the contingency treated stockpile area until they can be used as backfill.	The imported fill would be tracked separately to the on-site materials and tested/validated to confirm the fill meets the criteria to be reused on the Project Area in accordance with the Resource Recovery Order and Exemption.	-	-
Carbon filters	Hazardous waste or General solid waste (non-putrescible)	Stored in a dedicated waste container located within the Project Area.	-	-	Sent off-site for disposal once it has been classified in accordance with the Waste Classification Guidelines.

Waste type	Classification[1]	Waste Management Strategy			
		Storage/treatment	Reuse/recycle - on-site	Reuse/recycle - off-site	Off-site disposal
Containers or drums contaminated with sodium hydroxide or sodium persulphate residues	Hazardous or restricted (non-putrescible)	Stored and handled in accordance with the relevant material safety data sheet and legislation (i.e. PoEO Waste Regulation and the *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW)* (Dangerous Goods Act) and associated regulation (e.g. in a bunded area/away from certain substances).	-	There is the potential for containers formally storing sodium hydroxide to be reused, if they are sent to an appropriately licenced facility to clean and repurpose. Transport of the container would be in accordance with the PoEO Waste Regulation and Dangerous Goods Act and Regulation.	Disposed of in accordance with the PoEO Regulation and Dangerous Goods Act and Regulation as a trackable waste via a licenced waste contractor and disposed of at an appropriately licenced facility.
Oily rags and gloves	General solid waste (non-putrescible)	Stored in a dedicated waste bin within a bunded area located within the biopiling area.	-	-	Sent off-site for disposal once it has been classified in accordance with the Waste Classification Guidelines.
Leachate	Liquid waste	Leachate from the biopiles would be sent to the WWTP prior to being discharged in line with EPL 570. Refer to **Chapter 9 Surface water, wastewater and flooding** for further information on leachate management.	-	-	-
Slag deposits	Hazardous waste or General solid waste (non-putrescible)	Stored in a dedicated waste bin located within the DTD area.	-	-	Sent off-site for disposal once it has been classified in accordance with the Waste Classification Guidelines.

Waste type	Classification[1]	Waste Management Strategy			
		Storage/treatment	Reuse/recycle - on-site	Reuse/recycle - off-site	Off-site disposal
Fabric filters	Hazardous waste or General solid waste (non-putrescible)	Stored in a dedicated waste bin located within the DTD area.			Sent off-site for disposal once it has been classified in accordance with the Waste Classification Guidelines.
General waste (e.g. grease cartridges, rags, PPE)	General solid waste (non-putrescible)	Stored in a dedicated waste bin located within the biopile and DTD area, as required.			Sent off-site for disposal once it has been classified in accordance with the Waste Classification Guidelines.
PVC pipes and polypropylene covers	Hazardous waste or General solid waste (non-putrescible)	Collected in dedicated stockpile on-site. Biopile infrastructure would be cleaned where appropriate.	Reused at the Project Area if appropriate.	Sent to an off-site recycling facility by a licensed waste contractor if appropriate.	Disposal by a licensed waste contractor to a licensed facility.
Clay lining	Hazardous waste, Restricted Waste or General solid waste (non-putrescible)	At the completion of biopiling the clay material would be validated for on-site reuse in accordance with the Waste Classification Guidelines. The compacted clay liner at the base of the biopiles would be reused as backfill	Clay material appropriate for reuse on-site would be used during landforming (Stage 4).		If the clay material is not suitable for reuse it would disposed of to an appropriately licenced facility.

Note:
1 Waste classification would be confirmed prior to disposal in accordance with the Waste Classification Guidelines (NSW EPA, 2014a).

12.7.3 Ongoing operation

The ongoing operation of the Western Area is not expected to generate significant quantities of waste due to the nature of a vacant lot. Greenwaste would be generated from vegetation and weed management activities and is summarised in **Table 12-5**.

Table 12-5 Waste Management Strategy - ongoing operation

Waste type	Classification	Waste Management Strategy			
		Storage/treatment	Reuse/recycle on-site	Reuse/recycle off-site	Off-site disposal
Greenwaste	General solid waste (non-putrescible)	Stored in a dedicated waste bin.	-	Sent off-site for disposal to licensed composting facility.	-

The LTEMP would include identification of waste management requirements for the ongoing management of the Western Area, including vegetation maintenance.

In the event that another waste stream, not identified in **Table 12-5** is produced during maintenance activities it would not be stored on-site and would be removed following completion of the activity and taken to an appropriate facility, as detailed in the LTEMP.

12.7.4 Summary

The mitigation and management measures to be implemented to minimise potential waste management impacts are summarised in **Table 12-6**.

Table 12-6 Mitigation and management measures – waste management

Reference	Mitigation and management measures	Timing
W1	A WMP would be prepared as a sub-plan to the REMP. The WMP would: • identify requirements consistent with the waste and resource hierarchy and cleaner production initiatives; • include relevant measures from the revised *National Waste Policy: Less Waste, More Resources* (EPHC, 2009); • ensure resource efficiency is delivered through the design, remediation and operational practices; • provide consistent clear direction on waste and resource handling, storage, stockpiling, use and reuse management measures; • outline procedures for stockpiling of wastes (refer to W2); • set out processes for disposal, including on-site transfer, management and the necessary associated approvals; • outline that waste generated within the Project Area would be segregated at source and suitably stored in designated waste management areas within the Project Area; • include material tracking measures to track waste and recyclables generated from the Project and removed from the Project Area. Material tracking records would include types, volumes and management measures for waste and resources arising from/used for the Project; • outline an unexpected finds protocol to manage the potential for unexpected finds during the remediation of the soils (i.e., asbestos or other hazardous materials, excluding hydrocarbon contamination); • include a process for auditing, monitoring and reporting.	Stage 1 to Stage 5

Reference	Mitigation and management measures	Timing
W2	Stockpiled wastes would be: • appropriately segregated to avoid mixing and contamination; • appropriately labelled; • appropriately stored to minimise risk of erosion; • less than 5 m in height; and • located more than 40 m away from any sensitive receivers, ecological areas and watercourses (refer to **Figure 1-1**).	Stage 1 to Stage 5
W3	Liquid (excluding those that are suitable to be transferred to the WWTP) and non-liquid wastes generated from Project would be assessed, classified and managed. Wastes requiring off-site disposal would be disposed of at an appropriately licenced facility.	Stage 1 to Stage 5
W4	All contaminated soil (as defined by Waste Classification Guidelines) received into the Project Area would comply with the SAQP criteria defined as part of the Remedial Work Plan (RWP).	Stage 1 to Stage 5
W5	No waste would be stored on-site during ongoing operation. Workers undertaking maintenance activities following completion of the Project would remove any waste produced from the Western Area at the completion of the activity.	Ongoing operation

Following implementation and compliance of the WMP and the mitigation and management measures outlined above, the Project is not expected to have a residual adverse waste impact. Therefore there no cumulative waste impacts are expected to occur. Further consideration of cumulative impacts is discussed in **Chapter 19 Cumulative impacts**.

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13.0 Noise and vibration

13.1 Introduction

This chapter provides a summary of the noise and vibration impact assessment prepared for the Project. The detailed noise and vibration assessment was prepared by Wilkinson Murray Pty Limited and is provided in **Appendix G**.

13.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) request that this assessment provides the following; as presented in **Table 13-1**. **Table 13-1** also presents where in this chapter each of the requirements are addressed.

Table 13-1 SEARs – noise and vibration

SEARs	Where addressed
Noise and vibration: • A quantitative assessment of potential noise and vibration impacts from the remediation works on sensitive receivers, including a cumulative noise impact assessment considering existing operations.	**Section 13.5**
• A noise management plan detailing measures to mitigate noise from remediation works to the nearest residential areas and neighbouring premises including details of times of operation for all stages of remediation works.	**Section 13.6** for management and mitigation measures

The NSW Environment Protection Authority (NSW EPA) also provided input to the SEARs. Where applicable to this assessment, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

13.3 Method of assessment

The noise and vibration impact assessment has been carried out in general accordance with the following guidelines and policies:

- *Interim Construction Noise Guideline* (DECC, 2009) (ICNG);
- *NSW Noise Policy for Industry* (NSW EPA, 2017b);
- *NSW Road Noise Policy* (DECCW, 2011) (RNP);
- *Assessing Vibration: a technical guideline* (DEC, 2006);
- *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures* (German Institute for Standardisation, 1999);
- *British Standard BS7385 Part 2, 1993 – Evaluation and Measurement for Vibration in Buildings, Guide to Damage Levels from Ground-borne Vibration* (British Standard, 1993); and
- *British Standard BS6472, 1992 – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* (British Standard, 1992).

The scope of the noise and vibration impact assessment was undertaken in four parts. This involved identifying:

- the noise impacts from equipment and plant;
- potential vibration impacts;
- potential cumulative impacts; and
- potential traffic noise impacts from traffic generated by the Project.

The methodology of the noise impact assessment included the following:

- identifying the relevant noise criteria;
- determining Noise Management Levels (NMLs) for the Project based on the background noise levels in accordance with the ICNG;
- identifying noise scenarios for the Project based on the Project description (refer to **Chapter 4**), including a worst case scenario (which includes the concurrent operation of all fixed and mobile plant associated with all stages);
- modelling the potential noise emissions of the Project based on the Project scenarios and noise levels of the equipment likely to be used, using CadnaA acoustic noise prediction software; and
- assessing the potential noise impacts of the Project by comparing the predicted noise levels from the model to the NMLs.

The methodology of the vibration impact assessment included the following:

- identifying the relevant vibration criteria for human comfort and structural damage;
- identifying vibration producing equipment; and
- comparing the vibration levels according to distance generated by mobile plant likely to be used during the Project with the criteria.

The cumulative noise impact assessment considered several Project stages occurring concurrently and the potential impact in combination with other noise sources in the area. The cumulative noise impact assessment uses the NMLs for the Project which are based on the background noise levels and therefore includes noise from existing operations at the Clyde Terminal.

The traffic noise assessment was undertaken by considering the existing traffic volumes on the surrounding road network and the number of vehicles likely to be travelling to and from the Project Area. The traffic noise assessment was undertaken in accordance with the RNP.

Mitigation and management measures are provided to minimise and manage the potential noise and vibration impacts of the Project.

13.3.1 Applicable noise criteria

The ICNG is the appropriate regulatory guideline for the noise impact assessment for the Project. The NSW EPA recommends the use of the ICNG for assessing and managing noise generated by construction works. In the same way that the ICNG documents the process to assess noise from construction in NSW, it can be used as a guideline in relation to noise from demolition, excavation and associated works carried out during remediation projects.

The ICNG recommends that standard construction (remediation) work hours should typically be as follows:

- Monday to Friday – 7:00 am to 6:00 pm;
- Saturday – 8:00 am to 1:00 pm; and
- No work on Sundays or public holidays.

The ICNG recommends noise criteria at residences as presented in **Table 13-2**.

Table 13-2 Applicable noise criteria at residences using quantitative assessment

Time of day	NML $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: • Monday to Friday: 7:00 am to 6:00 pm • Saturday: 8:00 am to 1:00 pm • No work on Sundays or public holidays	Noise affected Rating Background Level (RBL) + 10 A-weighted decibel (dBA)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq\ (15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. • If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL + 5 dBA	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

For commercial or industrial premises, the ICNG recommends the following NMLs:

- industrial premises: external $L_{Aeq\ (15\ min)}$ 75 dBA; and
- offices, retail outlets: external $L_{Aeq\ (15\ min)}$ 70 dBA.

The NMLs are assessed at the most-affected point on or within the residential/commercial/industrial property boundary of the premises, or if that is more than 30 metres (m) from the premises, at the most-affected point within 30 m of the premises.

13.3.2 Noise modelling

A number of Project scenarios were developed and modelled to predict the noise impacts from the Project upon surrounding sensitive receivers. The scenarios are described in **Appendix G**, and were based on the Project stages described in **Chapter 4 Project description**.

A scenario was also developed which included the concurrent operation of Stages 2, 3, 4 and 5 across the whole Project Area, for example, one remediation technology occurring in an area, while in a different area (where use of a particular remediation technology has been completed) the equipment is being removed and in other separate areas infrastructure and waste removal and landforming is also occurring. This summary chapter focuses on this scenario only, and although this scenario is unlikely, it would result in the greatest potential impact.

Noise modelling was based on the typical use of all major plant and equipment over a 15-minute period. Noise predictions were conservatively assessed on the basis of the following:

- all plant and equipment would operate concurrently during each scenario/activity;
- no acoustic shielding was assumed for structures on-site (e.g. hoardings). The modelling only includes topographical shielding and surrounding (intervening) industrial premises; and
- no mitigation or management measures are incorporated in the modelling.

Noise modelling was undertaken using the CadnaA acoustic noise prediction software using an ISO 9613 noise prediction algorithm. The noise model takes into account factors including the equipment's sound level emissions and location, sensitive receiver locations, topography, noise attenuation due to geometric spreading, ground absorption and atmospheric absorption.

13.3.3 Vibration criteria

The effects of Project-generated ground vibration on buildings can be divided into the following two categories:

- human comfort – disturbance to building occupants (i.e. vibration in which the occupants or users of the building are inconvenienced or possibly disturbed); and
- effects on building structures – vibration in which the integrity of the building or structure itself may be prejudiced.

Vibration criteria for human comfort were established using the guideline *Assessing Vibration: A Technical Guideline* (DEC, 2006), and are provided in **Table 13-3** below. Vibration criteria for building damage were determined using German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures* (German Institute for Standardisation, 1999), and are provided in **Table 13-4** below. Vibration levels generated by truck operation have been included to reflect the minimum levels that can be typically expected.

Table 13-3 Criteria for exposure to continuous vibration (human comfort)

Place	Time	Peak velocity (milometers per second (mm/s))	
		Preferred	Maximum
Office[1]	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2

Note:
1 It has been conservatively assumed that offices exist within industrial premises.

Table 13-4 Structural damage criteria

Type of structure	Peak component particle velocity (mm/s)			
	Frequency of the vibration at the foundation			Vibration of horizontal plane of highest floor at all frequencies
	1 Hertz (Hz) to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz[1]	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40

Note:
1 For frequencies above 100 Hz, at least the values specified in this column shall be applied.

13.3.4 Project traffic generation and traffic noise criteria

The traffic noise assessment was based on the expected number of heavy and private vehicles to be generated by the Project, which is presented in **Table 13-5**. The traffic generated by the Project would include a mix of plant vehicles, delivery vehicles and workforce movements.

Table 13-5 Workforce and plant requirements for the Project

Description		Maximum daily traffic generation (movements[1])	Maximum peak hour traffic generation (movements)
Remediation equipment	Heavy vehicles (trucks/concrete trucks etc.)	100	20
Private vehicles	Project workforce	160	80
Total		**260**	**100**

Note:
1 A movement is a one way trip to or from the Project Area.

Criteria for the assessment of road traffic noise are set out in the RNP. The RNP provides assessment criteria for residential land uses and other noise sensitive land uses (e.g. places of worship), however does not provide criteria for industrial land uses. Traffic noise impacts have therefore been assessed for residential receivers only. **Table 13-6** presents the road traffic noise criteria for residences to be applied for particular road categories.

The noise level goals at the residential receivers, for the Project, based on the RNP are:

- $L_{Aeq,\ 15hr}$ day 60 dBA; and
- $L_{Aeq,\ 9hr}$ night 55 dBA.

Table 13-6 Criteria for road traffic noise

Road category[1]	Type of project/land use	Assessment criteria (dB)	
		Day (7:00 am to 10:00 pm)	Night (10:00 pm to 7:00 am)
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Notes:
1 The road category descriptions in this table are consistent with the RNP. The Traffic, transport and access assessment provided in **Chapter 14** of this Environmental Impact Statement (EIS) uses the terms State roads and local roads, therefore these terms have been used throughout this EIS. However to be consistent with the RNP, for the purposes of the noise assessment, the terms in the table above have been used. For clarity freeways and arterial roads are considered State roads. All other roads are considered local roads.

In addition, where the above criteria are already exceeded as a result of existing traffic the RNP notes:

"For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'no build option'."

13.4 Existing environment

The existing environment surrounding the Project Area includes a number of industrial and residential receivers, which are described below. Ambient noise monitoring was undertaken as part of the noise and vibration impact assessment to determine the existing background noise levels to use in the assessment.

13.4.1 Noise sensitive receivers

The environment immediately surrounding the Project Area is occupied by industrial premises, with residential areas located further beyond these. Receivers representing the industrial receivers and noise sensitive residential receivers relative to the Project are described in **Table 13-7**, and shown in **Figure 13-1**.

The closest noise sensitive receiver is located at 105 Asquith Street approximately 360 m from the Project Area (R2b).

Table 13-7 Noise sensitive receivers

Receiver ID	Receiver description	Representative address
Industrial receivers		
InN	Rosehill north – industrial premises (e.g. including a building product manufacturing business)	10 Colquhoun Street, Rosehill
InS	Silverwater south (InS) – industrial premises (e.g. including an electronic product manufacturing business)	106 Derby Street, Silverwater
InE	Silverwater east (InE) – industrial premises (e.g. including an aluminium product manufacturing business)	52A Holker Street, Silverwater
InW	Rosehill west (InW) – industrial area premises e.g. including an appliance business and a transportation business)	5 Shirley Street, Rosehill
Residential receivers		
R1	Rydalmere – residential area along the northern banks of the Parramatta River to the north of the Project Area	530 John Street, Rydalmere
R2a and R2b	Silverwater – residential area adjacent the Silverwater industrial area to the south of the Project Area	R2a: 86 Carnarvon Street, Silverwater R2b: 105 Asquith Street, Silverwater
R3	Rosehill – residential area on the western side of James Ruse Drive to the west of the Project Area	35 – 43 Penelope Lucas Lane, Rosehill

The closest potentially sensitive receiver to the east of the Project Area is the Silverwater Correctional Facility (approximately 1.4 km from the eastern boundary of the Site), rather than a residential receiver. Noise emissions associated with the Project can be expected to be lower at this location than at the other closer residential receivers provided above.

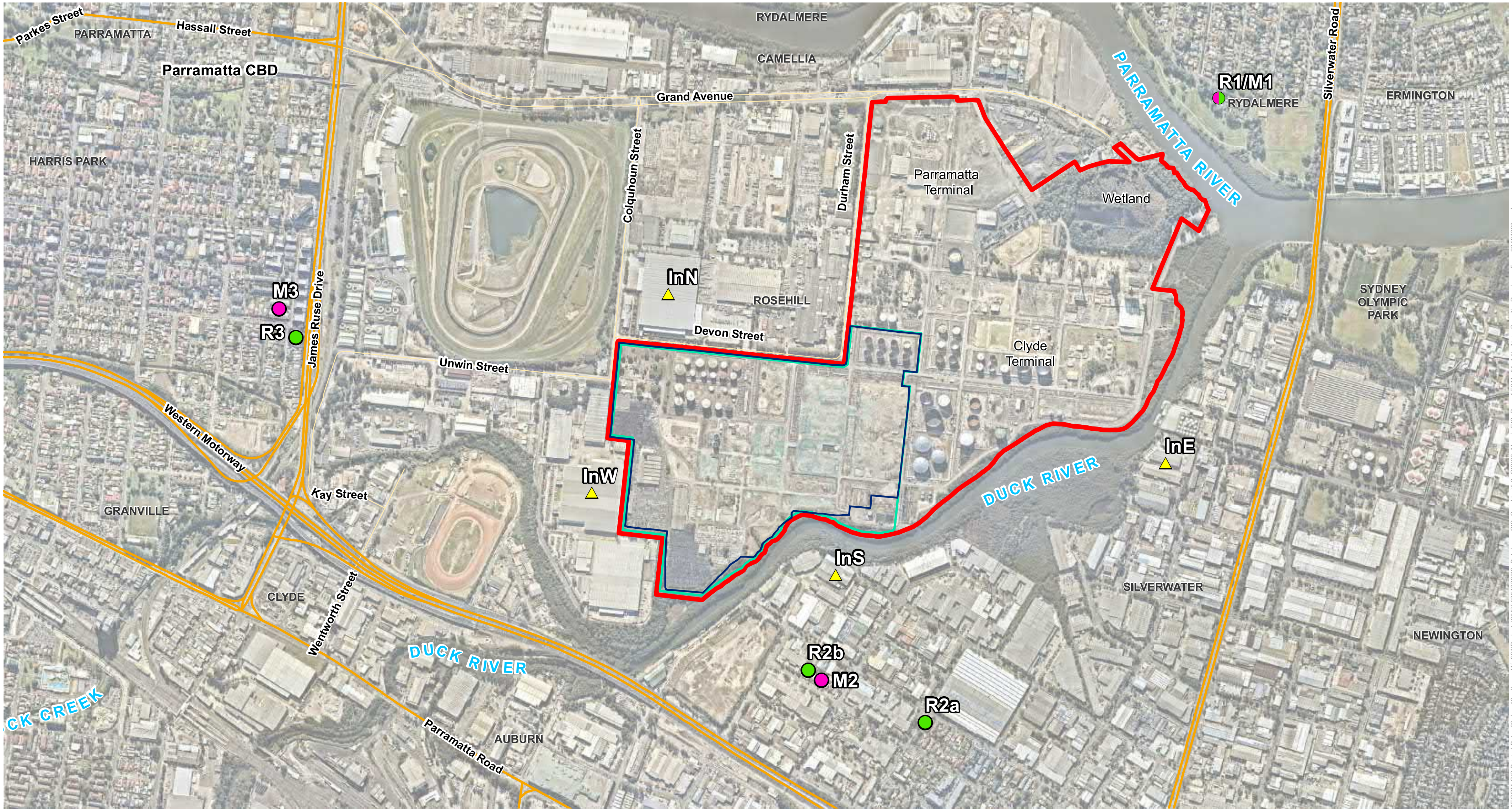

FIGURE 13-1: NOISE SENSITIVE RECEIVERS AND MONITORING LOCATIONS

0 200 400 m

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- State road
- Local road

Sensitive Receivers

- Industrial receiver
- Residential receiver
- Monitoring location

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

13.4.2 Ambient noise monitoring

Unattended environmental noise monitoring was conducted to establish the existing ambient (background) noise levels at the surrounding residential areas. Noise monitoring was undertaken between 31 October 2017 and 7 November 2017. Monitoring locations within each of the nearest residential suburbs are shown on **Figure 13-1** and included:

- Monitoring location M1 (Rydalmere): The noise logger was located at 530 John Street, Rydalmere to establish the ambient noise environment at residential receivers in Rydalmere to the north of the Project Area;
- Monitoring location M2 (Silverwater): The noise logger was located at 101 Asquith Street, Silverwater to establish the ambient noise environment at residential receivers in Silverwater to the south of the Project Area; and
- Monitoring Location M3 (Rosehill): The noise logger was located at 1-9 Eleanor Street, Rosehill to establish the ambient noise environment at residential receivers in Rosehill to the west of the Project Area.

These monitoring locations were selected to represent the surrounding sensitive residential receivers.

The measured data was processed into the assessment time periods (daytime, evening and night time) according to the NSW EPA's Noise Policy for Industry (NSW EPA, 2017b). Data affected by adverse meteorological conditions was removed from the dataset prior to processing.

Table 13-8 provides the RBL and LA_{eq} noise levels recorded during the daytime, evening and night time periods at the representative locations. The background levels include the noise emissions from the operations of the Clyde and Parramatta terminals.

Table 13-8 Measured ambient noise levels at noise sensitive receivers

Logger location	Noise level (dBA)					
	Daytime 7:00 am to 6:00 pm		Evening 6:00 pm to 10:00 pm		Night time 10:00 pm to 7:00 am	
	RBL[1]	LA_{eq}[2]	RBL[1]	LA_{eq}[2]	RBL[1]	LA_{eq}[2]
M1 Rydalmere	44	52	41	51	37	44
M2 Silverwater	42	55	41	51	38	48
M3 Rosehill	51	58	51	58	40	52

Notes:
1 The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
2 The LAeq is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

13.4.3 Surrounding road network and access to the Project Area

Road access to the Project Area is well established. Project related traffic movements from the arterial road network would either travel from James Ruse Drive along Grand Avenue and Colquhoun Street, or would come from the Great Western Highway along Wentworth Street, Kay Street and Unwin Street. The Project Area would be through Gate 6 at the corner of Unwin Street and Colquhoun Street.

Average daily traffic volumes for the key roads close to the Project Area are provided in **Chapter 14 Traffic, transport and access**.

13.5 Impact assessment

This section presents the results of the noise and vibration impact assessment undertaken for the Project.

13.5.1 Project Noise Management Levels

The noise sensitive receivers for the Project are identified in **Section 13.4.1**. The ambient noise levels at the sensitive receivers (refer to **Section 13.4.2**) have been reviewed against the guidance presented in the ICNG to develop Project NMLs. The Project NMLs for the noise sensitive receivers identified are presented in **Table 13-9**. This includes NMLs applicable for daytime standard hours, daytime out of hours and night time out of hours.

For industrial premises, the recommended external noise management level is 75 dBA when the premises are in use.

These NMLs have been used to complete the noise impact assessment for the Project.

Table 13-9 Noise management levels at residential receivers

Receivers	Daytime		Night time
	Standard hours	Out of hours[1]	Out of hours[2]
	Monday to Friday 7:00 am to 6:00 pm And Saturday 8:00 am to 1:00 pm $L_{Aeq,\ 15min}$ (dBA)	Saturday 1:00 pm to 6:00 pm And Sunday and Public Holidays 7:00 am to 6:00 pm $L_{Aeq,\ 15min}$ (dBA)	Monday to Sunday and Public Holidays 6:00 pm to 7:00 am $L_{Aeq,\ 15min}$ (dBA)
Rydalmere	54	49	42
Silverwater	52	47	43
Rosehill	61	56	45

Notes:
1 The works would be undertaken outside of standard hours as determined by the ICNG on Saturdays, being 1:00 pm to 6:00 pm
2 The lowest night time criterion was used as the out of hours NML for the time period 6:00 pm-7:00 am.

13.5.2 Remediation (Stage 1 to Stage 5)

13.5.2.1 Noise impact assessment

The results of the noise modelling undertaken for all of the assessed scenarios are presented in **Appendix G**. The results of the assessment show that noise levels generated throughout all stages of the Project are predicted to be below the applicable NML for all hours (including daytime standard hours, daytime out of hours and night time hours) at all residential and industrial receivers.

The summary below provides the predicted noise levels for the scenario where Stages 2, 3, 4 and 5 are occurring concurrently (concurrent scenario) across the whole Project Area.

Table 13-10 provides the predicted noise level for this concurrent scenario assessed at each sensitive receiver location during daytime standard hours and daytime out of hours. The applicable NML is also provided with no exceedance against these NMLs found.

Table 13-11 provides the noise level for this concurrent scenario assessed at each receiver location during night time hours. The applicable NML for night time hours is also provided with no exceedance against these NMLs found.

Table 13-10 Predicted noise levels at sensitive receivers for the concurrent scenario- Daytime hours

Receiver	Predicted noise level during daytime hours ($L_{Aeq\ (15\ min)}$ dBA)	Daytime standard hours[1]		Daytime out of hours[2]	
		NML (dBA)	Exceedances	NML (dBA)	Exceedances
R1	42	54	0	49	0
R2a	42	52	0	47	0
R2b	37	52	0	47	0
R3	45	61	0	56	0
InN	64	75	0	75	0
InS	58	75	0	75	0
InE	45	75	0	75	0
InW	62	75	0	75	0

Notes:
1 **Daytime standard hours**: Monday-Friday 7:00 am to 6:00 pm and Saturday 8:00 am to 1:00 pm.
2 **Daytime out of hours**: Saturday 1:00 pm to 6:00 pm and Sunday and public holidays 7:00 am to 6:00 pm.

Table 13-11 Predicted noise levels at sensitive receivers for the conservative worst-case scenario – Night time hours

Receiver	Predicted noise level during night time hours ($L_{Aeq\ (15\ min)}$ dBA)	Night time hours[1]	
		NML (dBA)	Exceedances
R1	34	42	0
R2a	32	43	0
R2b	<30	43	0
R3	32	45	0
InN	50	75	0
InS	49	75	0
InE	34	75	0
InW	49	75	0

Note:
1 **Night time hours**: Monday-Sunday and public holidays 6:00 pm to 7:00 am

The highest noise level predicted for residential receivers was 45 dB at receiver R3 during day time hours. This is below the applicable NMLs of 61 dB and 56 dB for daytime out of hours and daytime standard hours respectively. The highest noise level predicted for industrial receivers was 64 dB at receiver InN during daytime hours. This is well below the applicable NML of 75 dB for daytime out of hours and daytime standard hours respectively.

During night time hours, the highest noise level predicted for residential receivers was 34 dB for receiver R1, which is well below the applicable night time NML of 42 dB. The highest noise level predicted for industrial receivers at night time was 50 dB, well under the NML of 75 dB.

The assessment noted that the operation of the thermal desorption plant out of hours also achieves the criterion applicable to night time works at all residential receiver areas and would comfortably achieve the 75 dBA NML at surrounding industrial receivers.

In addition, the assessment found that based upon the ambient noise monitoring results, existing noise levels at surrounding residential receivers are generally more than 10 dBA above the predicted contributions from the Project. This means that the potential noise levels experienced at any sensitive receiver would be predominantly comprised of noise from existing (background) sources, rather than noise from the Project.

The results of the noise assessment show that noise impacts from the Project are not likely to be significant, even in the conservative worst-case scenario, which is unlikely to eventuate.

13.5.2.2 Vibration impact assessment

The nearest residential receivers are located in Silverwater separated by Duck River and further industrial premises which are located at a large distance from the Project (>100 m). At such distances, vibration from the Project would not be perceptible. The nearest buildings to the Project Area are industrial premises located approximately 30 m away to the west. On this basis the vibration assessment focuses on the nearest buildings. The following section therefore address vibration impacts to the industrial premises.

Table 13-12 lists vibration intensive plant likely to be used during the Project and provides predicted ground vibration levels at various distances. The vibration levels are indicative only and would vary depending on the particular item of plant and geotechnical conditions.

Table 13-12 Typical plant vibration levels

Stage	Activity	Peak Particle Velocity (PPV) vibration level (mm/s) at distance from activity			Structural damage criteria PPV mm/s	Human comfort criteria PPV mm/s
		10 m	20 m	30 m		
Stage 1 to Stage 5	Truck over smooth road surface	0.05	<0.01	-	20	0.56 – 2.2
Stage 1 to Stage 5	Excavator (earthmoving)	0.5 - 0.2	0.1	<0.1	20	0.56 – 2.2
Stage 4 and Stage 5	20 t padfoot roller	6.2	3.3	1.6	20	0.56 – 2.2

Based on the results in **Table 13-12**, vibration is unlikely to exceed the criteria for structural damage at the closest industrial properties. For example, the vibration from a 20 tonne (t) padfoot roller at a distance of 30 m would be 1.6 PPV mm/s, well under the structural damage criteria of 20 PPV mm/s.

The results in **Table 13-12** show that the recommended lower limit for human comfort may at times be exceeded, when a 20 t padfoot roller is used within 30 m for industrial premises that contain offices/workshops. If industrial offices/workshops are identified within 30 m of a padfoot roller, it is recommended that trials are conducted. If the trials confirm an exceedance, alternative work practices may need to be considered. The vibration from a 20 t padfoot roller at a distance of 30 m would be within the higher human comfort criteria of 2.2 PPV mm/s.

The results of the vibration assessment show that potential vibration impacts from the Project would not be significant.

13.5.2.3 Traffic noise assessment

The noise assessment found that existing traffic volumes along the major roadways (James Ruse Drive, Silverwater Road and Parramatta Road) exceed 40,000 vehicles per day (refer to **Chapter 14 Traffic, transport and access**).

Road traffic noise predictions using the Calculation of Road Traffic Noise 1988 (CRTN) procedure have been conducted for James Ruse Drive, Silverwater Road and Parramatta Road at the closest residential receivers located at a typical setback distance of 15 m. The traffic noise predictions confirm that the noise criteria of 60 dBA and 55 dBA for the day and night, respectively, will be exceeded for existing traffic.

The noise assessment found that given these existing traffic volumes and associated noise levels, the noise contribution from Project-related traffic movements would be negligible at residences along James Ruse Drive, i.e. less than 2 dB and therefore not distinguishable. The assessment found that this would also be the case at all other major roads along which Project-related vehicles would travel and along which residential properties are located. The potential impacts of Project-related traffic noise would therefore not be significant.

When travelling along local roads from Grand Parade, Wentworth Street or James Ruse Drive to access the Project Area, Project-generated traffic passes industrial properties only. There are no residential or other noise sensitive receivers along these routes.

13.5.3 Ongoing operation

There would be no impacts to sensitive receivers from the ongoing operation, as works would be restricted to inspection and management of the final landform.

13.6 Mitigation and management

13.6.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this EIS in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

Measure to address potential noise and vibration impacts during Stage 1 to Stage 5 of the Project would be detailed in the REMP, in a noise and vibration management sub-plan. The REMP and noise and vibration sub-plan would detail the environmental controls, mitigating measures, contingency plans and monitoring programs.

The mitigation and management measures to be included in the noise and vibration management sub-plan are discussed in more detail in the following section.

13.6.2 Remediation (Stage 1 to Stage 5)

The noise and vibration impact assessment found that potential noise and vibration impacts would be within the applicable criteria for the Project. Despite this, mitigation and management measures have been proposed to minimise noise and vibration emissions from the Project.

As outlined in **Section 13.6**, a noise and vibration sub-plan would be produced as part of the Remediation Environmental Management Plan. Measures which would be included in this plan include:

- plant and equipment with low noise emission levels would be used where practicable;
- community consultation with surrounding property owners/occupiers would be undertaken to assist in the alleviation of community concerns where required. A 24 hour community concerns phone line would be operated throughout the Project;
- a suitable complaints management procedure would be prepared and implemented; and
- training of the Project workforce would be undertaken and include noise management.

13.6.3 Summary

A summary of the mitigation and management measures to manage potential noise and vibration impacts from the Project are outlined in **Table 13-13**.

Table 13-13 Mitigation and management measures – noise and vibration

Reference	Mitigation and management measures	Timing
NV1	A Noise and Vibration Management Plan would be prepared as part of the REMP. This would include the following commitments: • plant and equipment with low noise emission levels would be used where practicable; • ensuring plant and equipment is properly maintained; • turning off machinery when not in use; and • vibration trials would be conducted when vibration intensive work (e.g. a 20 t padfoot roller) is proposed within 30 m of buildings. Training of the Project workforce would be undertaken and include ensuring work occurs within approved hours.	Stage 1 to Stage 5
NV2	A 24 hour community concerns phone line would be implemented for Stage 1 to Stage 5 of the Project. This would be detailed in the PMP for the Project.	Stage 1 to Stage 5

Reference	Mitigation and management measures	Timing
NV3	A suitable complaints management procedure would be prepared and implemented and documented in the PMP for the Project. This would include: • maintenance of a complaints register; • if required, noise and vibration monitoring would be conducted in response to complaints received to ensure compliance with Project noise and vibration criteria; • if necessary, reasonable and feasible measures would be implemented to address noise impacts; and • a feedback process would be established to manage complaints, including responding to complainant and updating them on the action/s taken.	Stage 1 to Stage 5

The noise assessment concluded that the Project meets the applicable noise criteria and is not affecting a sensitive receiver on its own. Nevertheless a negligible residual impact could still potentially occur (e.g. if the noise from the Project further increased a significant noise impact from another project).

13.7 Cumulative impact assessment

The Project, without management measures employed, is expected to have no significant residual impact. However, the potential for a cumulative impact with the Parramatta Light Rail, Wentworth Marina and Clyde Barging Facility projects has been considered. The Project alone is 5 dBA or more below the identified noise management levels. The identified cumulative projects are some distance from the Project and if a cumulative noise impact was to occur it would likely be driven by significant impacts from the other projects given the low noise predictions for the Project itself. As such whilst a temporary negligible cumulative impact may remain, it is unlikely to be significant for this Project.

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14.0 Traffic, transport and access

14.1 Introduction

This chapter provides a summary of the traffic, transport and access assessment undertaken for the Project. The detailed traffic and transport assessment was prepared by AECOM and is provided in **Appendix H**.

14.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) request that this assessment provide the following information; as presented in **Table 14-1**. **Table 14-1** also presents where in this chapter each of the requirements are addressed.

Table 14-1 SEARs – traffic, transport and access

SEARs	Where addressed
Traffic and access: • accurate predictions of the traffic generated by the remediation works and the impact on the safety and capacity of the surrounding road network and key intersections; and	**Section 14.5**
• measures to manage vehicle and pedestrian movements throughout remediation works.	**Section 14.6**

Roads and Maritime Services also provided input to the SEARs. Where applicable to this assessment, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

14.3 Method of assessment

The potential impact of the Project on the surrounding transport network has been assessed in accordance with the following policies, guides and plans:

- *NSW Long Term Transport Master Plan* (Transport for NSW, 2012);
- *Draft Camellia Town Centre Master Plan* (DPE, 2018a);
- *Guide to Traffic Generating Developments* (NSW Roads and Traffic Authority, 2002);
- *Guide to Traffic Management Part 12: Traffic Impacts of Developments* (Austroads, 2016); and
- *Australia/New Zealand Standard 2890.1 Parking facilities Part 1: Off-street car parking* (Standards Australia, 2004).

The scope of the traffic, transport and access impact assessment was undertaken in four parts. This involved identifying:

- the Study Area;
- the existing road, rail, public transport and active transport networks;
- traffic volumes at key intersections;
- potential traffic, transport and access impacts from traffic generated by the Project;
- recommending mitigation and management measures; and
- potential cumulative traffic, transport and access impacts.

14.3.1 Study Area

The Study Area for the traffic and transport assessment has been defined as the 'Camellia Precinct' urban renewal area as defined in the Draft Camellia Town Centre Master Plan Planning Report (DPE, 2018a). Indicatively, this area is bound by the Parramatta River to the north, Duck River and Duck Creek to the east and south and James Ruse Drive to the west.

14.3.2 Existing environment

An initial overview of the Study Area is provided to describe the current conditions and operations of the transport network including a discussion of the following characteristics:

- road network;
- rail network;
- public transport opportunities;
- cycling routes and facilities; and
- pedestrian routes and facilities.

Intersection turning movement count data was obtained on Thursday 26 October 2017 at the following key arterial road intersections:

1. James Ruse Drive, Grand Avenue and Hassall Street;
2. James Ruse Drive and Parramatta; and
3. Parramatta Road and Wentworth Street.

The data was collected by placing pole-mounted cameras at each intersection which recorded the vehicle turning movement demands between 7:00 am to 9:00 am in the morning, and 4:00 pm to 6:00 pm in the afternoon, for a combined total of four hours during the day of the survey.

Understanding these characteristics has allowed the baseline conditions for the existing traffic and transport environment to be identified.

14.3.3 Impact assessment

The impact assessment provides a comparison of the baseline environmental conditions against the potential impacts of the Project. The assessment highlights activities relevant to the traffic and transport and access assessment including the program of works, likely workforce required and number of heavy[1] and private[2] vehicles to be utilised. The assessment of the traffic impacts involves the use of Sidra Intersection traffic modelling software (Version 8), with baseline conditions established via the collection of intersection traffic count data as described above. The main performance indicators considered in this assessment using Sidra Intersection modelling are:

- Average Delay – the average duration in seconds that each vehicle is delayed when negotiating the intersection, which can be considered either by movement, approach lane or the whole intersection; and
- Level of Service (LoS) – a measure that uses a scale of A through F to define the value of average delay, as summarised in **Table 14-2**.

[1] A heavy vehicle as defined by the Austroads Glossary of Terms (2015) is a vehicle with a gross vehicle mass of aggregate trailer mass of more than 4.5 tonnes.
[2] For the purposes of this assessment a private vehicle is a light vehicle used to transport the Project workforce to and from the Project Area. A light vehicle is defined in the Austroads Glossary of Terms (2015) as a vehicle that is not a heavy vehicle.

Table 14-2 LoS performance criteria for intersections

LoS	Average delay (seconds per vehicle)	Description of operations at traffic signals
A	≤ 14	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity, at signals incidents will cause excessive delays
F	≥ 71	Long delays, lengthy queues

Source: RTA Guide to Traffic Generating Developments, 2002

Comparison of the baseline environmental conditions of the traffic network against the assumed traffic generated by the Project has informed the conclusions for the traffic impact assessment.

14.4 Existing environment

14.4.1 Overview

The Study Area is primarily zoned IN3 ‘Heavy Industrial’ under the *Parramatta Local Environmental Plan 2011*, and is characterised by significant industrial development. Additionally the Rosehill Gardens Racecourse is located in the west of the Study Area, the Sydney Speedway in the south and to the north of the racecourse there is a small area of land zoned B5 ‘Business Development’.

The Clyde and Parramatta terminals operate 24 hours a day, seven days a week and other industrial development in the area may also operate outside of standard daytime hours. Therefore traffic activity associated with these developments may occur at all hours of the day. The two nearby recreational venues of Rosehill Gardens Racecourse and the Sydney Speedway both generally hold events on Saturdays, with each site having the potential to attract large numbers of patrons.

The Study Area and relevant features of the existing environment are shown on **Figure 14-1** and **Figure 14-3**.

14.4.2 Road network

The Study Area is well connected to the surrounding arterial road network via the following classified roads managed and financed by Roads and Maritime Services:

- James Ruse Drive to the west, providing access to vehicles travelling to and from the north, as well as linking to the nearby east-west connections to the south;
- M4 Western Motorway to the south, a tollway providing access for vehicles travelling to and from both the east and west, as well as linking to other roads on the network providing access to and from the south. The M4 Western Motorway has recently been upgraded between Parramatta and Homebush as part of the WestConnex program of works, which involved the addition of travel lanes in both directions; and
- Great Western Highway (Parramatta Road) further to the south, providing access to the Study Area for vehicles travelling to and from both the east and west, as well as linking to roads providing access to and from the south.

Both the M4 Western Motorway and Parramatta Road are major radial arterial routes and tend to experience heavy congestion concurrent with the morning and afternoon commuter peaks. This often results in heavy congestion on weekdays in the eastbound direction during the morning and westbound during the afternoon and evening.

James Ruse Drive is cross-suburban and tidal traffic flows are therefore less prevalent with congestion generally occurring in both directions during weekday commuter peak periods.

Indicative traffic volumes on the nearby arterial road network are provided in **Table 14-3**.

Table 14-3 Average daily traffic volumes on the surrounding arterial road network[3]

Count station location	2012	2013	2014	2015	2016
James Ruse Drive, 120 metres (m) south of Thomas Street	70,280	70,837	-	-	-
Parramatta Road, 20 m west of Marsh Street	49,151	48,622	-	-	-
Parramatta Road, 140 m west of Harbord Street	44,193	42,902	42,809	44,063	45,756
M4 Western Motorway, 70 m east of Bedford Road (Homebush)[1]	93,034	92,666	90,998	91,164	88,699

Note:
1 The closest count station to the Site on the M4 Western Motorway is near Homebush, approximately 6 kilometres (km) east of James Ruse Drive.

Local road connections from the arterial road network described above to the wider road network in the Study Area link to two main local roads, both managed and financed by City of Parramatta Council. These are:

- Grand Avenue, which intersects with James Ruse Drive and Hassall Street to the north-east of Rosehill Gardens Racecourse and provides access to the Study Area from the north; and
- Wentworth Street, which intersects with Parramatta Road to the east of James Ruse Drive, and travels underneath the M4 Western Motorway to provide access to the Study Area from the south via Kay Street and Unwin Street.

Access to the Project Area from Grand Avenue is via Colquhoun Street or Durham Street, and Devon Street (all local roads) through Gate 6. Gate 6 is the access point for the Project Area and is located on the corner of Colquhoun Street and Unwin Street. Access to Gate 6 from Wentworth Street is via Kay Street and Unwin Street (both local roads). Gate 6 meets the requirements for use by heavy vehicles and plant required for the Project.

Due to the Study Area's industrial zoning, there is good access for heavy vehicles. All local roads within the Study Area are designed to cater for large heavy vehicles associated with the industrial land use in the area and are of a sufficient width to accommodate both through traffic and parking lanes for heavy vehicles. Pavement markings, including road centre lines, are largely non-existent throughout the Study Area.

Based on the Heavy Vehicle National Law (HVNL), which is administered by the National Heavy Vehicle Regulator (NHVR), Class 2 General Mass Limit (GML) heavy vehicles up to 25/26 m B-double in size are permitted to travel on all public roads within the Study Area, with access from the arterial road network provided via Grand Avenue and Wentworth Street. There is however a vehicle height restriction of 4.6 m where Wentworth Street travels under the M4 Western Motorway. Whilst the standard height limit of heavy vehicles is 4.3 m, should an over-height vehicle exceeding 4.6 m require access to the Study Area, this must be via Grand Avenue.

These existing road network attributes are shown on **Figure 14-1**.

Study Area traffic volumes

Intersection turning movement count data was obtained on Thursday 26 October 2017 at the following key arterial road intersections, with peak periods noted:

1. James Ruse Drive, Grand Avenue and Hassall Street – peak hours occurred between 7:00 am to 8:00 am and 4:15 pm to 5:15 pm;
2. James Ruse Drive and Parramatta Road – peak hours occurred between 7:00 am to 8:00 am and 4:45 pm to 5:45 pm; and
3. Parramatta Road and Wentworth Street – peak hours occurred between 7:00 am to 8:00 am and 4:45 pm to 5:45 pm.

[3] http://www.rms.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/

The results of these surveys are provided in detail in **Appendix H** and summarised in **Table 14-4**, with the locations of the surveys shown in **Figure 14-1**.

Table 14-4 Summary of intersection turning movement count data - peak periods

Intersection	South leg			East leg			North leg			West leg		
(Peak)	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
1 (AM)	307	1,844	112	128	27	119	261	2,100	139	299	269	303
1 (PM)	284	1,567	84	200	103	289	68	2,062	171	317	43	511
2 (AM)	0[1]	0[1]	0[1]	46	1,082	656	745	51	529	513	1,198	42
2 (PM)	1[1]	0[1]	1[1]	20	1,088	621	708	75	533	702	1,269	39
3 (AM)	-	-	-	-	1,722	139	81	-	61	118	1,829	-
3 (PM)	-	-	-	-	1,505	50	80	-	227	45	1,935	-

Note:
1 Northbound vehicles on Berry Street are banned from accessing Parramatta Road at this intersection.

The data collection date was approximately two months after tolls on the M4 Western Motorway went live, which is likely to have resulted in a redistribution of traffic patterns on the surrounding network (including Parramatta Road and James Ruse Drive) due to road users avoiding the toll. Therefore the surveyed traffic volumes could be indicative of traffic conditions marginally worse than the expected current average.

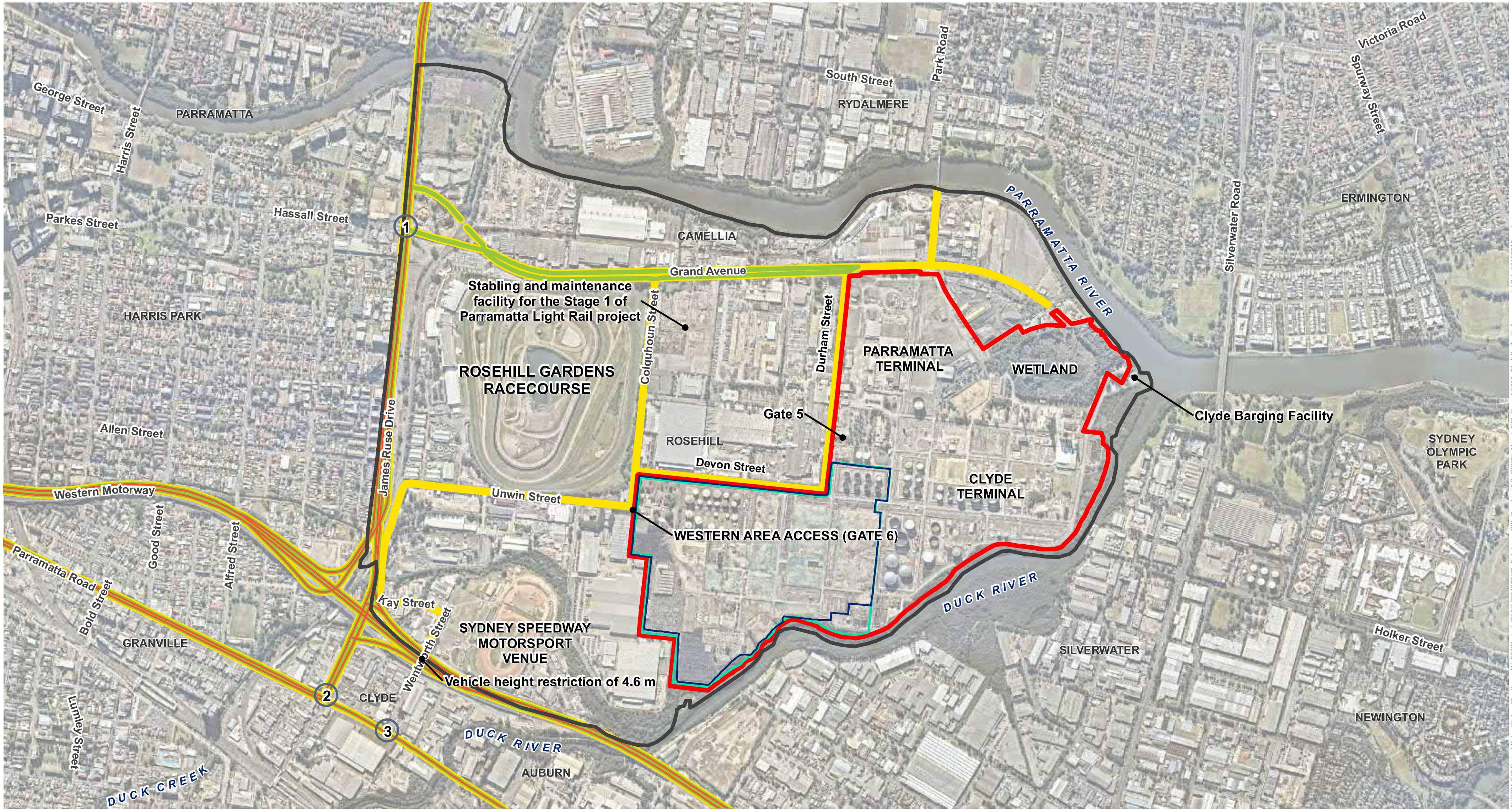

FIGURE 14-1: TRAFFIC AND TRANSPORT ASSESSMENT STUDY AREA AND ROAD NETWORK CONTEXT

KEY

- Study area
- Site boundary
- Project Area boundary
- Western Area boundary
- Traffic count location

RMS Routes

- HML 25/26m B-Double route
- HML Short Combination route
- Class 2 GML 25/26m B-Double route

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

AECOM

0 100 200 400 m

14.4.3 Rail network

Between James Ruse Drive and Rosehill Gardens Racecourse, the Clyde to Carlingford heavy railway line currently operates as the T6 Carlingford suburban passenger railway line (T6 Carlingford line), providing shuttle services that require passengers to transfer at Clyde when travelling to and from other areas including the Sydney and Parramatta central business districts on either the T1 or T2 lines.

Passenger services are available to the east and south of the Study Area with the closest stations being Rosehill and Camellia on the T6 Carlingford Line (refer to **Figure 14-3**). Rosehill Station however, effectively services Rosehill Gardens Racecourse only, with no public pedestrian access available through to the industrial area throughout the Camellia Peninsula.

The T6 Carlingford line operates predominantly as a single track heavy rail line and is planned to be replaced by Stage 1 of the Parramatta Light Rail project, with construction set to commence late in 2018 and be operational by 2023 (Transport for NSW, 2017). The Parramatta Light Rail project will involve installation of dual tracks along the existing T6 Carlingford line alignment, deviating south of Camellia Station towards the west to Parramatta and beyond as shown in **Figure 14-2**.

To the north of Grand Avenue is the former Sandown freight rail line that is not currently operational, however as shown in **Figure 14-2** the stabling and maintenance facility for the Parramatta Light Rail project is proposed to be provided to the east of Colquhoun Street, which would utilise this existing corridor.

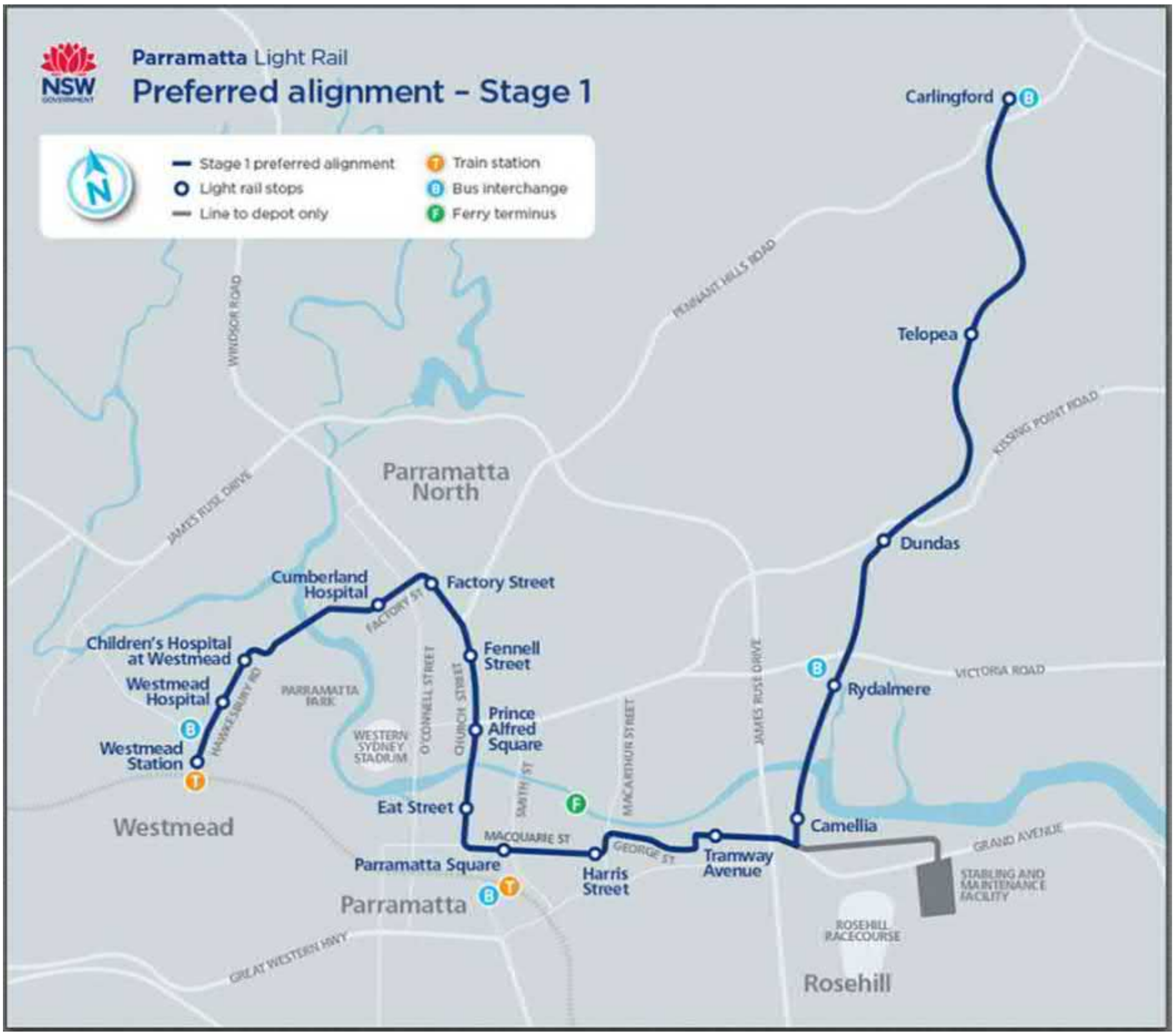

Figure 14-2 **Stage 1 preferred alignment for Parramatta Light Rail project**

Source: Transport for NSW, 2017.

14.4.4 Public transport – bus services and ferries

The closest bus route is the M92 which connects Parramatta with Sutherland via James Ruse Drive and Parramatta Road. The closest stop is located on James Ruse Drive, approximately 1 km to the west of the Project Area and is serviced with a 10 minute frequency during the morning and afternoon peak periods.

Additional bus services located further from the Project Area include the 909 service connecting Parramatta with Bankstown, via Alfred Street and Parramatta Road and the 544 service which connects Macquarie Park with Auburn. With the closest stops located on Alfred Street 1.3 km to the east of the Project Area and Adderley West, 800 m to the south of the Project Area and across the Duck River.

River ferry services are also available near to the Study Area, with Rydalmere Wharf located on the northern side of the Parramatta River serviced by the F3 Parramatta River ferry service connecting Parramatta with Circular Quay. The wharf is located approximately 400 m east of a shared pedestrian and cyclist bridge crossing the Parramatta River near the eastern end of Grand Avenue providing access to the Study Area.

These public transport facilities are shown on **Figure 14-3**.

14.4.5 Cycling routes and facilities

A variety of dedicated cycling facilities are provided in proximity to the Study Area. Shared cyclist and pedestrian pathways located near the Study Area include:

- Parramatta Valley Cycleway providing a regional east-west connection between Parramatta Park and Sydney Olympic Park, predominantly along the northern bank of the Parramatta River; and
- M4 Cycleway providing a regional east-west connection between Sydney Olympic Park and South Wentworthville along the M4 Western Motorway corridor. Further to the west there are connections to the Parramatta-Liverpool Rail Trail and Liverpool-Parramatta T-way shared pathways.

In addition, cyclists are permitted to ride on most public roads both within and beyond the Study Area, apart from the M4 Western Motorway where cyclists are not permitted between North Strathfield and Holroyd.

These cycling routes are shown on **Figure 14-3**.

14.4.6 Pedestrian routes and facilities

Provisions for pedestrians are generally limited throughout the Study Area. Sealed footpaths for pedestrian use are provided in the following locations:

- Grand Avenue along the northern side, from the rail overbridge to the access for 'Rosehill Business Park' just east of Colquhoun Street;
- James Ruse Drive, generally along the western side only, with facilities on the eastern side limited to pedestrian connections into Rosehill Gardens Racecourse only;
- the southern road route connecting the Study Area to Parramatta Road via Wentworth Street, Kay Street and Unwin Street, which generally has footpaths on at least one side of the road for the majority of the route;
- a crossing underneath James Ruse Drive that links Unwin Street to the western side of James Ruse Drive at A'becketts Creek; and
- Unwin Street, on the southern side between Shirley Street and Colquhoun Street.

Otherwise, the only other footpaths within the Study Area are provided on a limited, ad-hoc basis, generally outside some developments where footpaths have been constructed along site frontages only.

These pedestrian routes are shown on **Figure 14-3**.

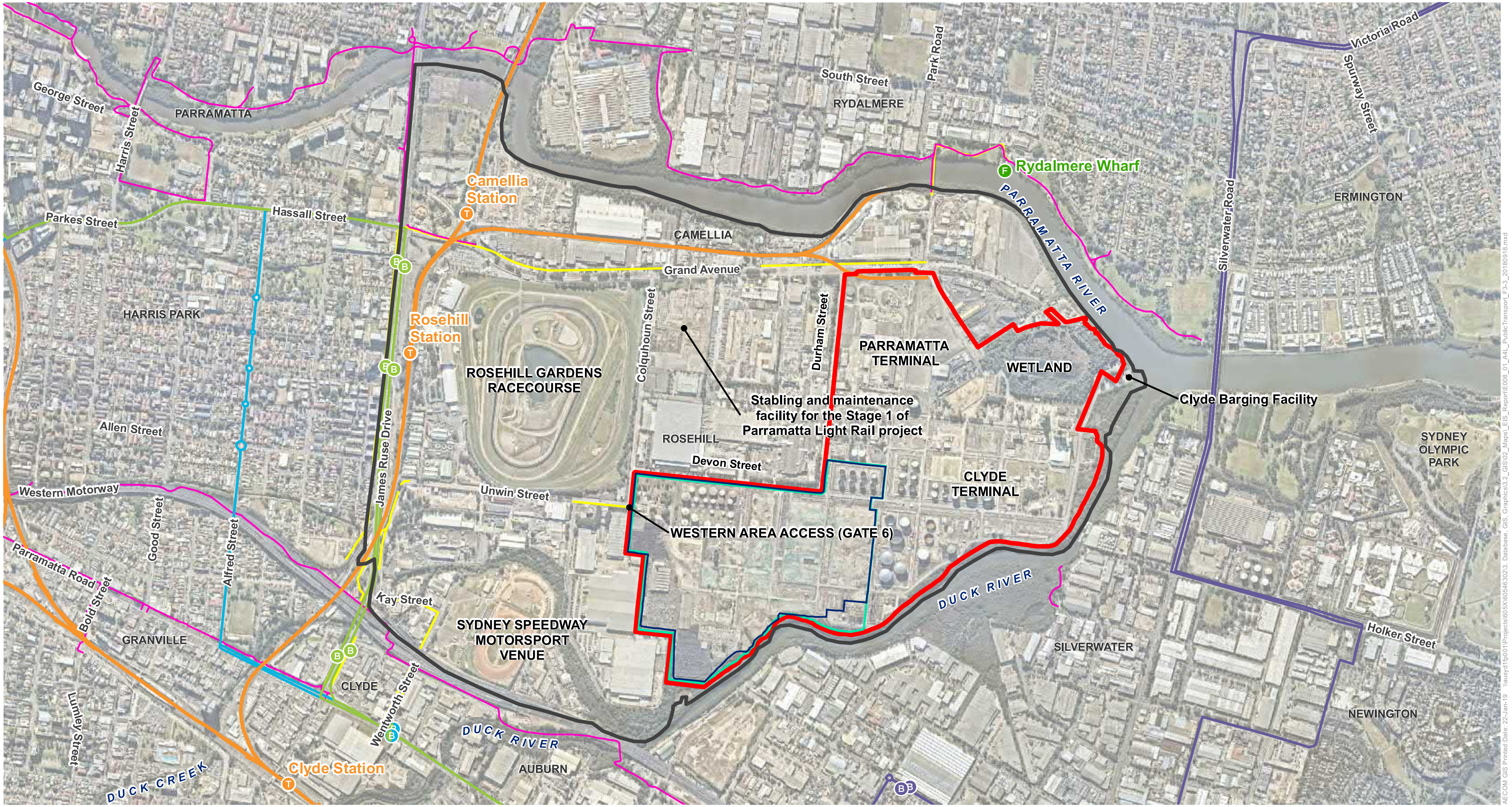

FIGURE 14-3: PUBLIC AND ACTIVE TRANSPORT CONTEXT

AECOM

0 100 200 400 m

KEY

- Study area
- Site boundary
- Project Area boundary
- Western Area boundary
- Cycleway
- Sealed footpath

Public Transport

- Railway
- Railway station
- Ferry wharf
- M92
- 909
- 544
- Bus stop

Note: Project Area boundary along the southern border is indicative only and will be refined during detailed design to exclude the tree management zone.

14.5 Impact assessment

14.5.1 Remediation (Stage 1 to Stage 5)

14.5.1.1 Access and parking

Workers

A number of public transport options are available near to the Study Area including bus, rail and ferry services. There would however be challenges for to the workforce to travel via public transport to the Project Area due to the need to walk substantial distances combined with the lack of a comprehensive footpath network throughout the Study Area. Cycling routes are located near the Project Area; however cyclists would be required to travel on the road for up to 2.1 km to access the Project Area from these routes.

Due to the missing links in the footpath network, and that walking distances connecting the Project Area to the various public transport options range from 1.4 km to 2.9 km, the workforce are likely to use private vehicles to access the Project Area. To reduce the reliance on private vehicles, workers and visitors to the Project Area would be encouraged to utilise other, more sustainable, means of transportation such as car-pooling or group transport to and from public transport facilities.

Although workers accessing the Project Area would be encouraged to utilise more sustainable modes of transport, provision would be made to allow for the workforce to park on-site. Over the course of the Project, a maximum of 80 Project workers would be expected to be on-site at any one time; however lower numbers of workers would likely be on-site for the majority of the Project. Notwithstanding this, a dedicated parking area for up to 80 cars would be set aside within the Western Area.

It may be possible to utilise existing areas within the Western Area including the former vehicle storage area for AutoNexus to the south of Gate 6. This area has extensive asphalt surfacing which may be able to be retained while the area is in use as a workforce car park. As the Project involves removal of hardstand surfaces (including asphalt) the on-site car park may need to be relocated as the Project progresses. The exact location(s) of car parking on-site would be confirmed during detailed design.

Providing sufficient on-site parking for the workforce would reduce the likelihood of on-street parking on the surrounding road network. In the unlikely event where the number of private vehicles access the Project Area exceeds the on-site parking provision, these vehicles would be directed to the car park opposite the Viva Energy state office building at Gate 5; however it is expected that any such events would be uncommon and of short duration.

Equipment and plant

In the course of undertaking the works, a variety of plant, equipment and materials would be required to be delivered by heavy vehicles to the Project Area. Plant, equipment and materials would also leave the Project Area by heavy vehicles during and at completion of the Project.

The nature of the Project would generally mean the majority of vehicle movement activity to occur on-site, with external movements via the public road network limited to:

- the initial delivery of plant and equipment to the Project Area;
- sporadic delivery of materials to support the works, for example fuel, fencing and concrete;
- removal of soils for off-site disposal at an appropriately licenced facility, should soils not be suitable for on-site treatment;
- delivery of fill material from off-site to achieve the required surface levels of the Project Area; and
- removal of plant and equipment from the Project Area during demobilisation once the works are complete.

The existing road network adequately caters for heavy vehicle access to the Project Area, with Class 2 GML 25/26 m B-doubles already permitted to travel directly to the Project Area via two separate route options from the nearby arterial road network.

Most of the expected plant, equipment and materials that would be either delivered or removed from the Project Area would be undertaken using vehicles permitted within the requirements of Class 2 under the NHVL. There is however, the possibility that a large piece of plant or equipment may need to be delivered (and subsequently removed) by a vehicle exceeding the existing permitted limit (e.g. a large excavator being carried by a prime-mover towing an oversize platform trailer).

Due to the vehicle height restriction of 4.6 m where Wentworth Street travels under the M4 Western Motorway, over-height vehicles exceeding 4.6 m would need to access the Project Area via Grand Avenue.

14.5.1.2 Traffic generation

Traffic generation analysis considered a peak scenario that combines the highest likely workforce (up to 80 workers per day during Stage 1) and maximum likely movements of heavy vehicles (up to 100 movements in the peak hour). This is considered a conservative analysis, as Stage 1 would only occur for the first three months of a three-year long program of works, with the remaining stages expected to attract a smaller workforce following completion of Stage 1. Furthermore, it would be unlikely that all workers would travel to and from the Project Area in separate private vehicles, with a number of workers likely to car pool to the Project Area.

Traffic generated by the Project is likely to affect the following key intersections for trips travelling either to or from the Project Area:

- the intersection of James Ruse Drive, Grand Avenue and Hassall Street;
- the intersection of Parramatta Road and Wentworth Street; and
- the intersection of James Ruse Drive and Parramatta Road.

The performance of the three key intersections has been evaluated using the Sidra Intersection model. The results of the intersection analysis are provided in **Table 14-5** to **Table 14-7**.

Table 14-5 James Ruse Drive, Grand Avenue and Hassall Street

AM/PM	Approach	Average delay (seconds)		Level of service	
		Existing	With Project	Existing	With Project
AM	**Overall**	**154.5**	**156.4**	**F**	**F**
	South	30.6	31.3	C	C
	East	72.5	72.7	F	F
	North	290.2	294.7	F	F
	West	112.7	112.6	F	F
PM	**Overall**	**161.6**	**163.5**	**F**	**F**
	South	32.1	33.2	C	C
	East	79.1	89.4	F	F
	North	317.1	318.9	F	F
	West	95.7	96.1	F	F

Table 14-6 James Ruse Drive and Parramatta Road

AM/PM	Approach	Average delay (seconds)		Level of service	
		Existing	With Project	Existing	With Project
AM	**Overall**	**37.7**	**37.7**	**C**	**C**
	East	38.8	38.8	C	C
	North	52.0	52.4	D	D
	West	25.9	25.7	B	B
PM	**Overall**	**33.4**	**33.6**	**C**	**C**
	East	33.7	33.7	C	C
	North	43.8	44.6	D	D
	West	26.3	26.2	B	B

Table 14-7 Parramatta Road and Wentworth Street

AM/PM	Approach	Average delay (seconds)		Level of service	
		Existing	With Project	Existing	With Project
AM	**Overall**	**18.1**	**18.6**	**B**	**B**
	East	8.8	10.1	A	A
	North	43.1	42.8	D	D
	West	25.0	25.0	B	B
PM	**Overall**	**25.6**	**25.9**	**B**	**B**
	East	6.9	7.1	A	A
	North	92.7	89.4	F	F
	West	29.8	29.8	C	C

The key findings of the Sidra Intersection model analysis and potential impacts from the generation of traffic by the Project are:

- the existing conditions at the intersection of James Ruse Drive, Grand Avenue and Hassall Street indicate that the intersection is currently operating with high levels of congestion;
- the existing conditions at the intersection of James Ruse Drive and Parramatta Road indicate that the intersection is currently operating at an acceptable level with some additional capacity for increased traffic during the AM and PM peaks; and
- the existing conditions at the intersection of Parramatta Road and Wentworth Street indicate that the intersection is generally operating at an acceptable level and some additional capacity for increased traffic during the AM and PM peaks.

The Sidra Intersection analysis results indicate that the Project has no impact on the LoS for any of the three intersections listed above. Overall the addition of traffic generated by the Project would be temporary and has a negligible effect on the arterial road network.

Due to the existing congestion issues at the intersection of James Ruse Drive, Grand Avenue and Hassall Street, private and heavy vehicles would be encouraged to travel to and from the Project Area via the southern route, during peak periods, where possible, via Unwin Street, Kay Street and Wentworth Street. This route would be detailed in the Traffic Management Plan (TMP) and provides similar travel times to the James Ruse Drive route for vehicles travelling to and from the west and south.

14.5.2 Ongoing operation

The generation of traffic after completion of the Project would be negligible and limited to a small number of vehicles used for maintenance activities. Therefore potential impacts of Project traffic during operation would be negligible.

14.6 Mitigation and management

14.6.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

Measures to address potential traffic, transport and access impacts of the Project would be detailed in the REMP (in a traffic management sub-plan) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for during Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the traffic management sub-plan, as well as the LTEMP are discussed in more detail in the following section.

14.6.2 Remediation (Stage 1 to Stage 5)

Potential impacts from the Project on traffic, transport and access include:

- the workforce may use private vehicles to access the Project Area due to walking distances and the lack of sealed footpaths from public transport facilities, which would increase the number of private vehicles on the road network;
- heavy vehicles required for the Project would increase the number of vehicles on the road network; and
- permits from the NHVR would be required for vehicles bigger than GML 25/26 m B-doubles.

However, whilst the Project is likely to increase the number of vehicles using the roads in and around the Study Area, overall the addition of this traffic would be temporary and would have a negligible effect on the arterial road network.

As outlined in **Section 14.6.1**, a TMP would be prepared as a sub-plan of the REMP. Measures which would be included in the TMP to manage potential traffic, transport and access impacts related to the Project include:

- the workforce would be encouraged to utilise more sustainable transport modes e.g. car-pooling in private vehicles;
- a dedicated parking area for up to 80 cars would be provided within the Western Area during the Project; and would have provision for:
  - convenient parking spaces for authorised visitors to the Project Area (i.e. not routine workers); and
  - emergency vehicle parking adjacent to the first aid office;
- procedures to identify vehicles with loads likely to exceed GML limits or those comprising non-standard dimensions that require access to the Project Area to ensure operators have the relevant permits from the NHVR, prior to use of any such vehicle;
- outline appropriate routes for oversize or over-height vehicles, including over-height vehicles exceeding 4.6 m avoiding the vehicle height restriction of 4.6 m at Wentworth Street where it travels under the M4 Western Motorway. Access to the Project Area for over-height vehicles would need to be via Grand Avenue;
- methods to encourage private and heavy vehicles to travel to and from the Project Area via the southern route where possible, via Unwin Street, Kay Street and Wentworth Street; and
- outline a vehicle management measure to ensure that private vehicles travelling within the Project Area do not conflict with heavy vehicles.

14.6.3 Ongoing operation

The generation of traffic after completion of the Project would be negligible. The LTEMP would include a section on traffic management which would detail the routes to be used to access the Project Area and the parking locations during operation.

14.6.4 Summary

A summary of the mitigation and management measures to manage potential traffic, transport and access impacts from the Project are outlined in **Table 14-8**.

Table 14-8 Mitigation and management measures – traffic, transport and access

Reference	Mitigation and management measures	Timing
TT1	A Traffic Management Plan (TMP) would be prepared as a sub-plan of the REMP. The TMP would include: • routes for heavy and private vehicles to access the Western Area; • appropriate routes for oversize or over-height vehicles; • on-site parking locations; and • the process for ensuring operators have the relevant permits from the NHVR, if required. The TMP would: • detail the temporary measures that would be implemented to mitigate road safety and network efficiency impacts during the Project, such as work zone speed limits and traffic control; • include a Driver Code of Conduct to outline expectations of Project related vehicles: - minimise the impacts of the Project on the local and regional road network; - minimise conflicts with other road users; and - require truck drivers use specified routes; • include a notification process for potentially affected businesses along Project haulage routes, in the event of a potential traffic disruption related to the use of vehicles larger than Class 2 GML 25/26m B-Doubles; and • Vehicle management measures to manage vehicle movements on-site to reduce the likelihood of conflicts between workers and private and heavy vehicles, including a speed limit of 20 km/h for the Project Area.	Detailed design/ Stage 1 to Stage 5
TT2	Workers would be encouraged to utilise more sustainable transport modes e.g. car-pooling, where feasible to reduce the reliance on private vehicles.	Stage 1 to Stage 5
TT3	On-site car parking for the workforce, within the Western Area would be provided during the Project for up to 80 cars. The car-parking area in the Western Area would be located near the site office, where possible and would have provision for: • convenient parking spaces for authorised visitors to the Project Area (i.e. not routine workers); and • emergency vehicle parking adjacent to the first aid office.	Detailed design/ Stage 1 to Stage 5
TT4	Should vehicles with loads exceeding GML limits or comprising non-standard dimensions require access to the Project Area, a permit would be obtained from the NHVR, prior to use of any such vehicle.	Stage 1 to Stage 5
TT5	The TMP would include a diagram outlining preferred routes to and from the Project Area which would: • avoid the intersection of James Ruse Drive, Grand Avenue and Hassall Street during peak periods for workforce and heavy vehicles; and • avoid the vehicle restrictions where Wentworth Street travels under the M4 Western Motorway for vehicles over the height of vehicles exceeding 4.6 m.	Stage 1 to Stage 5
TT6	The LTEMP would include a section on traffic management which would detail routes and access points to the Project Area and recommended parking locations.	Ongoing operation

Following the implementation of the above mitigation and management measures, the Project is expected to have a negligible and temporary impact on traffic, transport and access. Although the Project does not impact on the LoS of the James Ruse Drive, Grand Avenue and Hassall Street intersection, it would increase movements through this intersection, and this intersection is likely to be used by other proposed projects. Potential cumulative impacts are discussed in **Section 14.7** and **Chapter 19 Cumulative Impact Assessment**.

14.7 Cumulative impact assessment

Two developments have been identified that may occur at a similar time to the Project, these are the Parramatta Light Rail project, and the Clyde Barging Facility, which is associated with the Sydney Metro City and Southwest passenger rail project. Further, the likely decommissioning of the T6 Carlingford line service may also coincide with the Project.

The likely decommissioning of the T6 Carlingford line service is likely to improve network operations on Parramatta Road due to trains ceasing to use the rail level crossing located to the west of James Ruse Drive, which could improve network conditions to the south of the Project Area.

Conversely, works associated with the Parramatta Light Rail project may cause disruption to the road network and the intersection of James Ruse Drive, Grand Avenue and Hassall Street.

The Clyde Barging Facility also has the potential to result in cumulative impacts with the Project and the Parramatta Light Rail project. The Clyde Barging Facility would involve the transfer of machinery and excavated material by barges on the Parramatta River to trucks from a site at the eastern end of Grand Avenue. This transfer of machinery would also utilise the intersection of James Ruse Drive, Grand Avenue and Hassall Street.

However, as the Project is expected to have a negligible and temporary impact on the arterial road network, cumulative impacts with the Parramatta Light Rail project and the Clyde Barging Facility is likely to be minor. To manage potential cumulative traffic impacts with the Parramatta Light Rail project and Clyde Barging Facility, consultation with the project teams would be undertaken to gain an understanding of likely timing, working hours and potential traffic impacts. Additionally workers and heavy vehicle drivers would be encouraged to travel to the Project Area via the southern access route (refer to mitigation and management measure TT3). This would also help avoid the further disruption and/or congestion at the intersection of James Ruse Drive, Grand Avenue and Hassall Street, that may occur at this location.

A summary of the mitigation and management measures to manage potential cumulative traffic and transport impacts from the Project are outlined in **Table 14-9**.

Table 14-9 Mitigation and management measures – Traffic and transport cumulative impact assessment

Reference	Mitigation and management measures	Timing
TT7	Consultation with the Parramatta Light Rail project and Clyde Barging Facility would be undertaken to gain an understanding of project timing and traffic movements to avoid potential cumulative traffic impacts where possible.	Stage 1 to Stage 5

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15.0 Biodiversity

15.1 Introduction

This chapter provides a summary of the biodiversity impacts identified in the Biodiversity Development Assessment Report (BDAR) undertaken for the Project. The BDAR was prepared by Biosis Pty Ltd and is provided in **Appendix I**.

15.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) request that this assessment provides the following; as presented in **Table 15-1**. **Table 15-1** also presents where in this chapter each of the requirements are addressed.

Table 15-1 SEARs – biodiversity

SEARs	Where addressed
Biodiversity:	
• assessment of biodiversity impacts in accordance with the Biodiversity Assessment Method and documented in a BDAR; and	**Section 15.6**
• assessment of impacts on Green and Golden Bell Frog (GGBF) habitat likely to be present on-site in artificial and modified habitats.	**Section 15.6**

The NSW Office of Environment and Heritage (OEH) also provided input to the SEARs. Where applicable to this assessment, these requirements have also been addressed. This is discussed further in the SEARs cross reference table provided in **Appendix A**.

15.3 Legislation and planning policy

15.3.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'Matters of National Environmental Significance' (MNES) may be affected. If an activity has the potential for a significant impact, the activity would require approval from the Commonwealth under Part 9 of the EPBC Act.

An assessment of the impacts of the Project on MNES against the considerations outlined in the *Matters of National Environmental Significance: Significant impact guidelines 1.1* (DoE, 2013) was prepared to determine whether referral of the Project to the Commonwealth Minister for the Environment is required. The assessment identified that impacts on MNES relevant to the Project were considered unlikely to occur.

15.3.2 State legislation, policies and plans

State Environmental Planning Policy (Coastal Management) 2018

The *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP) aims to promote a co-ordinated approach to land use planning in the coastal zone of NSW in a manner consistent with the objects of the *Coastal Management Act 2016* (*NSW*) (CM Act). The SEPP has replaced the now repealed:

- SEPP No. 14 Coastal Wetlands;
- SEPP No. 26 Littoral Rainforests; and
- SEPP No. 71 Coastal Protection.

Due to the avoidance of direct and indirect impacts to the riparian vegetation and the Project resulting in improvements to the surface water and groundwater flows to the mapped wetland vegetation, the Project would not significantly impact upon the values listed under the Coastal Management SEPP. This is discussed further in **Section 15.6, Chapter 8 Soils, groundwater and contamination** and **Chapter 9 Surface water, wastewater and flooding**.

15.3.3 Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (*NSW*) (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

Section 7.9 of the BC Act states that an application for State Significant Development (SSD) must be accompanied by a BDAR. **Appendix I** includes a BDAR. A BDAR must meet the requirements of the NSW Biodiversity Assessment Method (BAM) (OEH, 2017a). The BDAR in **Appendix I** meets these requirements.

15.3.4 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (*NSW*) (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation.

Potential impacts on aquatic and marine biota are discussed in **Section 15.6**.

15.3.5 Biosecurity Act 2015

The *Biosecurity Act 2015* (*NSW*) was enacted to provide for the identification, classification and control of Priority Weeds with the purpose of determining if a biosecurity risk is likely to occur from:

- the introduction, presence, spread or increase of a pest into or within the State or any part of the State; and
- a pest plant has the potential to; harm or reduce biodiversity or out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.

Potential biosecurity impacts and recommendations to mitigate the biosecurity risks are provided in **Section 15.6**.

15.4 Method of assessment

15.4.1 Overview

The purpose of this assessment was to apply the BAM (OEH, 2017a) to assess the potential impacts of the Project to threatened species, populations and ecological communities (biota) listed under the BC Act and/or the EPBC Act. This assessment was reported in a BDAR which involved:

- identifying the Study Area;
- undertaking a desktop review of existing information;
- carrying out a flora survey;
- identifying and assessing the potential impacts; and
- recommending mitigation and management measures.

These are discussed further in the following section.

15.4.2 Study Area and Project Area

The Study Area for the assessment is comprised of the land associated with the former Clyde Refinery (the 'Site') and local sensitive environments that may be impacted by the Project, either directly or indirectly (refer to **Figure 15-1**). Beyond the Site boundary, these sensitive environments include:

- the riparian vegetation along the Duck River; and
- the Duck River.

Only certain areas within the Western Area would be directly impacted by the Project. These areas are contained within the Project Area. The Project Area has been refined to exclude the remnant vegetation along the Duck River riparian area and the drainage line running north-south along the western boundary of the Western Area. This has resulted in no direct removal of remnant native vegetation (including along the Duck River) from the Project Area as a result of the Project.

Another key consideration for the assessment is that the Project Area is largely within the project area for the approved Clyde Terminal Conversion Project (SSD 5147) (the 'Conversion Project'). The Conversion Project is ongoing within the Project Area and will be completed prior to the Project commencing. As such, the final condition of the Project Area following completion of the Conversion Project is what must be considered as the baseline for this assessment. This has been taken into consideration in **Section 15.5**.

15.4.3 Desktop review

This assessment involved a desktop review of existing information using relevant databases, spatial data, literature and previous reports for the Study Area. Key information utilised includes:

- Commonwealth Department of the Environment and Energy (DoEE) Protected Matters Search Tool for matters protected by the EPBC Act (DoEE, 2018a);
- NSW OEH BioNet Atlas of NSW Wildlife for threatened biota listed under the BC Act (OEH, 2018b);
- PlantNET (the Royal Botanic Gardens and Domain Trust, 2018); and
- BirdLife Australia, the New Atlas of Australian Birds 1998-2015 (Birdlife Australia, 2015).

Other sources of biodiversity information relevant to the study area were sourced from:

- The NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database (OEH, 2018b);
- Relevant vegetation mapping, including *The Native Vegetation of the Sydney Metropolitan Area* (OEH, 2016a);
- NSW Scientific Committee Final Determinations for locally occurring state listed threatened biota;
- Commonwealth Conservation and Listing Advice for locally occurring Commonwealth listed threatened biota;
- Clyde Terminal Conversion Project Environmental Impact Statement (EIS) prepared by AECOM Australia Pty Ltd (AECOM, 2013); and
- Ecological Assessment for the Clyde Terminal Conversion Project EIS prepared by AECOM Australia Pty Ltd (AECOM, 2013).

This information, as well as the other sources listed in **Appendix I**, provided context for the Study Area and records of flora and fauna.

15.4.4 Study Area investigation

Regional vegetation mapping (OEH, 2016a) and database searches were reviewed to inform the BDAR. Based on the results of the background review and the requirements of the BAM with respect to this BDAR, surveys were designed for the Study Area and Project Area, by Biosis BAM Accredited Assessor, Rebecca Dwyer.

A floristic assessment of the Study Area was undertaken by Biosis on 9 October 2017 by qualified and experienced ecologist, Callan Wharfe (Senior Ecologist). The Study Area was surveyed in accordance with the BAM (OEH, 2017a), the *NSW Guide to surveying Threatened Plants* (OEH, 2016b) and random meander methods (Cropper, 1993).

15.4.5 Assessment and management measures

Following the desktop review and Study Area investigation, an impact assessment has been undertaken. This impact assessment assessed the potential direct, indirect and prescribed impacts of biodiversity values in the Study Area.

In order to assess the impact of the Project on downstream water-dependent fauna and flora and groundwater dependent ecosystems (GDEs), an assessment of the potential for the Study Area and Project Area to support GDEs was undertaken using both the Bureau of Meteorology's Groundwater Dependent Ecosystems Atlas (BOM, 2018b) and metadata from State of NSW (DPI Water) 2016.

Once potential impacts are understood, if required, threshold offsets would be calculated in accordance with the BAM to inform if offsetting through biodiversity credits is required. Biodiversity credits are generated from management actions that improve biodiversity values and are used to offset the loss of biodiversity values on development sites. Biodiversity credits may be created from a BioBank site and traded as required to offset project impacts on biodiversity.

Where required, mitigation and management measures to assist the final design of the Project to further avoid and minimise impacts on biodiversity within and surrounding the Study Area have also been provided.

15.5 Existing environment

15.5.1 Study Area context

This section describes the landscape and site context of the Study Area, including the landscape features, soils, vegetation, waterbodies and connectivity features present within the Project Area and within a 1,500 m buffer to the Study Area, as required by the BAM. **Table 15-2** provides a summary of the existing landscape features.

Table 15-2 Existing landscape features within 1500 m to the Study Area

Landscape features	Description
Bioregions	The Study Area occurs within the Sydney Basin bioregion and the Cumberland subregion. The Sydney Basin bioregion occupies about 4.5 per cent of NSW and is one of two bioregions contained wholly within the State. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. The Sydney Basin Bioregion is one of the most species diverse in Australia.
Mitchell Landscape	The Study Area occurs within the Sydney Basin Pittwater Port Jackson Mitchell Landscape. This landscape occurs as a deep elongated harbour with steep cliffed margins on horizontal Triassic quartz sandstone. Small pocket beaches and more extensive Quaternary estuary fill of muddy sand occur at the head of most tributary streams. General elevation is 0 m to 80 m with local relief of 10 m to 50 m.
Soil	The Study Area is mapped as Disturbed Terrain on the Sydney 1:100k soil landscape mapping (Chapman & Murphy, 1989). This soil landscape is defined by extensive disturbance from human activity, including complete disturbance, removal or burial of soil. Refer also to **Chapter 8, Soils, groundwater and contamination**.
Native vegetation extent	A total of 48.9 hectares of native vegetation is mapped as occurring within the 1,500 m buffer area by the *Native Vegetation of the Sydney Metropolitan Area* (OEH, 2016a) mapping project. A list of PCT identified from the existing vegetation mapping is provided in **Appendix I**.
Cleared areas	The Project Area was largely devoid of vegetation at the time of assessment. Cleared areas within Project Area, Study Area and buffer include existing urban and industrial areas, road infrastructure, and the concrete foundations and redundant infrastructure which comprise the primary landscape type present in the Project Area.

Landscape features	Description
Rivers and streams	The Study Area is located within the Greater Sydney Local Land Services Region and the Port Jackson/Georges River catchment. The Study Area is bordered by Duck River to the south and is 1 km from the confluence of Duck River (a third order watercourse) and the Parramatta River (a fourth order watercourse). There are no mapped watercourses or drainage lines within the Project Area. Stormwater drainage channels that divert surface water to Duck River (and other receivers) occur within the Project Area and collect and treat dirty water within the Clyde Terminal's stormwater/wastewater management system. Duck River and the Parramatta River are identified as TYPE 1 (Highly sensitive key fish habitat) and CLASS 1 (Major key fish habitat) waterways respectively.
Wetlands	There are no wetlands within the Project Area or Study Area. A man-made wetland (the 'Wetland') that occurs within the Study Area supports a known population of GGBF, as well as Swamp Oak Floodplain Forest and Coastal Saltmarsh Threatened Ecological Communities (TECs) and threatened flora; namely Downy Wattle and Narrow-leaved Wilsonia.
Connectivity features	The Study Area is not considered to form part of a habitat corridor for native flora or fauna and therefore there are no habitat connectivity features within the Study Area.
Areas of geological significance	There were no recorded karst, caves, crevices, cliffs or other areas of geological significance within the Study Area or within the 1,500 m buffer area surrounding the Study Area.
Soil hazard features	Vegetated parts of the Study Area alongside Duck River are mapped as being Class 2 Acid Sulphate Soils. Cleared parts of the Site are mapped as Class 4 Acid Sulphate Soils (western half), and Class 3 Acid Sulphate Soils (eastern half) (*Parramatta Local Environment Plan 2011*).
Groundwater dependent ecosystems	The estuarine mangrove forest vegetation within the riparian zone of Duck River is identified as 'High potential GDE – from national assessment' (Office of Water, 2012).

15.5.2 Native vegetation

The Project Area has been assessed as not supporting native vegetation that would be representative of any NSW PCTs. Vegetation within the Project Area consists of planted native and exotic species in a managed industrial landscape setting, and disturbance tolerant species growing as weeds across the Study Area.

The vegetation present within the broader Study Area (outside the Project Area) was found to comprise of the Swamp Oak floodplain swamp forest Sydney Basin Bioregion and South East Corner Bioregion as illustrated in **Figure 15-1**. The vegetation is described as having mature Swamp Oak dominating the plant community within the Study Area. The Swamp Oak is present along the southern and western boundary of the Study Area between the mangrove forest vegetation fringing Duck River and the cleared areas within the Project Area. The vegetation occurs patchily along the southern boundary of the Study Area and continues in a similar manner towards the Parramatta River and surrounding the man-made Wetland in the north-east of the Study Area. A more or less continuous occurrence of the Swamp Oak exists along the drainage line adjacent to the western boundary of the Study Area and Project Area.

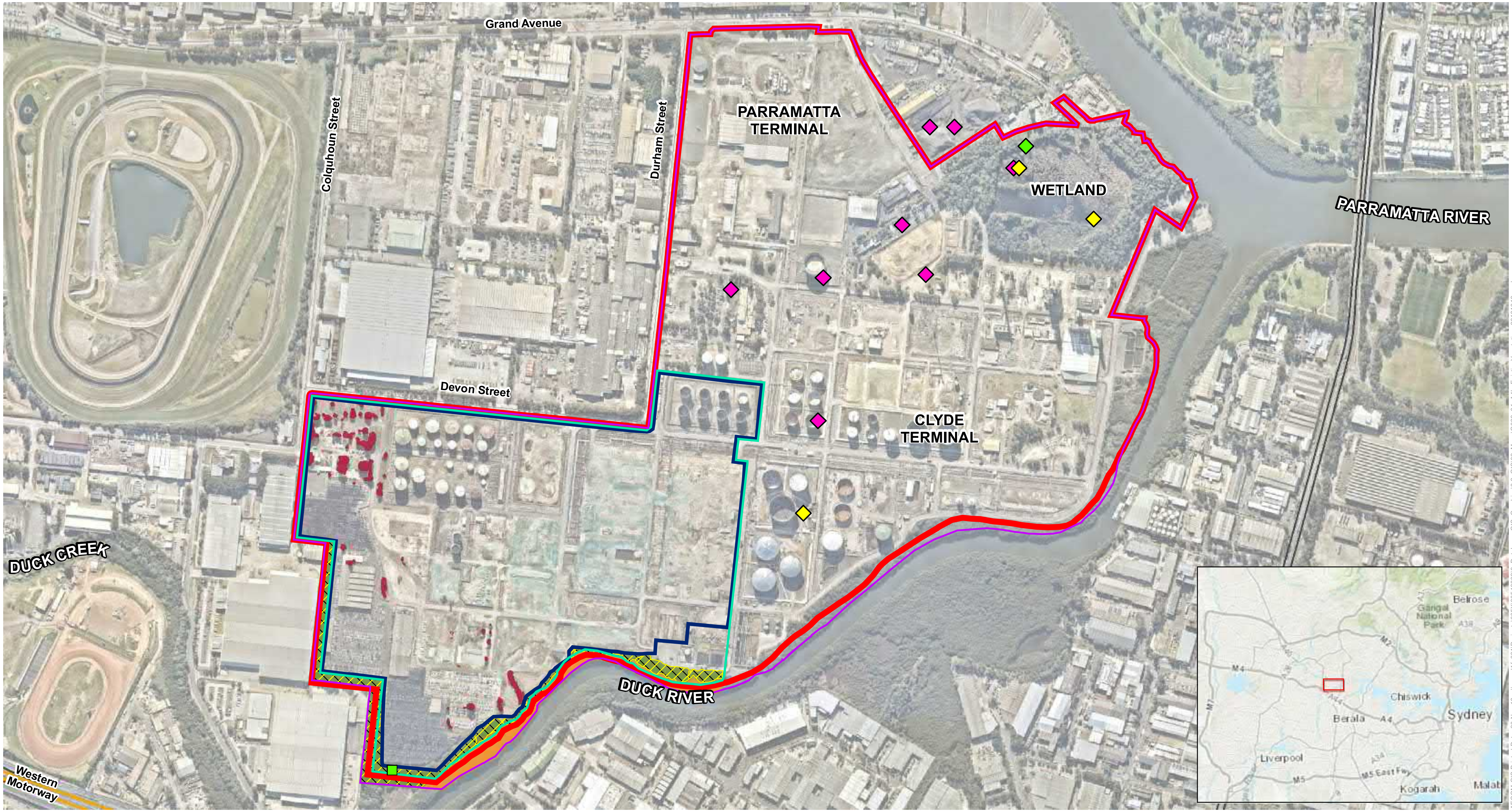

FIGURE 15-1: EXISTING VEGETATION

KEY

- Site boundary
- Project Area boundary
- Western Area boundary
- Study area
- BAM plot
- Swamp Oak Floodplain Forest (BC Act)
- Coastal Swamp Oak Forest (EPBC Act)

Green and Golden Bell Frog Sightings

- Green and Golden Bell Frog *Litoria aurea* (UBMS, 2007)
- Green and Golden Bell Frog *Litoria aurea* (Bionet Records)
- Green and Golden Bell Frog *Litoria aurea* (AECOM survey, Oct 2012)

Vegetation Communities

- Estaurine mangrove forest
- PCT 1234 - Swamp Oak floodplain swamp forest, Sydney Basin Bioregion and South East Corner Bioregion
- Planted natives

AECOM

0 100 200 300 m

15.5.3 Threatened species

Table 15-3 provides a list of threatened species expected to occur within the Study Area. This data is from the Threatened Biodiversity Data Collection and the BAM Calculator.

Table 15-3 Threatened species expected to occur within the Study Area

Scientific name	Common name	Class of credit	Habitat type	NSW listing status	Cth. listing status[1]
Botaurus poiciloptilus	Australasian Bittern	Ecosystem	--	Endangered	Endangered
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Ecosystem	--	Vulnerable	Not listed
Dasyurus maculatus	Spotted-tailed Quoll	Ecosystem	--	Vulnerable	Endangered
Ephippiorhynchus asiaticus	Black-necked Stork	Ecosystem	--	Endangered	Not listed
Mormopterus norfolkensis	Eastern Freetail-bat	Ecosystem	--	Vulnerable	Not listed
Ptilinopus superbus	Superb Fruit-Dove	Ecosystem	--	Vulnerable	Not listed
Chthonicola sagittata	Speckled Warbler	Ecosystem	--	Vulnerable	Not listed
Rostratula australis	Australian Painted Snipe	Ecosystem	--	Endangered	Endangered
Glossopsitta pusilla	Little Lorikeet	Ecosystem	--	Vulnerable	Not listed
Epthianura albifrons	White-fronted Chat	Ecosystem	--	Vulnerable	Not listed
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Ecosystem	--	Vulnerable	Not listed
Haloragis exalata subsp. exalata	Square Raspwort	Species	--	Vulnerable	Vulnerable
Litoria aurea	Green and Golden Bell Frog	Species	--	Endangered	Vulnerable
Maundia triglochinoides	Maundia triglochinoides	Species	--	Vulnerable	Not listed
Melaleuca biconvexa	Biconvex Paperbark	Species	--	Vulnerable	Vulnerable
Myotis macropus	Southern Myotis	Species	--	Vulnerable	Not listed
Persicaria elatior	Tall Knotweed	Species	--	Vulnerable	Vulnerable
Petaurus norfolcensis	Squirrel Glider	Species	--	Vulnerable	Not listed
Wilsonia backhousei	Narrow-leafed Wilsonia	Species	--	Vulnerable	Not listed
Lathamus discolor	Swift Parrot	Species/Ecosystem	Breeding	Endangered	Critically Endangered
Miniopterus australis	Little Bentwing-bat	Species/Ecosystem	Breeding	Vulnerable	Not listed

Scientific name	Common name	Class of credit	Habitat type	NSW listing status	Cth. listing status[1]
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Species/Ecosystem	Breeding	Vulnerable	Not listed
Pandion cristatus	Eastern Osprey	Species/Ecosystem	Breeding	Vulnerable	Not listed
Phascolarctos cinereus	Koala	Species/Ecosystem	Breeding	Vulnerable	Not listed
Pteropus poliocephalus	Grey-headed Flying-fox	Species/Ecosystem	Breeding	Vulnerable	Vulnerable
Anthochaera phrygia	Regent Honeyeater	Species/Ecosystem	Breeding	Critically Endangered	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Species/Ecosystem	Breeding, Foraging	Vulnerable	Not listed

Note:

1 Commonwealth listing status.

Fauna habitat assessments focussed on:

- identifying fauna habitats, assessing their condition and assessing their value to threatened species;
- observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings);
- habitat trees including large hollow-bearing trees, availability of flowering shrubs and feed tree species;
- the condition of native vegetation and the presence of exotic species;
- the quantity of ground litter and logs;
- searches for indirect evidence of threatened fauna; and
- the general degradation of the site as a result of past industrial land management practices and lack of maintenance.

As no vegetation was recorded within the Project Area of a structure, composition or function representative of any PCTs, no potential habitat for any of the species listed in **Table 15-3** was assessed as present. As such, no further assessment including targeted survey, in accordance with Section 6 of the BAM (OEH, 2017a) was undertaken, or is required.

Potential movement corridors and limited forage habitat was found to be present in the Study Area (but outside the Project Area) for a number of the above listed threatened fauna species including:

- Black-necked Stalk (ecosystem credit);
- Eastern Freetail-bat (ecosystem credit);
- Green and Golden Bell Frog (species credit);
- Southern Myotis (species credit);
- Little Bentwing (ecosystem/species credit); and
- Eastern Bentwing-bat (ecosystem/species credit).

The Swamp Oak floodplain vegetation within the Study Area was surveyed for the presence of threatened flora species during the field investigation undertaken in October 2017. No threatened floras were recorded.

15.5.4 Project Area following the Conversion Project

As outlined in **Section 15.4**, the approved Conversion Project includes the demolition of redundant infrastructure within the Project Area. This Project is ongoing but will be complete in the Western Area prior to the remediation works commencing. The final condition of the Project Area and the baseline for this assessment is outlined below:

- existing aboveground redundant infrastructure has been removed;
- as the drainage systems are still required, these will continue to be utilised and the ongoing maintenance of these drainage systems forms part of the Conversion Project. This maintenance includes the removal of silt and debris, the removal of any vegetation, and the draining of any pooled water across the Project Area;
- waste generated as a result of the Conversion Project will have been removed, recycled and/or processed prior to the Project commencing; and
- some native and non-native landscape plantings and scattered occurrences of disturbed vegetation present across the Project Area will remain following the completion of the Conversion Project.

15.6 Impact assessment

15.6.1 Overview

This section identifies potential impacts of the Project (prescribed, direct and indirect) on the biodiversity values in the Study Area and evaluates the significance of potential impacts in accordance with the criteria detailed in **Section 15.4**.

The assessment has informed if offsetting of biodiversity credits is required for the Project.

15.6.2 Remediation (Stage 1 to Stage 5)

15.6.2.1 Actions to avoid impacts

As outlined in **Section 15.4.2**, the Project Area does not include PCTs or fauna habitat of value. As such these values would not be directly impacted by the Project. The Project Area has also been delineated to ensure that works do not encroach into the tree protection zones (TPZs) of the Swamp Oaks along the river frontage with Duck River, thus avoiding potential impacts on these trees.

Potential fauna habitat present within the Project Area is of little value now and when considered in the context of the final form of the ongoing approved works for the Conversion Project. Habitat potentially present in the form of human made structures, including tanks and process units, has been removed by the Conversion Project and retained vegetation (not of sufficient structure/condition/function to be a PCT) does not support high quality habitats for locally occurring threatened fauna.

No threatened flora habitat occurs within the Project Area.

15.6.2.2 Prescribed impacts

An assessment of prescribed biodiversity impacts was undertaken for the Project. Prescribed impacts are those impacts prescribed to be assessed within the BAM and include impacts such as '*impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range'*. Further information on prescribed impacts can be found in **Appendix I**.

This assessment concluded that Project is unlikely impact upon on any of the prescribed impacts, given that there would be no disruption to the habitat and/or movement of threatened species or ecological communities within the Project Area.

15.6.2.3 Direct impacts

An assessment of the potential direct impacts of the Project has been undertaken and is presented in **Table 15-4**.

Table 15-4 Potential direct impacts

Type	Direct impacts
Native vegetation	There would be no direct impacts to native vegetation from the Project. Some native vegetation would be removed as a result of the Project where it remains following the Conversion Project, including the Swamp Oak and small trees and shrubs present as landscape planting. This vegetation has been assessed as not being of a sufficient structure, composition and function to represent a PCT. This vegetation does not support any habitat for threatened flora due to significant historical and ongoing disturbance to the ground layer, and supports negligible potential foraging habitat for highly mobile threatened bird and bat species as part of a larger home range. Given this, no further assessment or offsetting in accordance with the BAM (OEH, 2017a) is required.
Threatened species associated with non-native vegetation	Areas of exotic grassland are likely to remain present within the Project Area following the completion of the Conversion Project. These grasses may provide shelter and foraging opportunities for the GGBF that have dispersed into the Project Area during the Project. There are no significant occurrences of exotic trees or shrubs considered likely to provide forage or shelter habitat to other locally occurring threatened fauna species. Exotic vegetation does not support any habitat for threatened flora.
Threatened species associated with human made structures	As stated in **Section 15.4.2**, works approved under the Conversion Project (including infrastructure to be demolished or to undergo ongoing maintenance) are not part of the Project. As such, human made structures within the Project Area which may provide habitat for locally occurring threatened species, and are subject to the current assessment, are highly limited. A number of underpasses exist across the Project Area where access roads cross wider drainage channels or channels housing pipework. These areas are low to the ground (<1.5 metres in height), are open to light spill, generally comprise smooth concrete with no gaps or cracks and as such have been assessed as unlikely to provide habitat for microbats. Given the above, the Project has been assessed as unlikely to impact upon threatened species associated with human made structures.
Green and Golden Bell Frogs	The Clyde/Rosehill key population of GGBF is centred around the Wetland present in the north-east of the Site, approximately 500 m from the Project Area. The GGBF is listed as Vulnerable under the EPBC Act. The Project occurs adjacent to known habitat utilised by the important 'Clyde/Rosehill key population' of the species (DECCW, 2008) and as such an assessment of potential impacts in accordance with the EPBC Act has been undertaken. GGBF are known to disburse and forage over large distances and as such cannot be discounted from occurring within the Project Area, which supports potential low condition dispersal and forage habitat in the form of exotic grass tussocks and a densely grassed area. Removal of this habitat as a result of the Project is not considered likely to result in a substantial loss of foraging habitat for the population as areas of higher quality habitats would be maintained closer to the Wetland and within the Duck River and Parramatta River riparian zones. Based on a sound understanding of the occurrence and habitat preference of this species, it is concluded that the Project is unlikely to significantly impact GGBFs. On this basis, the EPBC Act is unlikely to be triggered and referral of the Project to the Australian Government Minister for the Environment would not be required. For further discussion refer to **Appendix I**.

Type	Direct impacts
Groundwater dependent ecosystems	Works associated with the Project are not expected to result in permanent interruptions to ground flow, or result in significant groundwater drawdown. A key aspect of the Project is the management of contaminated groundwater through the soil remediation works, and as such it can be expected that potential negative impact on GDEs associated with poor quality groundwater would be reduced. **Chapter 8 Soils, groundwater and contamination** provides further mitigation and management measures to improve the groundwater conditions. As such, negative impacts to GDEs present within the Duck River riparian zone and downstream water-dependent fauna and flora more broadly are not expected occur as a result of the Project.
Hydrology	The Project would include the management of stormwater and wastewater in accordance with appropriate measures and a Soil and Water Management Plan (refer to **Chapter 9 Surface water, wastewater and flooding**). The Project includes progressive separation of the Project Area from the existing stormwater/wastewater system and installation of stormwater management for final landform. Following the completion of Stage 4, the final landform would be complete and would include a layer of topsoil, and grasses, swales, with stormwater managed by overland flow. Impacts to biodiversity values are not expected to occur as a result of the changes to the hydrology of the Project Area.

15.6.2.4 Indirect impacts

The Project has the potential to result in inadvertent impacts on adjacent retained habitat or vegetation. Such indirect impacts include reduced viability of the adjacent habitat due to edge effects and noise, dust or light spill, loss of breeding habitats, transport of weeds and pathogens from the Project Area to adjacent vegetation, fragmentation of movement corridors and disturbance to specialist breeding and foraging habitat.

The Project would not result in a significant increase in edge effects impacting upon the retained vegetation at the southern edge of the Study Area. This vegetation already occurs adjacent to cleared land, which would be remediated. No further impact that may reduce the viability of this vegetation would occur. The Study Area has been assessed to contain minimal breeding habitat and no breeding habitats were recorded within the Project Area. As such, no breeding habitat would be lost as a result of the Project.

Potential biosecurity risks would be managed as part of the Project's Long Term Environmental Management Plan (LTEMP) in order to mitigate the transport of weeds and pathogens to adjacent vegetation areas. Specific mitigation and management measures would also be implemented to minimise indirect impacts to Green and Golden Bell Frogs. The Project Area does not include any movement corridors and so would not involve the fragmentation of any existing corridors.

Overall, it has been considered that the mitigation and management measures would minimise the likelihood of occurrence of these potential indirect impacts during the Project.

15.6.2.5 Offsets and biodiversity credits

No threatened species or ecological communities listed under the BC Act and/or identified as 'potential' serious and irreversible impact entities by the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH, 2017b) were recorded in the Project Area, or are considered likely to be significantly indirectly impacted by the Project.

It is determined that the Project is unlikely to result in a serious and irreversible impact to biodiversity values. All direct impacts to PCTs and the threatened species habitat they support have been avoided by the Project. As such, offsetting through the transfer of biodiversity credits is not required because the Project avoids impacts to native vegetation and impacts to threatened species and their habitats.

15.6.3 Ongoing operation

Operational impacts on biodiversity as a result of the Project are generally considered negligible as only minimal operational maintenance activities would be required, such as weed management.

15.7 Mitigation and management

15.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this EIS in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and LTEMP.

Measures to address potential biodiversity impacts of the Project would be detailed in the REMP (in a biodiversity management sub-plan) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for during Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the biodiversity management sub-plan, as well as the LTEMP are discussed in more detail in the following section.

15.7.2 Remediation (Stage 1 to Stage 5)

Under the REMP, a management sub-plan for biodiversity (Biodiversity Management Plan(BMP)) would be prepared to provide measures to manage biodiversity impacts relating to the Project Area during Stage 1 to Stage 5 of the Project. Such measures include:

- exclusion fencing to protect vegetation outside the Project Area;
- include measures in the BMP to mitigate against potential impacts on GGBF;
- all material stockpiles, vehicle parking and machinery storage would not be located in areas of native vegetation that are to be retained;
- measures to manage cleared native vegetation, weeds, dust generation, sediment and erosion and acid sulphate soils; and
- implementation of temporary stormwater controls to ensure that discharges to Duck River are consistent with the requirements of the NSW Environment protection licence number 570 for the Site (refer to **Chapter 9 Surface water, wastewater and flooding**).

Section 15.7.4 provides detailed mitigation and management measures for biodiversity. Where impacts relate to soils, groundwater and contamination or surface water, wastewater and flooding, measures have been provided in **Chapter 8 Soils, groundwater and contamination** and **Chapter 9 Surface water, wastewater and flooding,** respectively.

15.7.3 Ongoing operation

Impacts to biodiversity after completion of the Project would be negligible. The LTEMP would detail the environmental controls, mitigation measures, contingency plans as outlined in **Chapter 20 Mitigation and management**.

15.7.4 Summary

A summary of the mitigation and management measures to manage potential biodiversity impacts from the Project are outlined in **Table 15-5**.

Table 15-5 Mitigation and management measures – biodiversity

Reference	Mitigation and management measures	Timing
BD1	Installation of appropriate exclusion fencing protecting vegetation to be retained outside the Project Area. Exclusion fencing would be placed at a distance sufficient to minimise impacts within the vegetation's TPZs and in accordance with *AS4970-2009 Australiana Standard. Protection of trees on development sites* (Standards Australia Committee, 2009). Fencing is to include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'. The location of any 'No Go Zones' would be identified in site inductions. The above measures would be documented in the Biodiversity Management Plan (BMP).	Stage 1 to Stage 5
BD2	To mitigate against potential impacts to the GGBF population the following measures would be included in the BMP: • works inductions that focus on the potential occurrence of the species; • pre-clearance surveys by an environmental representative as needed of stockpiles and excavations to check for the presence of GGBFs; • management of stockpiles to minimise the chances of frogs using them for shelter habitat (e.g. maintenance of sediment fencing around stockpiles and no ponding of water); • measures would also be implemented to minimise indirect impacts to GGBFs through spread of Chytrid fungus; and • an unexpected finds protocol which outlines the need to engage a suitably qualified ecologist to relocate any GGBF encountered in the Project Area. Mitigation and management measures would be aligned with the actions currently being undertaken during the Conversion Project to maximise their successful implementation, and minimise potential confusion surrounding requirements.	Stage 1 to Stage 5
BD3	Material stockpiles, vehicle parking and machinery storage would be located within cleared areas and outside of vegetation exclusion zones.	Stage 1 to Stage 5
BD4	Where appropriate, native vegetation cleared from the Project Area should be mulched for reuse on-site, to stabilise bare ground (or similar).	Stage 1 to Stage 5
BD5	Measures to minimise the potential for the spread of weeds would be detailed in the BMP.	Stage 1 to Stage 5

Following the implementation of the above mitigation and management measures, the Project is expected to have no residual impact on biodiversity. Therefore there are no cumulative impacts on biodiversity expected. Further consideration of cumulative biodiversity impacts is discussed in **Chapter 19 Cumulative impacts**.

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16.0 Historic heritage

16.1 Introduction

This chapter provides a summary of the historic heritage assessment undertaken for the Project. A historic heritage assessment was prepared by AECOM and is provided in **Appendix J**.

16.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) request that this assessment provides the following; as presented in **Table 16-1**. **Table 16-1** also presents where in this chapter each of the requirements are addressed.

Table 16-1 SEARs – historic heritage

SEARs	Where addressed
Heritage: • assessment of impacts on State and local heritage.	• State and local heritage values are identified in **Section 16.5**. • Potential impacts are assessed in **Section 16.6**. • Mitigation and management measures to avoid, mitigate or manage potential impacts are recommended in **Section 16.7**.

16.3 Legislation and planning policy

16.3.1 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) defines 'environment' as both natural and cultural environments and therefore includes Aboriginal and non-Aboriginal historical cultural heritage items. Under the EPBC Act protected heritage items are listed on the National Heritage List (items of significance to the nation) or the Commonwealth Heritage List (items belonging to the Commonwealth or its agencies).

Searches of the National Heritage List, Commonwealth Heritage List and Register of the National Estate (RNE) were undertaken in August 2018 with no relevant listings identified within the Project Area. Items identified adjacent the Project Area are described in **Section 16.5.3**. The RNE has been suspended and is no longer a statutory list; however it remains as an archive.

Under Part 9 of the EPBC Act, any action that is likely to have a significant impact on a matter of National Environmental Significance (known as a controlled action under the Act), may only progress with approval of the Commonwealth Minister for the Department of the Environment. Matters of National Environmental Significance include world heritage properties and national heritage places.

There are no world heritage properties or national heritage places located within or in close proximity to the Project Area.

16.3.2 State legislation, policies and plans

Heritage Act 1977 (NSW)

The *Heritage Act 1977 (NSW)* was enacted to conserve the environmental heritage of NSW. Under Section 32, places, buildings, works, relics, moveable objects or precincts of heritage significance are protected by means of either Interim Heritage Orders or by listing on the NSW State Heritage Register (SHR). Items that are assessed as having State heritage significance can be listed on the SHR by the Minister on the recommendation of the NSW Heritage Council.

Archaeological relics (any relics that are buried) are protected by the provisions of Section 139. No formal listing is required for archaeological relics; they are automatically protected if they are of local significance or higher.

Under Section 170 of the *Heritage Act 1977*, NSW Government agencies are required to maintain a register of heritage assets. The Register places obligations on the agencies, but not on non-government proponents, beyond their responsibility to assess the impact on surrounding heritage items. The Site is not listed on any Section 170 registers.

A search of the SHR returned no results for within or adjacent the Project Area (refer to **Section 16.5.3**).

Environmental Planning and Assessment Act 1979 (NSW)

The *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act), administered by Department of Planning and Environment (DPE), requires that consideration be given to environmental impacts as part of the land-use planning process in NSW. In NSW, environmental impacts are interpreted as including impacts to Aboriginal and non-Aboriginal (i.e. European) cultural heritage. This chapter outlines the impacts of the Project on cultural heritage (refer to **Section 16.6**).

The EP&A Act also allows for the preparation of planning instruments to direct development within NSW. This includes Local Environment Plans (LEP), which are administered by local government, and principally determine land-use and the process for development control.

LEPs usually include clauses requiring that heritage be considered during development applications and a schedule of identified heritage items be provided (refer to **Section 16.5.3**).

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The Western Area falls within the boundary of the ‘Foreshore and Waterways area’ and is therefore subject to the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Harbour SREP), which is a deemed SEPP.

The SREP lists certain heritage items. Whilst there are no items listed in the Project Area, there is one item on and close to the wider Site, namely No. 35 Shell Oil Refinery Wharf on the Duck River (refer to **Section 16.5.3**).

Parramatta Local Environmental Plan 2011

The Site is located within the Parramatta Local Government Area (LGA). Part 5, Section 5.10 of the *Parramatta Local Environmental Plan 2011* (Parramatta LEP) relates to heritage conservation within this LGA. All heritage items listed on the Parramatta LEP are included in Schedule 5. The Parramatta LEP requires development consent for a range of heritage related activities including demolishing, removing or altering heritage items and disturbing or excavating an archaeological site.

Heritage items listed in Schedule 5 of the Parramatta LEP have been identified in the area surrounding the Project Area. There are no heritage items listed in the Parramatta LEP located within the Project Area (refer to **Section 16.5.3**).

16.4 Method of assessment

The historic (also known as European or non-Indigenous/non-Aboriginal) heritage values of the Project Area were assessed based on the known heritage values of previously identified and/or listed items, as well as the potential for historical archaeological relics to be present in below ground (subsurface) deposits. This assessment has been informed through:

- a review of legislation and policy relevant to the Project Area (refer to **Section 16.3**);
- a review of existing information about the Project Area; and
- an assessment of significance.

16.4.1 Desktop searches

The methodology used to establish the existing environment included desktop historical research. Previously identified and/or listed heritage items and previous heritage assessments were reviewed. Online searches of relevant heritage registers and databases (statutory and non-statutory) included:

- World Heritage List;
- Commonwealth Heritage List;

- National Heritage List;
- RNE (non-statutory archive);
- SHR;
- Parramatta LEP;
- State Heritage Inventory (SHI) (for Section 170 and Regional Environmental Plan (REP) listed items); and
- Parramatta Archaeological Zoning Plan.

The following previous heritage assessments were also reviewed:

- *Clyde Terminal Historical Archaeological Assessment Clyde Terminal Conversion Environmental Impact Statement* (AECOM, 2013);
- *Clyde Terminal Conversion Project Historic Archaeological Assessment* (Australian Museum Consulting, 2015); and
- *Clyde Terminal SSD 5147 Modification Statement of Heritage Impact* (AECOM, 2018c).

These registers, databases, and previous assessments were reviewed. Additional research was also undertaken through the State Library of NSW and Trove. The information gathered was used to gain an understanding of the heritage values associated with the Project Area and heritage items located within the local area.

16.4.2 Significance of assessment criteria

In order to understand how a development would impact on a heritage item it is essential to understand why an item is significant. An assessment of significance is undertaken to explain why a particular item is important and to enable the appropriate site management and curtilage to be determined.

The process of linking this assessment with an item's historical context has been developed through the NSW Heritage Management System and is outlined in the guideline *Assessing Heritage Significance* (NSW Heritage Office, 2001), part of the NSW Heritage Manual (Heritage Branch, Department of Planning).

The *Assessing Heritage Significance* guideline establishes seven evaluation criteria under which a place can be evaluated in the context of State or local historical themes. Similarly, a heritage item can be significant at a local level (i.e. to the people living in the vicinity of the site), at a State level (i.e. to all people living within NSW) or be significant to the country as a whole and be of National or Commonwealth significance.

In accordance with the guideline *Assessing Heritage Significance*, an item will be considered to be of State heritage significance if it meets more than one of the identified criteria (these are listed in **Appendix J**).

The NSW Heritage Council requires the summation of the significance assessment into a succinct paragraph, known as a Statement of Significance. The Statement of Significance is the foundation for future management and impact assessment.

An initial assessment of significance was undertaken for the former Clyde Refinery in 2013 (AECOM, 2013), with an updated significance assessment by AECOM in 2018 (AECOM, 2018c) (refer to **Section 16.5.4**).

16.5 Existing environment

16.5.1 Historical context

The historical context of the Site aids in the determination of the archaeological potential and heritage significance of the Project Area. The Site has had four historical phases: Aboriginal occupation; early land grants, John Fells & Co. and British Imperial Oil/Shell.

Aboriginal occupation (Pre c.1804)

The Project Area falls within the traditional country of the Darug (also spelt Dharuk, Dharruk, Dharug and Daruk) language group. Further details regarding Aboriginal occupation of the area can be found in **Chapter 17 Aboriginal heritage**.

Early land grants: Elizabeth Farm (1793-1918)

In 1793, John Macarthur (c.1767-1834) was granted 100 acres of land adjacent to the Parramatta River. Macarthur named the property 'Elizabeth Farm' after his wife. By 1800, Elizabeth Farm comprised nearly 300 acres and was used for cattle and sheep grazing.

On 8 October 1816, the Crown granted John Macarthur an additional 850 acres of land, which encompassed the area occupied by the former Clyde Terminal.

Elizabeth Farm was purchased in 1881 by Septimus Alfred Stephen. Stephen and his brother, Arthur, subdivided and sold off the property in four parts over three years.

The 1926 St Johns parish plan indicates that the northern portion of the Site had been resumed for a sewerage farm, but it also notes on the plan that it was "now sold", indicating that the works were never constructed.

Early land grants: Commonwealth Oil Corporation (1908-1911)

From the 1860s onwards, the Australian shale oil industry supplied a small proportion of Australia's oil needs. Until the 1920s, shale oil was refined at small scale distillation plants near the shale mining sites, predominantly in the state of NSW.

In 1908 the Commonwealth Oil Corporation (COC) purchased a large expanse of scrubby land at the confluence of the Parramatta and Duck rivers, on land formerly part of the Elizabeth Farm estate, for future shale oil expansion. In 1911 the COC went into receivership. No evidence can be found that COC constructed or operated a refinery on the Site. This land was subsequently acquired from COC by John Fell and Company Pty Ltd (John Fell & Co.) in 1913, when all the assets of the COC were transferred (Murray, 2001).

Establishment of the Clyde Refinery: John Fells & Co. (1918-1927)

John Fell & Co. was established to refine, blend and distribute oil, and went on to become a pioneer of the Australian oil industry (Macleod, 2012).

In 1918 the company supplemented its existing shale oil operations at Newnes by establishing a shale oil refinery on 60 acres of land at Clyde, NSW. The land upon which John Fell & Co. established the refinery had previously been part of Elizabeth Farm, before being transferred to the COC in 1908 (Shell Company of Australia, n.d.).

The genesis of the refinery remains unclear, but it is likely that it was John Fell & Co. who commenced construction. A Shell publication (Shell Company of Australia, n.d.) stated that John Fell & Co. decided to establish a shale oil refinery at Clyde in 1918.

In 1925, John Fell & Co. Pty Ltd consolidated their operations at Clyde, moving the storage and processing plant from Gore Bay and refining equipment from Newnes, to the Site. John Fell & Co. then signed an agreement with Shell for the supply of 1,500 tonnes of crude oil per month, with refining commencing at Clyde in 1926. Approximately 40 people were employed at the Clyde Refinery, handling the refining and distribution operations. Access to the Site was generally limited to the railway siding, with the Clyde Refinery producing Dux Motor Spirit, petroleum, coke, tractor distillate, gas oil, and Ajax Power Kerosene. In 1927, the Duck River Wharf opened, which enabled crude feed stock to be barged in along the Parramatta River from Gore Bay.

In 1927, the Clyde Refinery experienced a series of incidents which in due course resulted in the refinery being sold to Shell (Shell, 1993)

Shell as owner/operator of Clyde Refinery (1928-2013)

The Clyde Refinery was one of the longest operating, and one of the most complex, oil refineries in Australia. It operated from 1928 until 2013 and in that time underwent a series of major expansions. Activities and expansions of the Clyde Refinery are a summarised in **Table 16-2**.

Table 16-2 Summary of the former Clyde Refinery activities and expansions (1928-2013)

Period	Description
1 January 1928	Shell gains ownership and operation of the Clyde Refinery.
30 July 1928	An additional seven acres of land purchased for expansions.
1929 to 1939	The Clyde Refinery underwent its first major expansion with further 150 acres purchased from the Ford Motor Company in June 1930, which increased the total extent of the Clyde Refinery to 217 acres (Shell, 1993). This expansion was complemented by the purchase and construction of new equipment and buildings, including the Dubbs Cracking Unit and boiler units and the drum and tin filling shed.
1941-1945	Following the outbreak of World War II, crude oil supplies were cut to the Clyde Refinery and efforts were redirected to supplying and supporting the requirements of the Australian armed forces. For the duration of the war, the primary function of the Clyde Refinery was as a storage terminal and drum filling area. The only products manufactured during this period were solvents from imported gasoline and wash (gas) oil made from diesel fuels. Following the end of the war in 1945, crude oil was once again available and refining operations at the Site recommenced.
1947	In 1947 construction of the bitumen plant and neutralised lubricated oil production facilities began and were officially opened in 1948. The expansion culminated with the commissioning of the LVI Lubricating Oil Plant and the official opening of new laboratories at the Site in May 1953 (Shell, 1993).
1958-1959	From 1958-1959 the Clyde Refinery underwent its third major expansion and development and involved the erection of a platformer, significant modernisation, the extension of existing ancillary facilities, and the erection of double-storey administration buildings.
1960-1963	Major additions during this expansion phase included the catalytic cracking complex, high vacuum unit, ethylene and epikote plants, and the construction of two pipelines.
1964	Shell completed construction of their Parramatta Terminal in 1964, which subsequently replaced the Clyde Refinery as Shell's primary distribution centre in NSW. All marketing distribution functions, with the exception of bitumen and bulk solvents, were transferred from Clyde across to the new Parramatta facility.
1966-1968	This expansion phase included the erection of a splitter treater, the introduction of the No. 2 crude distiller, No. 7 steam boiler and turbo generator 1 (Shell, 1993).
1970	In 1970 an additional 35 acres of land was purchased from Mobil and a new polypropylene plant was erected for Shell Chemical.
1974-1975	A water recovery treatment and reuse system was installed for refinery process cooling in 1974-1975. This enabled the Clyde Refinery to be isolated from the previous Parramatta River-Duck River system (Shell, 1993).
mid-1970s	Following the conclusion of the major phases of expansion and development of the Clyde Refinery in the mid-1970s, only minor additions and modifications were made.
April 2012	In April 2012 Shell announced that the Clyde Refinery would permanently cease refining operations as these operations were not economically sustainable.
2013	In 2013 refining activity at the Site ceased (LyondellBasell, 2014) but the Site continued to operate as a finished fuels terminal.
2018	As of 2018, the Site remains in operation as the Clyde Terminal.

16.5.2 Physical development at the Site

The development of the Site over time can be traced through the analysis of sequential aerials of the location. **Table 16-3** presents observations made based on the available aerials (refer to Plates 2 to 10 of **Appendix J**).

Table 16-3 Description of the Site based on aerial photographs

Year of photograph	Description
1930	This photograph indicates that the Shell facility, shortly after it was purchased from John Fell & Co., was focussed on the corner of Devon and Unwin Streets. At this time, the Clyde Refinery consisted of a tank farm of approximately 18 tanks. On the corner of Colquhoun and Devon Streets there is a residential house, likely to be the manager's residence based on anecdotal evidence. The remainder of the facilities associated with the Clyde Refinery are located along the southern boundary of the tank farm area.
1951	This photograph indicates there had been extensive development at the Site, including two more houses along Devon Street. The Clyde Refinery is still consolidated to the south of the tank farms. The Clyde Refinery appears to have been connected to the tramway to the north by a track and series of branch lines. Oriented north-east to south-west are two structures that appear to be rail loading facilities. The tank farm originally comprised nine tanks and the six extant tanks in this area appear to be the same as from this period. The wharf at the confluence of Parramatta River and Duck River was in operation, and there appears to be a pipeline connecting the wharf to the Clyde Refinery. The south-east portion of the Site remains undeveloped.
1961	This photograph indicates the office blocks are now present on-site. The Credit Union and contractors facilities, as they still stand, are evident, as is the Administration building for the bitumen rail loading facilities. A number of new tank farms and facilities (e.g. Catalytic Cracking Unit) are evident and some are under construction, notably in the south-east portion of the Site. A number of these appear to be the same as those present on-site in 2013. The area adjacent to the confluence of Parramatta and Duck rivers (near the wharf) remains largely undeveloped.
1965	This photograph indicates that a number of tank farms and facilities have been constructed. The area at the confluence of Parramatta and Duck rivers (near the wharf) remains largely undeveloped, although it appears a series of causeways have been built through the swamp. The flares were in place by 1965.
1970	This photograph indicates that the distillate splitter treater and High Vacuum Unit is operational in their 2013 locations. The collection of sheds that had stood on the corner where platformer 3 was later built, have been demolished in this aerial. Some tank farms have been extended or moved, with some additional tank farms under construction. The houses on Devon Street are still extant.
1978	This photograph indicates that there have been extensive demolitions around the bitumen loading gantry and to the east and south. These activities appear to have removed the majority of the remaining infrastructure associated with the operation of John Fell & Co. The water treatment facility (cooling treatment facility) has been constructed. The main interceptor had been put in place by 1970. Between 1970 and 1978 the houses on Devon Street were demolished. The LPG Loading Facility had been completed since 1970.
1986	This photograph indicates that there have been no major alterations to the Site since 1978. The movements control building had been constructed and the NSW State Office had been constructed subsequent to the 1978 aerial and prior to that from 1986.
1994	This photograph indicates that the Central Control Room had been constructed. The shed on the current Site of the bitumen loading gantry has been demolished, and the gantry constructed. The mounded LPG Loading Facility has also been constructed at this time.
2013	The 2013 aerial shows the Site at the time of its closure (where refinery infrastructure was still present).
2017	The 2017 aerial shows that infrastructure including tanks have been removed since the Clyde Refinery ceased operation.

16.5.3 Register and database searches

A search of relevant heritage registers and databases was undertaken on 31 August 2018.

No items listed on the World Heritage List, Commonwealth Heritage List, National Heritage List and the SHR were identified within the Project Area or within 200 metres (m) of the Project Area. This distance was chosen to identify those sites close enough to be potentially impacted by the Project.

No items listed on the RNE (a non-statutory archive) or the Parramatta LEP were identified within the Project Area; however four items were identified within 200 m of the Project Area (refer to **Figure 16-1**). These are:

- RNE:
  - Lower Duck River Wetlands (RNE No.19254, Registered Place) (also listed on the Auburn LEP (I47)). This has been registered for its ecological value.
  - Parramatta and Lane Cove Rivers Landscapes (RNE No.14309, Indicative Place). The listing is undeveloped and contains no information regarding the significance of the area. It has not been considered further.
- Parramatta LEP:
  - Capral Aluminium (I575). This is listed for historical, associative and representative reasons associated with local industry and manufacturing.
  - Wetlands (I1) located in sections along the shores of Parramatta and Duck rivers, including the Wetland within the north-east of the Site. This has been listed as it is an item of ecological significance.

Four LEP items that are greater than 200 m from the Project Area (RTA Depot (I576), Silverwater Bridge (I73), Pumping Station (I5) and Tram Alignment (I6)) are also shown on **Figure 16-1** due to the figure's scale, however they are not included in this assessment as they would not be impacted by the Project due to the distance from the Project Area.

In addition an item listed on the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 that is close to the Site is also shown on **Figure 16-1**. This item (No. 35 Shell Oil Refinery Wharf on the Duck River) is also more than 200 m from the Project Area and is not discussed in this assessment as it would not be impacted by the Project.

The Site is also located within the Parramatta Archaeological Management Unit 2966 (Parramatta AMU 2966), as identified in the Parramatta Archaeological Zoning Plan. Parramatta AMU 2966 comprises the site of the Shell Company of Australia's former refinery works, including associated infrastructure, storage tanks and pipe complexes, as well as offices, amenities, and sealed internal access roads. The Parramatta AMU 2966 was assessed as having no archaeological significance (OEH, 2018c).

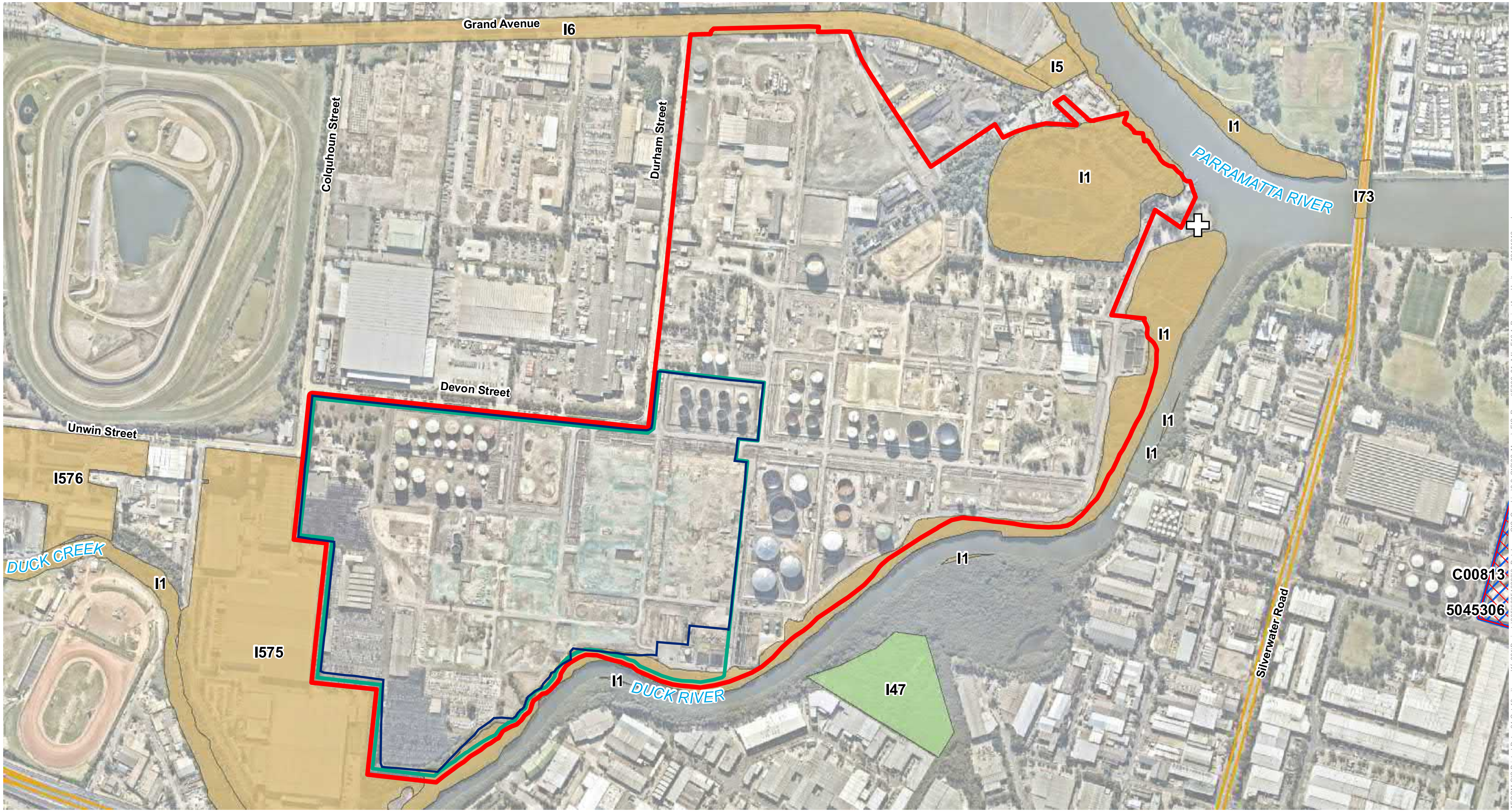

FIGURE 16-1: PROJECT AREA AND SURROUNDING HERITAGE ITEMS

KEY

Site boundary
Project Area boundary
Western Area boundary
State road
Local road

LEP Heritage

State Heritage Act
Conservation Area - General
Item - General
Item - Landscape

SREP (Sydney Harbour Catchment) 2005

Shell Oil Refinery Wharf

0 100 200 300 m

16.5.4 Previous heritage assessments

In 2013, AECOM undertook an assessment to determine the impacts to heritage significance that may be caused by the conversion of the former Clyde Refinery for use solely as a finished fuels terminal (Clyde Terminal Conversion Project (State Significant Development (SSD) 5147) (the 'Conversion Project')). Although not listed on any register, the former Clyde Refinery was determined by this assessment to have State significance. A significance assessment was undertaken for the former Clyde Refinery against the guideline *Assessing Heritage Significance* (NSW Heritage Office, 2001) at this time.

The Historical Archaeological assessment (AECOM, 2013) found that the demolition of redundant refinery infrastructure would have a negative impact on the significance of the Site. Conservation, however, was determined not to be a viable option due to financial and practical reasons around on-going management and maintenance. It was recommended that impacts be mitigated through archival recordings and that two areas of archaeological potential, that were identified, be investigated further (AECOM, 2013).

Further investigation of these two areas of archaeological potential was undertaken by Australian Museum Consulting in 2015. This investigation concluded that a combination of construction techniques and past disturbance within the two identified areas meant *"there is no potential for significant relics to be present"*, with the recommendation that no further assessment or investigation be undertaken (Australian Museum Consulting, 2015).

Based on the work undertaken by Australian Museum Consulting in 2015 an updated significance assessment was completed by AECOM in 2018 (AECOM, 2018c) as outlined in the guideline *Assessing Heritage Significance* (NSW Heritage Office, 2001). This significance assessment concluded the following:

> *"The Clyde Terminal (former Clyde Refinery) is of State significance for its historical, associative values. Historically, it demonstrates NSW's increasing use of and reliance on fossil fuels and the expansion of business in the State from import to production. It is associated with the Shell Company, one of the leading producers and retailers of fuel in NSW.*
>
> *The Clyde Terminal is of local social and technical significance. It is likely to be of social significance to the local community as it has been an employer of locals for over 80 years and has been an active participant and supporter of community events throughout that time. The former Clyde Refinery can also demonstrate technical developments in the process of refining Crude Oil.*
>
> *Clyde Terminal does not have any potential for significant relics to be present at the site and that excavations are unlikely to yield substantial information that is not readily available from other sources.*
>
> *…Note: Significance grading of individual components was not considered appropriate for Clyde Terminal. Many of the structures that evidence the refinery activities have been demolished which makes it difficult to make a comparison of individual elements that display varying grades of significance*."

For the purposes of this assessment the significance remains as per the significance assessment outlined above.

16.6 Impact assessment

16.6.1 Remediation (Stage 1 to Stage 5)

The potential heritage impact for each stage (Stage 1 to Stage 5, as outlined in **Chapter 4 Project description**) of the Project is summarised in **Table 16-4**.

Table 16-4 Potential heritage impact per Project stage

Stage	Potential heritage impact
Stage 1 – preparation works	There is the potential for a temporary impact to the identified heritage values of the former Clyde Refinery as a result of Stage 1. This would be related to changing the existing site landscape through additions of fencing, temporary facilities, etc.
Stage 2 – removal of redundant infrastructure and waste	There is the potential for a permanent impact to the identified heritage values of the former Clyde Refinery as a result of Stage 2 through the removal of redundant infrastructure. Further to this, indirect impacts are possible during this stage to the adjacent ecological listed items Lower Duck River Wetlands (I47) and Wetlands (I1) if contaminated soil or water migrates off-site and is inadvertently spread into these areas.
Stage 3 – remediation	There is the potential for indirect impacts to the identified heritage values for the adjacent ecological listed items (Lower Duck River Wetlands (I47) and Wetlands (I1) if contaminated soil or water migrates off-site and is inadvertently spread into these areas.
Stage 4 – landforming	The impact to the identified heritage values of the former Clyde Refinery associated with Stage 4 would be negligible as by this stage of works the heritage elements within the Project Area would already have been removed. There is the potential for indirect impacts to the identified heritage values for the adjacent ecological listed items (Lower Duck River Wetlands (I47) and Wetlands (I1)) if sediment migrates off-site and is inadvertently spread into these areas
Stage 5 – completion works and demobilisation	The impact to the identified heritage values of the former Clyde Refinery associated with Stage 5 would be negligible as by this stage of works the heritage elements within the Project Area would already have been removed. There is the potential for indirect impacts to the identified heritage values for the adjacent ecological listed items (Lower Duck River Wetlands (I47) and Wetlands (I1)) if the final landform is not managed to minimise off-site soil and erosion impacts.

The Project would be undertaken within the bounds of the former Clyde Refinery, which has previously been assessed to have State significance (refer to **Section 16.5.4**), although it remains unlisted on any register. As outlined in **Table 16-4**, direct impacts from the Project (Stage 1 and Stage 2) to the heritage value of the former Clyde Refinery have already been mitigated by previous archival recordings as part of the Conversion Project.

Indirect impacts to the ecological items Lower Duck River Wetlands (I47) and Wetlands (I1) during Stage 2 to Stage 5 can be avoided through appropriate control measures. A separate ecological assessment has been undertaken (refer to **Appendix I** and **Chapter 15 Biodiversity**) and covers protectionary measures for these ecological items. **Chapter 8 Soil, groundwater and contamination** and **Chapter 9 Surface water, wastewater and flooding** also include measures to protect against potential off-site impacts, including those that may adversely impact the items listed above.

Item Capral Aluminium (I575) is outside the bounds of the Project Area and would therefore not be directly impacted. It is also unlikely that the Project would have any indirect impacts on this item.

16.6.2 Ongoing operation

The impact to the identified heritage values following completion of the Project would be negligible as the heritage elements within the Project Area would already have been removed during the Project.

There is the ongoing potential for the interim final landform to impact on the Lower Duck River Wetlands (I47) and Wetlands (I1) during operation if the landform is not managed to minimise off-site soil and erosion impacts.

16.7 Mitigation and management

16.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

Measure to address potential historic heritage impacts of the Project would be detailed in the REMP (in a historic heritage section) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for during Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the historic heritage section of the REMP, as well as the LTEMP are discussed in more detail in the following section.

16.7.2 Remediation (Stage 1 to Stage 5)

The Project has the potential to have both direct and indirect impacts to heritage items, including the heritage value of the former Clyde Refinery and the nearby wetlands. Potential heritage impacts from the Project can be summarised as:

- potential direct impacts to Site, associated with the removal of subsurface refinery infrastructure; and
- potential indirect impacts to the Lower Duck Wetlands (I47) and Wetlands (I1), associated with the potential for contamination and sediment to leave the Project Area and impact the ecological value of these items.

Direct impacts from the Project (Stage 1 and Stage 2) to the heritage value of the former Clyde Refinery have already been mitigated by previous archival recordings as part of the Conversion Project. Indirect impacts to the ecological items Lower Duck River Wetlands (I47) and Wetlands (I1) can be avoided through appropriate sediment, erosion and surface water control measures (refer to **Chapter 16 Biodiversity** and **Chapter 8 Soil, groundwater and contamination**).

16.7.3 Ongoing operation

The impacts to heritage values after completion of the Project would be negligible and would be associated with potentially impacting the ecological value of the Lower Duck River Wetlands (I47) and Wetlands (I1). Impacts to these items would be managed through the LTEMP (refer to **Chapter 8 Soil, groundwater and contamination)**.

16.7.4 Summary

A summary of the mitigation and management measures to manage potential historic heritage impacts from the Project are outlined in **Table 16-5**.

Table 16-5 Mitigation and management measures – historic heritage

Reference	Mitigation and management measures	Timing
HH1	Workers and contractors would be made aware of the heritage values of the former Clyde Refinery and the three surrounding listed items of Lower Duck River Wetlands (I47), Wetlands (I1) and Capral Aluminium (I575), during the site induction.	Stage 1 to Stage 5

Reference	Mitigation and management measures	Timing
HH2	As noted in the Australian Museum Consulting archaeological assessment (Australian Museum Consulting, 2015), the north-west portion of the Site has low potential to contain significant relics. Notwithstanding this, should an unexpected find of likely significance be uncovered (including artefact scatters (glass, animal bone, ceramic, brick, metal etc.), building foundations, etc.), consistent with the unexpected finds protocol from the Clyde Terminal Conversion Project (SSD 5147), the following stop work procedure would be followed: • all work in the nearby area is to cease immediately; • contact OEH Heritage Branch; and • depending on the possible significance of the relics, an archaeological assessment and an excavation permit under the NSW *Heritage Act 1977* may be required before further works can continue in that area.	Stage 1 to Stage 5

Following the implementation of the mitigation and management measures above, there would be no residual impacts from the Project on historic heritage. Therefore there are no cumulative impacts on historic heritage expected. Further consideration of cumulative impacts is discussed in **Chapter 19 Cumulative impacts**.

17.0 Aboriginal heritage

17.1 Introduction

This chapter provides a summary of the Aboriginal heritage assessment undertaken for the Project. A detailed Aboriginal heritage assessment was prepared by AECOM and is provided in **Appendix K**.

17.2 Scope of the assessment

The Secretary's Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 17-1**. **Table 17-1** also presents where in this chapter each of the requirements are addressed.

Table 17-1 SEARs – Aboriginal heritage

SEARs	Where addressed
Heritage: • identify and assess potential impacts on Aboriginal cultural heritage values along the Duck River frontage and describe measures to avoid, mitigate and manage any impacts.	• Aboriginal cultural heritage values are identified in **Section 17.5**. • Potential impacts are assessed in **Section 17.6**. • Management measures to avoid, mitigate or manage potential impacts are recommended in **Section 17.7**.

The NSW Office of Environment and Heritage (OEH) also provided input to the SEARs. Where applicable to this chapter, these requirements have also been addressed. These are discussed further in the SEARs cross reference table provided in **Appendix A**.

17.3 Legislation and planning policy

17.3.1 Commonwealth legislation

Aboriginal and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Commonwealth)* (the ATSIHP Act) provides for the preservation and protection of tradition, places, areas and objects of particular significance to Indigenous Australians.

The ATSIHP Act can override state and territory laws in situations where a state or territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an Aboriginal area or object. The Commonwealth Minister must consult the appropriate Minister of that state or territory before making a declaration to protect an area or object in a state or territory

No declarations relevant to the Project Area have been made under the ATSIHP Act.

Native Title Act 1993

The *Native Title Act 1993 (Commonwealth)* (NTA) provides for the recognition and protection of native title for Aboriginal peoples and Torres Strait Islanders. The NTA recognises native title for land over which native title has not been extinguished and where persons able to establish native title are able to prove continuous use, occupation or other classes of behaviour and actions consistent with a traditional cultural possession of those lands.

The NTA makes provision for Indigenous Land Use Agreements (ILUA) to be formed as well as a framework for notification of Native Title Stakeholders for certain future acts on land where Native Title has not been extinguished.

Searches of the *Schedule of Applications (unregistered claimant applications*), *Register of Native Title Claims*, *National Native Title Register*, *Register of Indigenous Land Use Agreements* and *Notified Indigenous Land Use Agreements* were undertaken in November 2018, with no relevant listings identified for the Project Area.

Environment Protection and Biodiversity Conservation Act 1999

Under Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* Act *(Commonwealth)* (EPBC Act), any action that is likely to have a significant impact on a matter of National Environmental Significance may only progress with approval of the Commonwealth Minister for the Environment. An action is defined as a project, development, undertaking, activity, series of activities, or alteration.

Under the Act, protected heritage items are listed on the National Heritage List (items of significance to the nation) or the Commonwealth Heritage List (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE), which was closed in 2007 and is no longer a statutory list. Statutory references to the RNE in the EPBC Act were removed on 19 February 2012. However, the RNE remains an archive of over 13,000 heritage places throughout Australia.

Searches of the National Heritage List, Commonwealth Heritage List and RNE were undertaken in October 2016, with no relevant listings identified for the Project Area.

17.3.2 State legislation, policies and plans

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act), administered by Department of Planning and Environment (DPE), requires that consideration be given to environmental impacts as part of the development control process in NSW. In NSW, environmental impacts are interpreted as including impacts to Aboriginal and non-Aboriginal cultural heritage.

Division 4.1 of Part 4 of the EP&A Act provides a determination regime for State Significant Development (SSD). As detailed in **Section 5.1** the Project was declared SSD by the Minister under section 4.36(3) of the EP&A Act.

Pursuant to Section 4.41 of the EP&A Act, Aboriginal Heritage Impact Permits (AHIPs) are not required for SSD projects that are authorised by a development consent. Potential impacts to Aboriginal heritage values associated with SSD projects are typically managed under Aboriginal Cultural Heritage Management Plans (ACHMPs). ACHMPs are statutorily binding once approved by DPE.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974 (NSW)* (NPW Act), administered by the Office of Environment and Heritage (OEH), is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Secretary of OEH responsibility for the proper care, preservation and protection of ‘Aboriginal objects’ and ‘Aboriginal places’, defined under the Act as follows:

- an *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains); and
- an *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

An AHIP issued under Section 90 of the NPW Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened.

As indicated in **Section 1.3.1**, pursuant to Section 4.41 of the EP&A Act, AHIPs are not required for SSD projects that are authorised by a development consent.

Section 89A of the NPW Act requires notification of the location of Aboriginal sites within a reasonable time, with penalties for non-notification. Section 89A is binding in all instances, including Division 4.1 projects.

Parramatta Local Environmental Plan 2011

Clause 5.10 of the *Parramatta Local Environmental Plan 2011* (Parramatta LEP) provides specific provisions for the protection of heritage items, heritage conservation areas, archaeological relics, Aboriginal objects and Aboriginal places of heritage significance within the Parramatta Local Government Area (LGA). The definitions of these aspects of heritage in the Parramatta LEP are provided in section 2 of **Appendix K**.

Under Clause 5.10 of the Parramatta LEP, development consent is required for activities resulting in impacts to heritage, including impacts to archaeological sites, Aboriginal objects or Aboriginal places of heritage significance.

Schedule 5 of the Parramatta LEP provides a list of heritage items, conservation areas and archaeological sites within the Parramatta LGA. There are no relevant Aboriginal heritage listings for the Project Area.

Parramatta Development Control Plan 2011

The *Parramatta Development Control Plan 2011* (Parramatta DCP) provides detailed planning controls for development in the Parramatta LGA and came into effect on 12 October 2011. Section 3.5.3 of Part 3 of the Parramatta DCP pertains specifically to Aboriginal heritage and contains a series of development controls for protecting and managing the known and potential Aboriginal heritage values of Parramatta LGA. These controls have been considered however as the Project is a SSD the planning controls required by the Parramatta DCP do not apply.

The Parramatta DCP identifies the Project Area as an area of Low Aboriginal Heritage Sensitivity, but also an area of Aboriginal association.

17.4 Method of assessment

17.4.1 Baseline review

The Aboriginal heritage assessment has been informed through:

- a review of the Aboriginal Cultural Heritage Assessment Report (ACHAR) undertaken for the Clyde Terminal Conversion Project (SSD 5147) (the ‘Conversion Project’) (AECOM, 2013);
- a review of legislation relevant to the Project Area;
- a review of landscape context of the Project Area with particular consideration to its Aboriginal archaeological implications;
- a review of the archaeological context of the Project Area, based on published resources, previous reports written for the Site and government databases; and
- visual inspection of the Project Area.

This information, alongside the SEARs presented in **Table 1-1**, informed the methodology for this chapter.

17.4.2 Assessment approach

In 2012, AECOM was commissioned by the Shell Company of Australia Ltd (Shell) to undertake an ACHAR for the Conversion Project. The Conversion Project encompassed the majority of the Project Area, with the unassessed portion of the Project Area comprising land currently vacant and formerly leased to AutoNexus Pty Ltd in the west of the Project Area (refer to **Figure 2-2**).

The key findings of the ACHAR undertaken for the Conversion Project, including those of its full Aboriginal community consultation program, are of relevance to the Project. This point notwithstanding, in order to identify potential impacts to Aboriginal cultural heritage values as a result of the Project, AECOM has undertaken an updated review of existing environmental and archaeological data sources for the Project and complimented this with a standalone visual inspection of the Project Area, as outlined in **Section 1.5.3**.

This approach is justified based on the conclusions of the ACHAR for the Conversion Project which included:

- No new or previously recorded Aboriginal archaeological sites were identified during the field inspection component of the assessment.
- The inferred pre-disturbance topography of the Project Area was unlikely to have encouraged sustained Aboriginal activity or occupation. Aboriginal use of the Project Area is likely to have taken the form of visits for resource collection.
- Disturbances resulting from the construction of the Clyde Refinery, including dredging, filling and native vegetation clearance, are likely to have destroyed any evidence of past Aboriginal activity within the Project Area (both surface and subsurface).
- Proposed impact areas within the Project Area were assessed as grossly disturbed, consisting of active or redundant components of the refinery operation (i.e., existing infrastructure areas).
- A full program of Aboriginal community consultation was carried out as part of the ACHAR for SSD 5147. While noting its cultural significance in general terms (i.e., as an important resource zone and cultural landscape component), the Registered Aboriginal Parties involved in SSD 5147 identified no specific cultural values or concerns for the Project Area.
- On the basis of the above, AECOM recommended that no further Aboriginal heritage investigations were warranted for SSD 5147. However, contingency management measures for any Aboriginal objects uncovered during the Clyde Terminal Conversion Project were provided.

The Project Area has been refined so that the vegetation along the Duck River and the western border of the Project Area are excluded from the Project Area and would not be disturbed. However, it should be noted that, excluding extant mangrove and saltmarsh vegetation communities along and directly adjacent to the Duck River, linear strips of vegetation along the southern and western margins (outside) of the remediation Project Area were also observed to consist of historically planted trees.

17.5 Existing environment

Environmental variables such as topography, geology, hydrology and the composition of local flora and faunal communities played an important role in influencing how Aboriginal communities moved within and utilised their respective Country. In addition, an assessment of historical and contemporary land use activities is important for understanding the formation and integrity of archaeological deposits, as well as assessments of subsurface archaeological potential.

17.5.1 Landscape context

A summary of the landscape context of the Project Area (both regional and local) is provided in this section. Further details on the regional and local geological context are provided in **Chapter 8 Soils, groundwater and contamination** and **Appendix K**.

Topography and hydrology

The natural topography of the Project Area has been heavily modified through the development of the Clyde Refinery. Nonetheless, historical reference materials suggests that, in pre- and early-post European settlement times, the Project Area would have been characterised by relatively flat, low-lying terrain subject to both permanent and intermittent flooding.

The Site is located at the confluence of the Parramatta and Duck rivers. The Parramatta River is the main tributary of Sydney Harbour. Duck River is a major tributary of Parramatta River, which rises in the suburb of Birrong, about 6 km to the south of the Site.

Prior to historical land use disturbances, this area likely comprised a highly productive and attractive resource zone for Aboriginal people occupying or travelling through the Rosehill area.

Rising sea levels during the post-glacial and early Holocene periods (peaking around 7,000 years ago) had implications for Aboriginal people occupying the Sydney region, with diminishing land area and associated environmental changes likely necessitating the modifications to traditional settlement patterns. Therefore, the Project Area is unlikely to have encouraged sustained Aboriginal activity or occupation. Aboriginal use of the Project Area is likely to have taken the form of short stay visits for resource collection.

Geology and soils

Existing geological and geotechnical data indicate that the geology and associated soils of the Site, including the Project Area, can be subdivided into four units (ERM, 2012). These comprise:

- Unit 1 (Fill material): Poorly compacted mixture of silt, clay and gravel, with localised areas of slag, furnace ash and concrete. Typical thickness of about 0.5 metres (m) to 1 m, with maximum reported thickness of 3 m. This unit was used to raise the level of the surface of the low lying tidal swamp/mangrove area along the Parramatta and Duck rivers.
- Unit 2 (Estuarine sediments): Silty clay-clayey silt, with occasional sandy lenses and shell fragments to a thickness of approximately 4 m. This unit is generally restricted to the area adjacent to the Parramatta and Duck rivers.
- Unit 3 (Alluvial sediments): Tertiary alluvial sediments up to 20 m thick, including clay with sandy lenses.
- Unit 4 (Residual clay) - residual Ashfield Shale less than 2 m thick.

On the basis of the above, it is concluded that stones suitable for flaked and/or edge-ground stone tool manufacture would not have been available within or immediately surrounding the Project Area.

Excavated stone artefacts from sites in the Parramatta LGA indicate the collection and use of two rock types, namely silcrete and silicified tuff, with a range of other lithic materials (e.g. quartz, silicified wood, quartzite) also used, although not as intensively.

Flora and fauna

Native vegetation within, and directly adjacent to, the Project Area has been extensively modified as a result of the development of the Clyde Refinery and Terminal and adjoining light industrial land uses. Aboriginal scarred trees are considered unlikely to occur within this area. Today, vegetation is limited to linear strips of planted and remnant vegetation, with the latter restricted to estuarine mangrove and saltmarsh communities directly adjacent to the Duck River. Mapped vegetation communities within, and directly adjacent to, the Project Area include estuarine mangrove, fringe forest (Swamp Oak Floodplain Forest) and saltmarsh (AECOM, 2013).

Regarding the pre- and early-post-European settlement native vegetation regime of the Site, McLoughlin’s (2000) investigation of the vegetation along the Parramatta River and its bays from 1788 to about 1940 suggests that this comprised an estuarine ‘complex’ of mangroves, salt marsh and Casuarina/Melaleuca forest.

Native vegetation communities and locally occurring watercourses would likewise have supported a large and diverse range of terrestrial, avian and aquatic fauna.

While available historical records provide only limited insight into Aboriginal exploitation of plants across the Sydney Region (Attenbrow, 2010; Kohen, 1986), it can be said that the original vegetation communities of the Site and its environs would have supplied Aboriginal people with a range of edible and otherwise useful plant species.

Land disturbance

Field observations made during the visual inspection of the Project Area indicated that the land has been grossly modified as a result of historical land use activities. This is consistent with available historical reference materials.

Disturbances have resulted from the construction of the Clyde Refinery, including dredging, filling and native vegetation clearance, as well as adjoining light industrial land uses. These are likely to have destroyed evidence of past Aboriginal activity across the Site (including within the Western Area boundary).

17.5.2 Archaeological context

A summary of the archaeological context of the Project Area (both regional and local) is provided in this section. A more detailed description of this context is provided in **Appendix K**.

17.5.2.1 Regional context

Sydney region

Available archaeological data indicate that Aboriginal people have occupied the Sydney region for at least 36,000 years (CHM, 2005a; Williams et al. 2014). Excavated materials from these periods are evidence of relatively small populations of Aboriginal people having high residential and low logistical mobility (Attenbrow, 2010, CHM, 2008).

Late Pleistocene/early Holocene chipped stone items attest to a preference for silicified tuff sourced from secondary geological sources such as the Hawkesbury-Nepean River gravels (McDonald 2008; Williams et al. 2014). Retouched 'tools' include unifacially-flaked pebble implements, saws, burins and a variety of scrapers, with unmodified utilised flakes also well represented (Kohen et al. 1984; Williams et al. 2014). Stone tools such as these will have been complemented by a range of organic implements such as wooden digging sticks, spears and boomerangs. However, these do not survive archaeologically (Attenbrow 2010:154).

The rise and spread of complex fishing and stone working technologies indicates growing economic specialisation. The use of stone working technologies is linked to increased foraging risk associated with greater climatic variability as well as the redefinition of social space, reduction of resources (Attenbrow et al. 2009; CHM 2008: 40). Complex, long-distance exchange networks are also shown archaeologically (e.g., Attenbrow et al. 2012; Grave et al. 2012) as are important developments in artistic activities (CHM 2008).

Port Jackson catchment

Investigations to date have generated a large body of archaeological data concerning pre-contact Aboriginal settlement and subsistence patterns in the Port Jackson catchment, with hundreds of sites having been identified and recorded in varying degrees of detail. Middens and rockshelter sites are particularly well represented. However, a variety of other site types (e.g. grinding groove and rock engraving sites, open artefact sites) have also been identified.

Collections of archaeological fauna items from the catchment indicate the exploitation, for food and other purposes, of a wide range of terrestrial and aquatic resources, with marine fauna (e.g. fish) forming a particularly important part of the diet of people living along the coast and estuaries.

Excavated stone, bone and shell artefact collections, indicate the production of a variety of implements for use in activities such as fishing and hunting. It has been suggested that the majority date to the mid-to-late Holocene.

Research conducted by Attenbrow (1990, 1991, 1992a, 1992b, 1994) suggests that "*many activities, including those relating to tool-making which probably happened at base campsites, took place close to the estuarine and freshwater waterways as well as the marine shorelines*".

Site distribution patterns also suggest an occupational emphasis on coastal/estuarine environments and the Hawkesbury Sandstone, with hinterland/freshwater environments and areas underlain by Wianamatta shales used less intensively.

17.5.2.2 Local context

Parramatta LGA

Existing NSW OEH Aboriginal Heritage Information Management System (AHIMS) data indicate that a large number of Aboriginal archaeological investigations have been undertaken within the Parramatta LGA over the last few decades.

Existing archaeological data for this area identifies the most common site type as an open artefact site, with the majority of previously recorded open artefact sites identified as a result of subsurface archaeological investigations in heavily-developed urban contexts. Archaeological finds in the area are dominated by flaked stone artefacts.

Despite over 200 years of European settlement, previous investigations within the Parramatta central business district indicate the survival of Aboriginal archaeological objects and sites in subsurface contexts, albeit with variable integrity depending on the nature and extent of local historical disturbance.

Previous archaeological investigations of the Parramatta Sand Sheet[1] (PSS) within the Parramatta central business district have identified this sand body as a feature of high scientific and cultural significance (CHM, 2005a, 2005b, 2006). Flaked stone assemblages from the PSS have revealed changes over time in raw material use and associated stone artefact technologies, linked to the shifting settlement and subsistence patterns of Aboriginal people occupying the greater Parramatta area.

Variability in the PSS's archaeological resource is also explained by varying levels of historical disturbance, as well as Aboriginal people's differential use of the areas bordering the Parramatta River.

AHIMS database

The AHIMS database contains records of Aboriginal objects reported to the Director General of the Department of Premier and Cabinet in accordance with Section 89A of the NPW Act. It also contains information about Aboriginal places, which have been declared by the Minister to have special significance with respect to Aboriginal culture. Previously recorded Aboriginal objects and declared Aboriginal places are known as 'Aboriginal sites'.

A search of the AHIMS database on October 2017 for a 16 kilometres squared (km^2) area centred on the Project Area (AHIMS search area) returned 93 site entries. Coordinates for the sites within the AHIMS search area indicate that no registered sites are within or immediately adjacent to the Project Area. The nearest site, an open artefact site 'Sydney Turf Club Carpark' (45-6-2559), is located approximately 1.1 kilometres to the north-west of the Project Area.

17.5.3 Visual inspection

A visual inspection of the Project Area was undertaken on 20 November 2017 by AECOM archaeologist Dr Andrew McLaren. The primary purpose of this inspection was to establish whether the Project would, or would be likely to, harm any Aboriginal objects. The visual inspection was undertaken using a combination of pedestrian and vehicle survey and focused on the vegetated southern and western margins of the Project Area. Notes were taken regarding Ground Surface Visibility (GSV), Ground Integrity (GI, i.e. land condition), and Aboriginal archaeological sensitivity and impact risk. Impact risk was determined on the basis of archaeological sensitivity, as well as the nature of the proposed activity.

Consistent with available historical reference materials and the findings of the Aboriginal cultural assessment for the SSD 5147 project, the visual inspection confirmed that the overwhelming majority of land within the Project Area has been grossly modified as a result of historical land use activities; principally, the development of the Clyde Refinery but also adjoining light industrial land uses. Field observations indicated that the Project Area currently consists principally of former refinery infrastructure areas, now cleared following demolition works. Active and decommissioned components of the refinery operation are also present in the north-western and north-eastern portions of the Project Area. The westernmost portion of the Project Area was occupied by the AutoNexus car storage facility at the time of the visual inspection (currently vacant).

Excluding extant mangrove and saltmarsh vegetation communities along and directly adjacent to the Duck River, linear strips of vegetation along the southern and western margins of the Project Area do not comprise remnant vegetation but rather historically planted trees. Ground surface visibility in these areas was, in general, very poor due to grass cover and/or fallen tree matter.

No evidence of past Aboriginal occupation was observed during the visual inspection nor were any lithic materials suitable for flaked and/or edge-ground stone tool manufacture.

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[1] The Parramatta Sand Sheet is an informal stratigraphic name for an extensive fluvial sand body present along both sides of the Parramatta River within the Parramatta LGA.

17.6 Impact assessment

The key findings of this Aboriginal heritage assessment are:

- there are no registered Aboriginal sites or places located within or immediately adjacent to the Project Area (the nearest site is 1.1 kilometres away);
- visual inspection indicates that land within the Project Area has been subject to extensive disturbance through historical and current land use activities;
- no Aboriginal objects were identified during the visual inspection undertaken for the Project;
- taking into account the nature and extent of past ground disturbances across the Project Area, as well as the pre- and early-post European settlement landscape context of this area, the Aboriginal archaeological sensitivity of land within the Project Area is assessed as negligible; and
- the potential for impacts to Aboriginal objects within the Project Area as a result of the Project is considered to be negligible.

The Project Area has been refined so that the vegetation along the Duck River and the western border of the Project Area are excluded from the Project Area and would not be disturbed. The potential for impacts to Aboriginal cultural heritage within the Project Area as a result of the Project (both during and after completion of the remediation works) is therefore considered to be negligible.

Impacts to Aboriginal heritage values associated with approved SSD projects are typically managed under ACHMPs. ACHMPs are statutorily binding once approved by DPE. Based on the findings above, an ACHMP is deemed to not be required for the Project.

No further Aboriginal heritage investigations are recommended for the Project.

17.7 Mitigation and management

17.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement (EIS) in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

As the Project has been assessed as having a negligible impact on Aboriginal cultural heritage no further Aboriginal heritage investigations are recommended for the Project and proposed mitigation and management measures are associated with unexpected finds only.

The measure to address unexpected finds would be detailed in the REMP (in an Aboriginal heritage section) for works undertaken during Stage 1 to Stage 5 of the Project and the LTEMP for the operation of the Project. These plans would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for during Stage 1 to Stage 5 and during operation, respectively.

The mitigation and management measures to be included in the Aboriginal heritage section of the REMP, as well as the LTEMP are discussed in more detail in the following section.

17.7.2 Summary

The proposed management measure for potential impacts on unexpected Aboriginal heritage objects is provided in **Table 17-2**.

Table 17-2 Mitigation and management measure – Aboriginal heritage

Reference	Mitigation and management measures	Timing
AH1	Any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains discovered during remediation of the Project Area would be managed in accordance with the unexpected heritage finds and human remains procedure for the Project, which would be prepared in accordance with the: • NSW Police Force Handbook (2016); and • NSW Health Exumation of Human Remains Policy (2013). The following standard unexpected heritage finds procedure should be adopted (refer to Annexure A of **Appendix K** of the EIS for further detail): 1. all works must cease immediately in the area to prevent any further impacts to the object; 2. notify the Environmental Representative; 3. engage a suitably qualified archaeologist to determine the nature, extent and significance of the find and provide appropriate management advice; and 4. prepare and submit an AHIMS site card for the site. In the event that potential human skeletal remains are identified, the following unexpected humans remains finds procedure should be followed: 1. all work in the vicinity of the remains should cease immediately; 2. the location should be cordoned off and the NSW Police notified; and 3. if the Police suspect the remains are Aboriginal, they would contact the Office of Environment and Heritage and arrange for a forensic anthropologist or archaeological expert to examine the site. Subsequent management actions would be dependent on the findings of the inspection undertaken under Point 3 (refer to Annexure A of **Appendix K** of the EIS for further detail on these actions).	Stage 1 to Stage 5 and ongoing operation

Following the implementation of the management measure above, there would be no residual impacts from the Project on Aboriginal heritage. Therefore there are no cumulative impacts on Aboriginal heritage expected. Further consideration of cumulative impacts is discussed in **Chapter 19 Cumulative impacts**.

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18.0 Hazards and risks

18.1 Introduction

This chapter provides an assessment of the hazards and risks for the Project in accordance with the Secretary's Environmental Assessment Requirements (SEARs) and the NSW Department of Planning's *Hazardous and Offensive Development Application Guidelines, Applying SEPP 33* (DoP, 2011) (Applying SEPP 33).

18.2 Scope of the assessment

The SEARs (refer to **Appendix A**) that are relevant to the hazards and risk assessment are provided in **Table 18-1**. **Table 18-1** also presents where in this chapter each of the requirements have been addressed.

Table 18-1 SEARs – hazards and risk

SEARs	Where addressed
Hazards and risk: • a preliminary risk screening in accordance with *State Environmental Planning Policy No 33 - Hazardous and Offensive Development* and Applying SEPP 33 (Department of Planning, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the development, including but not limited to hazardous materials that can be created during the process of remediation; and	The preliminary risk screening assessment is provided in **Section 18.6.1.1**.
• should the preliminary risk screening indicate that the proposed development is "potentially hazardous", a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No. 6, 'Hazard Analysis' (Department of Planning, 2011) and Multi-Level Risk Assessment (Department of Planning, 2011).	A PHA is not required for the Project. Refer to **Section 18.6**.
Waste: • details of transport, handling, storage and use of dangerous goods, chemical and products on-site, including measures to minimise leakage and migration of pollutants.	**Section 18.6.1.1** and **18.6.1.2. Chapter 8 Soils, groundwater and contamination and Chapter 9 Surface water, wastewater and flooding** provides details on minimising leaks and migration of pollutants. **Chapter 12 Waste management** described the measures to manage wastes produced by the Project.

18.3 Legislation and planning policy

18.3.1 Work Health and Safety Act 2011

The *Work Health and Safety Act 2011 (NSW)* (WH&S Act) and its supporting Regulation 2017 (WH&S Regulation) provide for a nationally consistent approach to health and safety throughout NSW workplaces. A key principle of the WH&S Act is that workers and others are entitled to the highest level of protection against workplace hazards and risks that is reasonably practicable to provide.

The WH&S Act applies to the storage and handling of dangerous goods and also includes specific provisions regarding the management of asbestos and asbestos containing materials (ACMs).

The WH&S Regulation sets out the procedures for dealing with asbestos in the workplace, as well as the process of licensing certain personnel as official asbestos removalists. The Project is expected to yield a certain amount of asbestos waste, or waste materials containing asbestos. Viva Energy would abide by these regulations for dealing with asbestos waste. Issues regarding asbestos management are considered in **Chapter 8 Soils, groundwater and contamination** and **Chapter 12 Waste management**.

The WH&S Act and the WH&S Regulation defines major hazard facilities (MHFs), regulates their operation and includes measures to prevent accidents occurring at MHFs. The Clyde Terminal is classified as a MHF.

Any works to or modifications of a MHF need to be discussed with SafeWork NSW as the administrators of the WH&S Act. The Project would not occur within the part of the Site where the Clyde Terminal is located. Viva Energy regularly consults with SafeWork NSW regarding the Clyde Terminal and will continue to do so moving forward. However, as the Project would not affect the MHF, consent and approval of SafeWork NSW is not required.

Viva Energy has consulted with SafeWork NSW in regards to the Project (refer to **Chapter 6 Stakeholder Engagement**).

18.3.2 Environmentally Hazardous Chemicals Act 1985

The *Environmentally Hazardous Chemicals Act 1985 (NSW)* (EHC Act) provides the EPA with the power to regulate the use of certain chemicals and chemical wastes in NSW by issuing Chemical Control Orders (CCOs). Two CCOs have been made by the EPA under the EHC Act to control the use of Polychlorinated Biphenyl (PCB) materials and wastes and scheduled chemical wastes, which includes the management of such materials at the Clyde Terminal. The CCOs outline controls on the generation, processing, storing, conveying and disposal of PCB and scheduled chemical materials or wastes. Any PCB or scheduled chemical wastes generated as part of the Project above the limits provided in the CCOs would be managed according to the CCO.

The management of wastes is discussed in **Chapter 12 Waste management**.

18.3.3 Protection of the Environment Operations (Waste) Regulation 2005

The *Protection of the Environment Operations (Waste) Regulation 2005 (NSW)* (PoEO Waste Regulation) sets out provisions for tracking certain wastes as they are transported throughout NSW and interstate. Some wastes managed by the Project, such as contaminated soils and asbestos, are likely to be identified under Schedule 1 of the PoEO Waste Regulation as being required to be tracked when transported off-site and disposed of. These waste tracking requirements relate to record keeping that must be undertaken by consigners, transporters and receivers when these types of wastes are transported.

All wastes received or removed from the Project Area would be stored, transported and disposed of in accordance with PoEO Waste Regulation requirements and tracked via implementation of the Material Tracking Plan.

18.3.4 Dangerous Goods (Road and Rail Transport) Act 2008

The *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW)* (Dangerous Goods Act) regulates the transport of dangerous goods by road and rail, to protect property and the environment and protect public safety. The *Dangerous Goods (Road and Rail Transport) Regulation 2014 (NSW)* (Dangerous Goods Regulation) defines a dangerous good as:

- a substance determined by a Competent Authority to be dangerous goods; or
- a substance that satisfies the dangerous goods classification criteria in Part 2 of the *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2018) (ADG Code).

The Dangerous Goods Act and Regulation requires that dangerous goods are transported by appropriately licenced vehicles and drivers. The Dangerous Goods Regulation also outlines provisions for packaging, vehicle safety standards and documentation.

As the Project would use, store and handle potentially dangerous goods the Project would be undertaken in accordance with the Dangerous Goods Act and Regulation.

18.3.5 State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

The *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* (SEPP 33) provides an approach for the planning and assessment of potentially hazardous and/or offensive development.

SEPP 33 applies to hazardous and offensive industries as well as potentially hazardous and offensive industries. SEPP 33 requires a PHA to be completed for potentially hazards industry, which is defined as industrial development, that when operating without proper controls would pose significant risk to human health, life, property or the biophysical environment.

Whilst remediation activities are not technically a type of industry, a SEPP 33 risk screening assessment has been completed for the Project in accordance with the Applying SEPP 33 guidelines. The outcomes of this assessment are provided in this chapter.

18.3.6 Applying SEPP 33

The Applying SEPP 33 guideline provides guidance on how to interpret and implement SEPP 33 and outlines a risk screening assessment for potentially hazardous industries.

The Applying SEPP 33 guideline defines hazardous materials as substances falling within the classification of the ADG Code (refer to **Section 18.3.7**).

The screening assessment considers classes of materials, identified in the ADG Code, quantities of the materials to be stored on-site, distance of the storage location to the site boundary and transport of materials to and from the site, to determine if a proposed development is potentially hazardous. If the results of the screening assessment indicate that the proposed development is potentially hazardous then SEPP 33 will apply and a PHA is required.

Applying SEPP 33 provides screening thresholds to compare hazardous materials against and determine if a development is potentially hazardous. Screening thresholds for materials relevant to the Project are provided in **Table 18-2** and **Table 18-3**.

Table 18-2 Applying SEPP 33 - Screening thresholds

Dangerous goods class	SEPP 33 screening threshold
Class: 3 (flammable liquids) Division: N/A Packing group: III (substances presenting low danger) Abbreviation: 3PGIII	5 tonne at 0 metres (m) from site boundary. As the tonnage increases, the screening threshold distance increases (i.e. 10 tonnes at 3 m).
Class: 5 (oxidising substances) Division: 5.1 (oxidising substances) Packing group: N/A Abbreviation: 5.1	5 tonne
Class: 8 (corrosive substances) Division: N/A Packing group: II (substance presenting medium danger) Abbreviation: 8PGII	25 tonne

Source: Applying SEPP 33, Table 1 and 3 and Figure 9 (Department of Planning, 2011)

Table 18-3 Applying SEPP 33 - Transportation screening thresholds

Dangerous goods class	Number of vehicle movements		Minimum quantity per load (tonne)	
	Annual (cumulative)	Weekly (peak)	Bulk	Packages
3PGIII	> 1,000	> 60	10	No limit
5	> 500	> 30	2	5
8	> 500	> 30	2	5

Source: Applying SEPP 33, Table 2 (Department of Planning, 2011)

18.3.7 Australian Code for the Transport of Dangerous Goods by Road & Rail

The ADG Code outlines the requirements to transport dangerous goods. This code provides classes and packing groups for various dangerous goods. The code is used as a base in the Applying SEPP 33 guidelines to determine the screening thresholds for potentially hazards materials.

18.4 Method of assessment

The hazards and risk assessment has considered:

- the existing condition of the Project Area;
- potential hazards and risk during Stage 1 through to Stage 5 of the Project, including a SEPP 33 risk screening assessment;
- potential hazards and risk following completion of the Project; and
- management and mitigation measures, including existing Viva Energy management procedures.

The Project involves the transport of contaminated soil to (soils to be remediated) and from (soils to be disposed of) the Project Area. These contaminated soils may potentially contain dangerous goods or hazardous materials and may result in a hazard in the event of a spill. The transport and handling of contaminated soil would be managed by the mitigation and management measures identified in the following chapters:

- **Chapter 8 Soils, groundwater and contamination**;
- **Chapter 9 Surface water, wastewater and flooding**;
- **Chapter 10 Air quality**;
- **Chapter 11 Human health risk assessment**;
- **Chapter 12 Waste management**; and
- **Chapter 14 Traffic, transport and access**.

18.4.1 SEPP 33 risk screening assessment

Although the remediation activities are not technically a type of industry, a SEPP 33 risk screening assessment has been completed for the Project in accordance with the Applying SEPP 33 guidelines. The risk screening assessment has considered potentially hazardous materials stored, handled and transported to the Project Area for use during the Project (Stage 1 to Stage 5).

The methodology for the risk screening assessment for storage and handling of potentially hazardous materials involved:

1. identifying the type, dangerous goods class, quantity, and mode of storage of potentially hazardous materials;
2. identifying the distance between stored potentially hazardous materials and the Project Area boundary;
3. grouping the potentially hazardous materials by class, activity and location; and
4. comparing the potentially hazardous material groups to the screening thresholds stated in Applying SEPP 33 and using this comparison to determine if SEPP 33 applies to the Project.

18.5 Existing environment

18.5.1 Existing infrastructure

Following completion of the Clyde Terminal Conversion Project (SSD 5147) (the 'Conversion Project'), the Western Area will no longer be required for operational purposes. Existing tanks, pipework, and associated infrastructure, as approved under SSD 5147, will be decommissioned and removed prior to the Project commencing. As such, there would be no bulk storage or transport of finished products to and from the Clyde Terminal from within the Western Area during the Project.

The far western/south-western part of the Western Area was leased to a third party (AutoNexus), and is currently vacant.

Therefore, potentially hazardous materials located at the Clyde Terminal or the leased part of the Western Area have not been considered in this assessment. For the purposes of this assessment the Western Area would not contain any dangerous goods prior to the Project commencing.

Services/utilities

Power and water supply to the Western Area is currently limited, and is restricted to the current operational tank farms (to be removed as part of the Conversion Project), the AutoNexus area, and the WWTP. Power and water supplies would be re-established as part of the preparation works for the Project (Stage 1).

Existing utilities include a Metropolitan Water, Sewerage & Drainage Board (MWSDB) sewer line and a TransGrid pilot cable, as well as the drainage network. Existing utilities would be identified (and marked where appropriate) during Stage 1 (refer to **Section 4.2.4**).

A natural gas connection point is located adjacent the northern Project Area boundary on Devon Street and would supply natural gas to the Project Area for the operation of the Direct Thermal Desorption (DTD) unit (refer to **Section 4.4.2**).

18.5.2 Contamination overview

The long-term and historic use of the Western Area has resulted in a number of contamination impacts to the soils and groundwater. A secondary source of contamination may be caused by imported fill likely used for historical levelling works.

The current understanding of the nature and extent of the impacts within the Western Area is based on investigation works which were conducted between 1991 and 2018 (refer to **Appendix C**). Based on these investigations, chemicals of potential concern (COPCs) within the Western Area include:

- Total Petroleum/Recoverable Hydrocarbons (TPH/TRH);
- Benzene, Ethyl-benzene, Toluene and Xylene compounds (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Heavy metals;
- Phenols;
- PCBs;
- Tetraethyl lead; and
- Per- and polyfluoroalkyl substances.

Further, the Site's historic use as a refinery means that other chemicals such as acids, ethanolamine, sodium hydroxide, solvents and trichloroethylene may also be present in the Western Area's drainage system. There are also areas of buried waste/leaded sludges beneath the Western Area (western and southern boundaries) and there is the potential for asbestos containing materials to be present.

Chapter 8 Soils, groundwater and contamination provides more information on the contamination status of the Project Area, and how the Project would be managed to avoid potential off-site impacts.

18.5.3 Existing management systems

The Clyde Terminal currently operates under the Environmental Management Manual (EMM). The EMM outlines how the conditions of SSD 5147 and Viva Energy's integrated Health, Safety, Security Environment and Social Performance Management System (HSSE & SP MS) are implemented. The other existing plans and registers for the Site include:

- Pollution Incident Response Management Plan for the Clyde Terminal (2018);
- Safety case/Emergency Response Plan;
- Site Wide Hazard and Effects Register (HEMP Register); and

- Dangerous Goods Manifest.

The Project would be undertaken in accordance with these existing plans and registers, where relevant.

18.5.4 Receptors

The key receptors for potential hazards and risks arising from the Project include:

- workers carrying out the Project on the Western Area;
- visitors to the Western Area;
- workers on neighbouring sites including the Clyde Terminal;
- members of the public travelling along the local road network; and
- environmental receptors such as the Duck River and associated ecological communities.

In the unlikely event that a Project incident occurs outside of the Project Area (e.g. traffic accident involving a Project vehicle) there is the potential for other receptors, such as members of the public and workers at the nearby industrial facilities (including the Site), to be impacted.

18.6 Impact assessment

18.6.1 Remediation (Stage 1 to Stage 5)

The Project would be contained in an area that would be separated from the Clyde Terminal operations. A security fence would be erected between the Clyde Terminal and the Western Area. Personnel working on the Project would not automatically be allowed access to the Clyde Terminal or other parts of the Site. As such the Project is unlikely to increase or change the safety risks associated with the Clyde Terminal.

Hazards and risks associated with Stage 1 through to Stage 5 of the Project have been categorised as:

- storage, handling and transport of dangerous goods and hazardous materials;
- human health impacts;
- traffic and transport hazards; and
- below and above ground utilities and electrical safety.

A risk screening assessment for potentially hazardous industry has been undertaken which assessed and considered the potential risks from the storage, handling and transport of hazardous materials (refer to **Section 18.6.1.1**).

An assessment of human health impacts is provided in **Chapter 11 Human health risk assessment**. Indirect impacts to human health as a result of amenity impacts are considered unlikely to occur, as minimal amenity impacts are expected to affect the general public.

Traffic and transport impacts are discussed in **Chapter 14 Traffic, transport and access**. The potential for traffic incidents would be managed by the Traffic Management Plan and Vehicle Management Plan. Potential impacts from the transport of hazardous materials are assessed as part of the risk screening assessment discussed below.

18.6.1.1 Risk screening assessment for potentially hazardous materials

A number of materials would be required for the Project as listed in **Chapter 4 Project description**. Of these materials the following are listed in the ADG Code and are therefore potentially hazardous materials under SEPP 33:

- diesel, for the operation of plant including excavators, loaders, trucks, piling rig, back-up generator for the DTD unit;
- nutrients/compost/microbes (e.g. triple super phosphate, mono-ammonium phosphate) for landfarming and biopiles;

- sodium persulphate and sodium hydroxide, used as oxidising/activating agents during in-area soil mixing;
- activated carbon in the granulated activated carbon (GAC) filters (for water and vapour) used in the biopiles;
- natural gas to fire the heating burners of the DTD unit; and
- stabilisation additives such as Portland cement and/or fly ash.

This list has been reviewed against the ADG Code and relevant Material Safety Data Sheets. **Table 18-4** lists the potentially hazardous materials alongside their dangerous goods class as per the ADG Code, mode of storage, maximum quantity likely to be held within the Western Area at one time and the distance of the storage location to the Western Area boundary.

Table 18-4 Quantities required for each potentially hazardous material

	Potentially hazardous material		
	Diesel fuel (UN No.1202)	**Sodium persulphate (UN No.1505)**	**Sodium hydroxide (UN No.1823)**
Project Stage	Stage 1 to Stage 5	Stage 3 (in-area soil mixing - oxidant)	Stage 3 (in-area soil mixing - activator)
Dangerous goods class	3PGIII	5.1PGIII	8PGII
Mode of storage	Bulk tank storage in bunded area	1 tonne bags	1,000 L intermediate bulk container (IBC)
Maximum quantity stored on-site	10 tonnes	4 tonnes	Approximately 20 kL (~20 tonnes)
Location and distance from Project Area boundary	Mainly at the DTD unit - approximately 250 m	In-area soil mixing area – on boundary 0 m	In-area soil mixing area – on boundary 0 m
Vehicle movements - Annual (cumulative)	50	<50	<10
Vehicle movements - Weekly (peak)	1 (tank refuelled once a week)	<10	<5

Table 18-4 excludes the following materials:

- the GAC proposed to be used for biopiling would be the type of activated carbon which is not listed as a dangerous good under the ADG Code, as confirmed by the relevant Material Safety Data Sheets;
- Portland cement and/or fly ash used would not be the type which is listed as dangerous good under the ADG Code, as confirmed by the relevant Material Safety Data Sheets; and
- natural gas (ref. 1971) would be used to fire the heating burners of the DTD unit. There is a natural gas connection point located adjacent to the Project Area boundary on Devon Street. The Project would connect to this point and run a temporary pipe to the DTD unit. Natural gas would not be stored or transported to the Project Area.

A comparison of the potentially hazardous materials to be used during the Project as provided in **Table 18-4** was made against the Applying SEPP 33 guidelines screening thresholds for both storage (refer to **Table 18-5**) and transport (refer to **Table 18-6**). The comparison shows that the storage and transport of these materials is below the screening thresholds and therefore a PHA is not required.

Table 18-5 Comparison of potentially hazardous Project materials and storage thresholds

DG class	Potentially hazardous material	Maximum quantity stored on-site	Distance from Project Area boundary	Applying SEPP 33 Threshold
3PGIII	Diesel fuel (UN No. 1202)	10 tonnes	250 m	10 tonnes at 3 m
5.1PGIII	Sodium persulphate (UN No. 1505)	4 tonnes	N/A	5 tonnes
8PGII	Sodium hydroxide (UN No. 1823)	20 tonnes	N/A	25 tonnes

Table 18-6 Comparison of potentially hazardous Project materials and transport thresholds

DG class	Potentially hazardous material	Maximum quantity stored on-site	Estimated vehicle movements		Vehicle movements - Applying SEPP 33 Threshold	
			Annual	Weekly	Annual	Weekly
3PGIII	Diesel fuel (1202)	10 tonnes	50	1	>1,000	>60
5.1PGIII	Sodium persulphate (1505)	4 tonnes	<50	<10	>500	>30
8PGII	Sodium hydroxide (1823)	20 tonnes	<10	<5	>500	>30

In the event that during detailed design it is identified that a material is required to be used during the Project which has not been assessed in **Table 18-5** and **Table 18-6**, then a screening risk assessment against SEPP 33 would need to be completed as part of the Project Management Plan (PMP) before it can be transported, stored or used on-site.

18.6.1.2 Handling and storage

There is the potential for spills and leaks to occur during the Project including:

- spills and leaks of fuels and oils from plant and equipment resulting in unintentional additional contamination having the potential to mobilise off-site;
- spills and leaks of materials stored and used on-site or transported off-site as part of the remediation activities (e.g. diesel, additives); and
- leaks of residual matter from within redundant pipework prior to removal.

In addition the Project would require the extensive movement and disturbance of contaminated soils within and around the Project Area. This movement of soils has the potential to result in the contamination of previously uncontaminated areas should unintentional spills or stockpiling occur outside of designated areas.

The management of spills, leaks and stockpiling would be through the Soil and Water Management Plan (SWMP) (Refer to **Chapter 8 Soils, groundwater and contamination**). The SWMP would include the following mitigation and management measures:

- bunding of any fuel or chemical storage on the Project Area. This bunding would be designed to contain 110% of the volume of liquids stored within the bunded area and would be placed on an impermeable surface;
- requirement for and location of spill kits for chemicals or fuels that could potentially be spilt or leak; and
- regular inspection of remediation equipment and plant to ensure leaks are minimised and rectified.

The transport, handling and storage of dangerous goods and hazardous substances used during the Project would be undertaken in accordance with the relevant legislation, guidelines and material safety data sheets (refer to **Section 18.7.2**). This would include storing materials in the appropriate container, in bunded areas and away from other materials (where required) and wearing appropriate personal protection equipment.

18.6.1.3 Services/utilities and electrical safety

The Project would involve the removal of utilities and services as well as the production of electricity, by a diesel generator. Service location for services/utilities would be undertaken as part of Stage 1 across the Project Area to confirm the location of and identify services present on-site. If necessary additional service investigations would be completed ahead of ground disturbance works commencing.

Potential utility impacts include striking a utility causing personal injury and/or disruption of services. The service location activities have been included in the Project to manage potential impacts, including safety impacts of intercepting services/utilities. This work would include:

- a desktop assessment of known utility services;
- use of a Ground Penetrating Radar (GPR) imaging and other service location equipment across the Project Area to identify known services;
- engagement with utility companies prior to and during the service location works;
- Non-destructive Excavation (NDE) and/or potholing as needed to positively identify services (when required);
- tag/mark the identified service as required;
- updating utilities survey as-built with known positions, levels and heights of all redundant and live services;
- notifying Dial Before You Dig (DBYB) and utilities companies of services that have not been previously identified; and
- reassessing whether changes to the proposed work methodology are needed based on the results of this process.

If necessary subsurface infrastructure, including services/utilities would be excavated and removed during Stage 2 of the Project. The procedures to manage the service location and removal activities would be detailed in the Project Management Plan (PMP). Providing that the appropriate measures are identified and implemented as per the PMP it is unlikely that impacts from intercepting services or utilities would occur.

18.6.2 Ongoing operation

Following completion of the Project the Western Area would be a broadly flat, vacant site. Activities on the Project Area would be limited to those associated with environmental monitoring and ongoing management of the final landform. Minimal materials, equipment, vehicles and workforce would be required for these activities. Potential hazards and risks associated with ongoing operation could include a vehicle collision or equipment incident. These potential risks would be managed by ensuring personal required to use equipment and access the Western Area are appropriately inducted and trained and work health and safety requirements are followed.

18.7 Mitigation and management

18.7.1 Overview

Measures to address the potential impacts of the Project are summarised from all technical chapters in this Environmental Impact Statement (EIS) in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a PMP, Remediation Environmental Management Plan (REMP) and Long Term Environmental Management Plan (LTEMP).

Measures to address potential hazards and risks would be detailed in the PMP and the REMP for works undertaken during Stage 1 to Stage 5 of the Project. These plans would detail the controls, mitigating measures, contingency plans and monitoring programs for Stage 1 to Stage 5.

The mitigation and management measures to be included in the PMP and REMP are discussed in more detail in the following section.

18.7.2 Remediation (Stage 1 to Stage 5)

The on-site remediation activities would reduce the concentration in the soil of the following COPCs:

- TPH/TRH;
- BTEX;
- PAHs; and
- Phenols.

The Project is likely to decrease the hazard and risk profile of the Western Area with the cleaning and removal of subsurface infrastructure and by reducing the risk of exposure to contaminated material.

The screening risk assessment for potentially hazardous materials to be used during the Project indicated that SEPP 33 does not apply and therefore a PHA is not required. In the event that a material is used during the Project which has not been assessed in **Table 18-5** and **Table 18-6**, or greater quantities and/or vehicle movements are required for materials used during the Project, then a screening risk assessment would need to be completed before it can be transported, stored or used on-site. The outcomes of this assessment would advise on the next steps. A decision making flowchart would be included in the PMP which would outline the next steps.

The transport, storage and handling of hazardous substance would be undertaken in accordance with:

- *Work Health and Safety Act 2011 (NSW);*
- *PoEO Waste Regulations;*
- *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW)*;
- *Dangerous Goods Regulation (Road and Rail Transport) Regulation 2014 (NSW) ;*
- ADG Code;
- relevant Australian Standards;
- the Applying SEPP 33 guidelines; and
- the relevant Material Safety Data Sheets.

The management of materials, contaminated soils and wastes would be by the implementation of the following management sub-plans, which would form part of the REMP:

- Soils and Water Management Plan (refer to **Chapter 8 Soils, groundwater and contamination**);
- Waste Management Plan (refer to **Chapter 12 Waste management**); and
- Material Tracking Plan (refer to **Chapter 12 Waste management**).

The likelihood of accidentally striking a service/utility would be reduced by implementing the service location protocols, which would be described in the PMP.

An Occupational Health and Safety Plan and Emergency Response and Contingency Plan would also be prepared as part the remediation documentation. These plans would include measures to manage the potential work health and safety hazards and emergency risks.

In addition to the Project specific plans, Viva Energy's existing HSSE & SP MS would also be applied to the Project.

18.7.3 Ongoing operation

Following completion of the Project any hazards and risks would be minor as only minor maintenance activities would be conducted during this phase. Any hazards would be unlikely to occur provided the measures in the LTEMP and Viva Energy's HSSE & SP MS are followed.

The Emergency Response Plan would be updated following completion of the Project to reflect the changed site conditions in the Western Area.

18.7.4 Summary

A summary of the mitigation and management measures to manage potential hazards and risk from the Project are outlined in **Table 18-7**.

Table 18-7 Mitigation and management measure – hazards and risk

Reference	Mitigation and management measures	Timing
HR1	The REMP would outline the following to manage hazards and risks for the Project: • materials brought to the Project Area are not to exceed the thresholds provided in the Applying SEPP 33 guideline; • the GAC proposed to be used for biopiling would be activated carbon which is not listed as a dangerous good under the ADG Code. This would be confirmed by checking the relevant Material Safety Data Sheets before purchasing the material; • Portland cement and/or fly ash used during the Project would not be the type which is listed as dangerous good under the ADG Code. This would be confirmed by checking the relevant Material Safety Data Sheets before purchasing the material; and • in the event that a material is to be used during the Project which has not been assessed in the EIS (**Chapter 18 Hazards and risks**) or greater quantities and/or vehicle movements are required for materials used during the Project, then a screening risk assessment would need to be completed before the material can be transported, stored or used on-site.	Stage 1 to Stage 5
HR2	The transport, storage and handling of hazardous substances would be undertaken in accordance with: • *Work Health and Safety Act 2011 (NSW)*; • *Protection of the Environment Operations (Waste) Regulation 2005 (NSW)* • *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW);* • *Dangerous Goods Regulation (Road and Rail Transport) Regulation 2014 (NSW);* • *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018); • relevant Australian Standards; • the thresholds outlined in Applying SEPP 33 guidelines; and • the relevant Material Safety Data Sheets.	Stage 1 to Stage 5
HR3	The PMP would detail the process for identifying and managing services/utilities.	Stage 1
HR4	The Site Emergency Response Plan would be updated following completion of the Project to reflect the changed site conditions in the Western Area.	Ongoing operation

Following the implementation of the above mitigation and management measures, no adverse residual hazardous impacts are likely. Therefore there are no cumulative hazards and risks assessment is considered necessary. Further consideration of cumulative impacts is discussed in **Chapter 19 Cumulative impacts**.

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19.0 Cumulative impacts

19.1 Introduction

This chapter provides an overview of the potential cumulative impacts associated with the Project.

Further information on the assessment of cumulative impacts can be found in the relevant technical assessments provided in **Appendix D** to **Appendix K**.

Residual impacts resulting from other projects in the vicinity of the Project have been considered for this cumulative impact assessment. The identification of other developments that could occur in the vicinity of the Project included relevant projects listed on public databases that are of a relevant scale and involve activities that could result in a cumulative impact with the Project. The methodology for the cumulative impact assessment is discussed in more detail in **Section 19.4**.

19.2 Scope of the assessment

The Secretary's' Environmental Assessment Requirements (SEARs) (refer to **Appendix A**) requests that this assessment provides the following, as presented in **Table 19-1**. **Table 19-1** also presents where in this chapter each of the requirements are addressed.

Table 19-1 SEARs – cumulative impacts

SEARs	Where addressed
The Environmental Impact Statement (EIS) must include: • detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment, which includes: - an assessment of the potential impacts of all stages of the remediation works, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes.	An assessment of cumulative impacts of the project is provided in **Section 19.5**.

19.3 Legislation and planning policy

There are currently no official NSW or Australian Government guidelines on undertaking cumulative impact assessments. Therefore, the cumulative impact assessment in this EIS is based on the broad requirements set out in the SEARs for the project.

19.4 Method of assessment

19.4.1 Overview

Cumulative impacts are determined by an assessment of developments that are proposed, have been approved (but not yet under construction) and/or those that would be constructed or operating in the vicinity of and/or at the same time as the execution or operation of the Project.

The assessment of cumulative impacts is a receptor based assessment, whereby in order to have cumulative effects, the impacts from two projects need to affect the same receptor.

A particular impact from one project may be considered negligible, but when the impacts of multiple projects are considered, the impacts may be significant. One project may also reduce the effectiveness of the mitigation and management measures proposed for another project which in turn may result in a cumulative effect.

Impacts can be either adverse or beneficial. Where an adverse impact is considered likely, mitigation and/or management measures would be implemented to avoid or reduce those impacts. The assessment of cumulative impacts assumes that the specific mitigation and management measures outlined for the Project in the various chapters of this EIS have been applied resulting in the residual impacts of the project outlined in **Section 19.5.1**. This summary therefore focuses on the more strategic measures that may be implemented in coordination with other relevant projects.

19.4.2 Approach

The first stage of cumulative impact assessment is to understand the adverse residual impacts of the Project (refer to **Chapters 8** to **18**). The second stage is to identify other projects nearby that may affect the same receptors as the Project and/or affect the effectiveness of the other projects' mitigation and management measures. Other relevant projects that may generate a cumulative impact with the Project have been identified using the following assessment parameters:

- **Spatial parameter** – The spatial parameter depends on the characteristics of the environmental impact and the likely area over which a residual impact would occur. For example, an air quality impact would potentially affect a wider area than a noise impact and would therefore affect different community or environmental receptors in different ways.
- **Temporal parameter** – The temporal parameter relates to how far into the future or the past the assessment considers cumulative proposals or activities. Projects that are operational have already been considered as they form part of the existing environmental baseline for each environmental aspect assessed in this EIS. Projects that are not yet on exhibition have been discounted as their assessments do not contain enough detail on residual effects or final design to allow a robust cumulative impact assessment to take place.

For this assessment the temporal parameter has been applied to relevant projects that are:

- currently under construction and/or likely to be under construction but not yet completed;
- approved, but not yet under construction; and
- that have been subject to a statutory environmental impact assessment and the assessment has been exhibited or displayed on a government website.

The following sources were consulted to identify projects for potential inclusion in the cumulative impact assessment:

- NSW Department of Planning and Environment (DPE) Major Projects website (DPE, 2018b);
- Development Applications register on the City of Parramatta Council website (City of Parramatta, 2018); and
- public notices and the 'invitations to comment' register on the Commonwealth Department of Environment website (DoEE, 2018b).

Only projects considered to be of 'material' scale in the vicinity of the Project were included on the list of projects to be screened. The materiality threshold for this cumulative impact assessment is defined as projects listed on the DPE's Major Projects website as SSD, SSI and known projects (e.g. on the council's website) of a relevant scale that involve activities that could result in a cumulative impact.

19.5 Impact assessment

19.5.1 Adverse residual impacts of the Project

Subject to development consent, the Project would be expected to commence in January 2020 and be completed by March 2023. The following provides a summary of the residual impacts identified in **Chapters 8** to **18** from the Project:

- Soils, groundwater and contamination. There is the potential that contaminated groundwater and/or contaminated soil could be mobilised off site. The implementation of management and mitigation measures within the Remediation Environmental Management Plan (REMP) and the Long Term Environmental Management Plan (LTEMP) would mean that no significant residual adverse impacts to off-site receptors from contaminated soils and groundwater are likely. Indeed the Project is likely to have a beneficial impact on soils and groundwater overall.. Nevertheless a negligible residual impact could potentially occur (e.g. through cross contamination of soils in the Project Area, through minor groundwater flows or small amounts of contamination mobilised through dust off-site).

- Surface water, wastewater and flooding. Various potential impacts relating to surface water, wastewater and flooding were identified. This included the potential for surface water to flow off-site that contravenes the water quality or volume limits of NSW Environment Protection Licence number 570 during Stage 1 to Stage 5 of the Project. However, with the implementation of the proposed management measures no significant residual impacts to water quality are expected. The Project Area would continue to be flood prone, as has historically been the case, however the Project would not result in a residual adverse impact to the flooding potential of the land. Future development of the Project Area would consider the flood risk as part of the requirements of a future development application.
- Air quality and odour. The remediation works are likely to result in various emissions, including dust, combustion, volatile organic compounds (VOC) and stack emissions. The air quality impact assessment concluded that all pollutants with the exception to PM_{10}, $PM_{2.5}$ and odour would be below the relevant NSW Environment Protection Authority (EPA) criteria incrementally and inclusive of the existing background levels. Provided recommended mitigation measures to minimise the Project's pollutant contribution to the local air shed and a reactive air quality management program is implemented to minimise off-site particulate and odour impacts, no significant impacts are likely during the Project. Nevertheless, emissions would be released from the Project and would result in negligible (non-significant) adverse air quality impacts at nearby industrial and residential receivers during Stage 2 to Stage 4.
- Human health. Remediation activities could result in increased risk of human health impacts to on-site receptors including remediation workers and workers at the Clyde Terminal. Through the implementation of an Occupational Health and Safety Plan, the residual adverse human health impacts to both on-site workers and identified off-site residents, recreational users and commercial workers are not expected.
- Waste management. The incorrect management of waste could result in the unnecessary generation of waste, demand for materials (e.g. rather than reuse) and increased off-site disposal. Following implementation of the Waste Management Plan, the Project is not expected to have a residual adverse impact related to waste management.
- Noise and vibration. Potential noise impacts could result from Stages 2, 3 and 4 of the Project. The noise assessment concluded that the Project meets the applicable noise criteria and is not affecting a sensitive receiver on its own. Nevertheless a negligible residual impact could still potentially occur (e.g. if the noise from the Project further increased a significant noise impact from another project).Traffic and transport. The Project would increase the number of trucks and private vehicles using the local road network around Camellia. Following the implementation of mitigation and management measures, the Project is expected to have a negligible and temporary impact on traffic, transport and access. Although the Project does not impact on the LoS of the James Ruse Drive, Grand Avenue and Hassall Street intersection, it would increase movements through this intersection, and this intersection is likely to be used by other proposed projects.
- Biodiversity. Potential impacts on ecological receptors resulting from the loss of habitat for threatened species and impacts on groundwater dependent ecosystems were identified. Due to the Project Area being developed to exclude vegetation within the Western Area including the Duck River frontage, the potential for these impacts were greatly reduced as part of the development of the Project. Following the implementation of mitigation and management measures, the Project is expected to have no residual impact on biodiversity.
- Historic heritage. Following the implementation of the mitigation and management measures, there would be no residual impacts from the Project on historic heritage.
- Aboriginal heritage. The Project Area has been developed to exclude the Duck River frontage in order to minimise the potential for impacts on Aboriginal cultural heritage values. Following implementation of mitigation and management measures there would be no residual impacts as a result of the Project.

- Hazards and risk. The Project would temporarily introduce additional hazardous chemicals and dangerous goods to the Project Area. Following the implementation of mitigation and management measures, no adverse residual hazardous impacts are likely.

Following the implementation of management and mitigation measures outlined in **Chapter 20 Mitigation and management**, a number of the environmental aspects would have no potential residual impacts. There is however the potential for some temporary, non-significant residual impacts associated with:

- Soils, groundwater and contamination;
- Air quality and odour;
- Noise and vibration; and
- Traffic, transport and access.

The potential for these temporary, non-significant residual impacts to interact with potential impacts from other projects is discussed in **Section 19.5.3**.

19.5.2 Potential cumulative projects

Table 19-2 lists the projects identified which have the potential to result in cumulative impacts with the Project.

Table 19-2 Projects assessed in the cumulative impact assessment

Project name	Brief project description	Status/timing
Parramatta Light Rail	Parramatta Light Rail Stage 1 is a major infrastructure project proposed by Transport for NSW, comprising a 12 kilometre (km) two-way light rail track, connecting Westmead to Carlingford via Parramatta central business district. The proposed alignment of the main light rail track would run along Hassall Street and along James Ruse Drive, around 1.1 km from the Site. The Parramatta Light Rail project would involve the decommissioning of the T6 Carlingford passenger rail service. A stabling and maintenance facility for the Parramatta Light Rail project would be located at 6 Grand Avenue, Camellia. A track leading from the main light rail track would run along Grand Avenue to the facility.	The Parramatta Light Rail Stage 1 project was approved in May 2018. Preliminary construction works for Stage 1 began in late 2018. The main construction works will begin in 2019. Services will begin in 2023.
Wentworth Point Marina (DA644/2017)	A marina development is proposed at Wentworth Point along Parramatta River (around 3 km east of the Site), which would consist of a 63 wet berth marina, catering for boats up to 15 m long. The marina development would also consist of a dry storage stacking facility catering for 228 boats up to 10 metres (m) long.	Development consent was granted on 6 June 2018. The construction period for this development may overlap with the Project depending when works begin for the marina. Construction of the wet berths is anticipated to take approximately –three to four months to construct once the foreshore works are completed and the dry boat storage facility is expected to be completed within 16 months.

Project name	Brief project description	Status/timing
Clyde Barging Facility	Transport for NSW has approved the establishment of a barging facility next to the Parramatta River near Camellia for the Sydney Metro City and Southwest project. The facility is located outside the Project Area boundary. During operation the facility would receive barges carrying spoil excavated from the new Sydney Metro Barangaroo Station and underground structures including the under-harbour tunnels. This material would be loaded onto trucks and trailers at the facility using excavators and transported to approved locations throughout Sydney for reuse. The facility will require access from Grand Avenue, Rosehill.	The facility is expected to be used for about two years during tunnelling and station excavation works. The facility will be established from May 2018 and is expected to operate from July 2018 until early-2020.

Table 19-3 summarises the potential residual impacts of the projects which have been identified to potentially result in cumulative impacts with the Project.

Table 19-3 Potential residual impacts of identified nearby projects

Adverse residual impacts	Receptors
Parramatta Light Rail	
Air quality During construction, potential air quality impacts would be primarily associated with the generation of dust and emissions from the operation of on-site machinery, excavation works, materials handling and material storage. Vehicle movements within the project disturbance footprint would also contribute to emission loads. **Noise and vibration** Airborne noise during high noise generating activities including the installation of embedded track is anticipated to result in significant exceedances of Noise Management Levels within the Rosehill/Camellia Precinct. During most activities however, construction noise levels would frequently be lower than the worst case levels for significant periods of time. **Traffic and transport** Works associated with the Parramatta Light Rail project may also cause disruption to the road network adjacent to the intersection of James Ruse Drive, Grand Avenue and Hassall Street.	• Residents in Rydalmere (air quality, noise and vibration) • Road users (traffic and transport)

<table>
<tr><th>Adverse residual impacts</th><th>Receptors</th></tr>
<tr><td colspan="2">Wentworth Point Marina (DA644/2017)</td></tr>
<tr><td>Air quality
The air quality impacts can be summarised as follows:
• minor impact on air quality from exhaust emissions from construction plant and equipment;
• minimal amounts of dust would be generated from the excavation and general site works;
• potential for dust generation from stockpiles; and
• emissions from operation of wet berths and the dry boat storage facility would not be significant.
Noise and vibration
The main sources of noise and vibration during construction works are likely to be piling works for the wet berth and rowing club, and earthworks for site levelling. Increased noise levels may result from the use of on-site and off-site mechanical equipment during the course of the works. Building structures are expected to be prefabricated structures, positioned with cranes.</td><td>• Residents in Rydalmere and Silverwater (air quality, noise and vibration)</td></tr>
<tr><td colspan="2">Clyde Barging Facility</td></tr>
<tr><td>Air quality
Operations and decommissioning works all have the potential to generate dust and would generate vehicle emissions.
Noise and vibration
Operations and decommissioning works would generally be undertaken
Mondays to Fridays 7:00am to 6:00pm and Saturdays 8:00am to 1:00pm. There may be a need for works outside of these hours, particularly due to tides or to coordinate with other vessel movements or restrictions on oversize road vehicle movements. Predicted noise levels exceed the noise management objectives at the nearest residential receivers to the north (away from Silverwater Road) and at passive recreation areas in Silverwater Park and Eric Primrose Reserve during piling activities at the wharf which would be undertaken intermittently over a two-month period. All other activities are predicted to comply with the noise management objectives. There would also be an introduction/increase in noise and activity near an area of potential habitat for migratory birds.
Traffic and transport
The proposal includes extending the existing access road through the easement to the new site access at the end of Grand Avenue. During operation of the facility, there would be approximately 21,875 truck and trailer departures. Dependent on the progress of tunnelling, approximately on average 63 truck and trailers would be required per day to remove spoil off-site. During peak periods there would be up to 125 truck and trailers required per day to remove spoil off-site.</td><td>• Industrial businesses on Grand Avenue (air quality, noise and vibration, traffic and transport)
• Rosehill Racecourse (air quality, noise and vibration, traffic and transport)
• Residential receivers in the suburb of Rydalmere and Ermington (air quality, noise and vibration)
• Users of Eric Primrose Reserve (air quality, noise and vibration)
• Users of Silverwater Park (air quality, noise and vibration)</td></tr>
</table>

19.5.3 Cumulative impacts

Table 19-4 describes the potential cumulative impacts that could occur as a result of the Project in combination with the projects listed in **Table 19-3**. It is important to recognise that these are potential cumulative impacts and would be largely subject to the final timing, location and status of each development during the Project. The impacts described below generally assume a worst case scenario.

Table 19-4 Potential cumulative impacts during the Project

Issue	Potential cumulative impacts during the Project
Soils, groundwater and contamination	With the implementation of mitigation and management measures as part of the soil and water management plan, the Project is expected to have no significant residual impact post-mitigation. The potential for a cumulative impact with the Projects listed in **Table 19-3** has been considered. As none of these projects have the potential for a residual soils, groundwater and contamination impact, no cumulative impacts with the Project would be anticipated for these aspects.
Air quality	Results of the dispersion modelling indicated that both incremental and cumulative impacts for all pollutants with the exception to PM_{10}, $PM_{2.5}$ and odour were below the relevant NSW EPA criteria. The highest cumulative concentrations for both 24-hour PM_{10} and $PM_{2.5}$ are largely attributed to high background concentrations and the impact of the Project is considered minor in this context. Provided all recommended mitigation measures to minimise the Project's pollutant contribution to the local air shed and a reactive air quality management program is implemented to minimise off-site particulate and odour impacts, no significant impacts are likely during the Project. For the purpose of this cumulative impact assessment the key air quality emission from the projects listed in **Table 19-3** relates to dust and particulates. Odour was not identified as a concern for the cumulative projects. The Project is proposing to implement a reactive air quality management program. This program would monitor dust from the Project as well as dust in the surrounding air shed. As dust concentrations increase reactive management measures would be implemented until certain works would need to cease. The use of the reactive air quality management program means that potential cumulative impacts resulting from dust and particulates with the projects listed in **Table 19-3** would be avoided. Therefore no significant cumulative air quality impacts are likely.
Noise and vibration	The Project, without management measures employed, is expected to have no significant residual impact. However, the potential for a cumulative impact with the Projects listed in **Table 19-3** has been considered. The Project alone is 5 dBA or more below the identified noise management levels. The identified cumulative projects are some distance from the Project and if a cumulative noise impact was to occur it would likely be driven by significant impacts from the other projects given the low noise predictions for the Project itself. As such whilst a temporary negligible cumulative impact may remain, it is unlikely to be significant for this Project.
Traffic and transport	The Project is expected to have a negligible and temporary impact on the arterial road network. As outlined in **Section 19.5.1**, this is based on the existing congestion issues at the intersection of James Ruse Drive, Grand Avenue and Hassall Street. Cumulative impacts with the Parramatta Light Rail project and the Clyde Barging Facility are likely to be minor. To manage potential cumulative traffic impacts with the Parramatta Light Rail project and Clyde Barging Facility, consultation with the project teams would be undertaken to gain an understanding of likely timing, working hours and potential traffic impacts. Additionally workers and heavy vehicle drivers would be encouraged to travel to the Project Area via the southern access route (refer to mitigation and management measure TT3). This would also help avoid the further disruption and/or congestion at the intersection of James Ruse Drive, Grand Avenue and Hassall Street, that may occur at this location.

Overall, the Project is expected to have negligible cumulative impacts with the Parramatta Light Rail project and the Clyde Barging Facility, and specifically in regards to potential traffic impacts. Consultation with the execution team for these projects would be undertaken to better understand the timing and potential for cumulative impacts, so that works can be scheduled to avoid cumulative traffic impacts. This is discussed further in **Section 19.6**.

19.6 Mitigation and management

19.6.1 Overview

Significant cumulative impacts with other developments in the vicinity of the Project are considered unlikely. Opportunities to further minimise remediation impacts from the Project beyond those considered in this EIS would be undertaken during detailed design and finalisation of the Detailed Remedial Action Plan, through the application of appropriate management and mitigation measures and through consultation with key stakeholders.

Measures to address the potential cumulative impacts of the Project are summarised from all technical chapters in this EIS in **Chapter 20 Mitigation and management**. These measures would be detailed, as relevant, within management plans including a Project Management Plan, REMP and LTEMP.

To manage potential cumulative impacts with the Clyde Barging Facility and the Parramatta Light Rail project, consultation with their respective project teams would be undertaken to gain an understanding of likely timing, working hours and potential traffic impacts.

19.6.2 Summary

The mitigation and management measures outlined in **Table 19-5** are intended to assist in reducing the potential cumulative impacts resulting from the Project.

Table 19-5 Mitigation and management measure – cumulative impacts

Reference	Mitigation and management measures	Timing
CU1	Consultation with the Parramatta Light Rail project and Clyde Barging Facility would be undertaken to gain an understanding of project timing and traffic movements to avoid potential cumulative traffic impacts where possible.	Stage 1 to Stage 5

20.0 Mitigation and management

The preceding chapters of this Environmental Impact Statement (EIS) describe the potential impacts of the Project and identify a suite of measures and controls for managing risk and to avoid, mitigate or offset potential impacts. This chapter provides a summary of the proposed mitigation and management measures during Stage 1 to 5 of the Project, as well as the ongoing operational management of the Western Area. It also outlines how the management plans sit within the wider remediation documentation for the Project.

20.1 Management plans

20.1.1 Remediation (Stage 1 to Stage 5)

Measures to address the potential impacts of Stage 1 to Stage 5 of the Project are provided in each of the technical chapters in this EIS and are summarised below. These measures would be detailed, as relevant, within management plans including:

- A Project Management Plan (PMP) which would outline the procedures and processes for managing the remediation activities during Stage 1 to Stage 5 of the Project. This plan would also include a Community Consultation Plan, Occupational Health and Safety Plan, Quality Management Plan and Emergency Response and Contingency Plan as relevant.
- A Remediation Environmental Management Plan (REMP) which would detail the environmental controls, mitigating measures, contingency plans and monitoring programs for during Stage 1 to Stage 5 of the Project. The REMP would include the following sub-plans:
  - Acid Sulphate Soils Management Plan (ASSMP)
  - Soil and Water Management Plan (SWMP)
  - Air Quality Management Plan
  - Waste Management Plan
  - Noise and Vibration Management Plan (NVMP)
  - Traffic Management Plan (TMP)
  - Biodiversity Management Plan (BMP).
- Detailed Remedial Action Plan (RAP) would be prepared, as outlined in the Conceptual RAP (**Appendix C**).
- Remedial Work Plan (RWP) (including Excavation Plans for the contractor) would also be prepared and include a Validation Sampling and Analysis Quality Plan (SAQP). The Conceptual RAP (refer to **Appendix C**) outlines the validation works which would be conducted to confirm that the remediation works have achieved the remediation objectives and to confirm the suitability of soils for reuse in the Project Area in accordance with NSW EPA endorsed guidelines.

Preparation of the above documents would be considerate of conditions of consent for the Project and would include the mitigation and management measures as outlined in **Section 20.2**, as relevant to each plan.

20.1.2 Ongoing operation

A Long Term Environmental Management Plan (LTEMP) would be prepared to detail the environmental controls, mitigating measures, contingency plans and monitoring programs for the Western Area after remediation has been completed. The LTEMP would include:

- persons responsible for administering the LTEMP;
- potential work health and safety requirements;
- maintenance requirements;
- Project Area access points;

- a Groundwater Monitoring Plan (GMP) to detail groundwater monitoring requirements at the Project Area;
- record keeping requirements; and
- audit and corrective action requirements.

It would also include the relevant mitigation and management measures as outlined in **Section 20.2**.

20.2 Summary

Table 20-1 provides a summary of the proposed mitigation and management measures that would be implemented during the Project, and which would be incorporated into the PMP, REMP and the LTEMP. These measures would also inform the development of the Detailed RAP.

Table 20-1 Summary of mitigation and management measures

Reference	Mitigation and management measures	Timing	Relevant Plan
	General		
G1	Viva Energy would carry out the Project in accordance with the EIS, Response to Submissions report (yet to be published) and the Project approval conditions.	Stage 1 to Stage 5/ ongoing operation	All
G2	Viva Energy would ensure that a PMP, REMP and LTEMP are prepared and implemented for the Project.	Stage 1 to Stage 5/ ongoing operation	All
G3	Viva Energy would appoint a suitable qualified Environmental Representative to review and advise on the implementation of the REMP, and monitor the implementation and effectiveness of the mitigation and management measures	Stage 1 to Stage 5	REMP
G4	The Project workforce would undergo training in accordance with the PMP and REMP and other training commitments agreed to as part of the Project approval.	Stage 1 to Stage 5	PMP and REMP
	Soils, groundwater and contamination		
SGC1	An Acid Sulfate Soils Management Plan (ASSMP) would be prepared in accordance with the *Acid Sulfate Soils Assessment Guidelines* (NSW Acid Sulfate Soils Management Advisory Committee, 1998) to guide the ongoing monitoring and management of ASS within the Western Area. The ASSMP would include: • measures to identify ASS impacted soils within the Project Area prior to undertaking excavation activities; • measures to manage ASS that need to be excavated from the Project Area. These measures would be in accordance with the *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014); and • contingency measures to manage impacts that have the potential to occur if specified management strategies fail, and to outline remediation and restoration actions that may be required.	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
SGC2	A Soil and Water Management Plan (SWMP) would be prepared that outlines: • erosion and sediment control requirements (developed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004)) including: - the use of geotextile liners or temporary capping to reduce infiltration of surface water runoff; - installing silt fences around stockpiles to reduce erosion; - installing silt and sediment traps across stormwater drains in proximity to excavation areas; - placing stockpiles on impermeable sheeting to prevent infiltration, where possible; and - locating stockpiles away from council stormwater drainage systems; • control measures for the dewatering, storage, movement and treatment of groundwater encountered in excavations. This would include the following: - accumulated groundwater in excavated areas would be tested to confirm that it can be appropriately treated in the Wastewater Treatment Plant (WWTP); and - groundwater would be collected and sent to the on-site WWTP in accordance with the established Site wastewater management procedures and discharged in line with the requirements of EPL 570. • management measures required for the appropriate handling of soils containing asbestos; • requirement for inspection of erosion and sediment control structures; • potential chemical pollutants (e.g. fuels, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded and lined areas to minimise the risk of spillages or mobilisation of these pollutants into soil and groundwater; • requirement for and location of spill kits for chemicals or fuels that could potentially be spilt or leak; • regular inspection of remediation equipment and plant to ensure leaks are minimised and rectified; • measures to remove incidental rainfall from bunded remediation areas and transfer it to the WWTP by the existing surface water system or via temporary pipeline; • requirements for monitoring of groundwater for the duration of the Project; • measure to require vehicles leaving the Project Area to utilise the wheel wash to reduce soil on roads, production of dust and the introduction of contamination to groundwater and/or stormwater system. Maintenance requirements for the wheel wash would also be outlined; and • if significant impacts are identified below 4 mbgs (including LNAPL) an area-specific risk assessment would be prepared to assess the requirement for remediation (and/or management measures) and would be reviewed by the NSW EPA accredited Site Auditor (Auditor).	Stage 1 to Stage 5	REMP
SGC3	Validation Sampling and Analysis Quality Plans (SAQPs) would be produced alongside the detailed RAP that outline the requirements for the validation of remediated materials proposed for on-site reuse and for the acceptance of imported fill material to the Project Area.	Stage 1 to Stage 5	RWP

Reference	Mitigation and management measures	Timing	Relevant Plan
SGC4	Following the completion of the Stage 1 to Stage 5 works, a Validation Report would be prepared in accordance with the New South Wales (NSW) Environment Protection Authority (EPA) Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2011) and reviewed/approved by the Auditor, confirming that the Western Area is suitable for commercial/industrial land use. The Validation Report may include progressive validation reports for separate portions of the Western Area to enable progressive validation of these areas.	Stage 1 to Stage 5	Detailed RAP
SGC5	The LTEMP would include a Groundwater Monitoring Plan (GMP) to be implemented to confirm that natural attenuation processes are occurring and residual hydrocarbon concentrations are not posing a human health or ecological risk. It would also include management of residual contaminated materials (as and if required).	Ongoing operation	LTEMP
	Surface water, wastewater and flooding		
SW1	The Soil and Water Management Plan (sub-plan to the REMP) would outline the following: • stormwater around excavations would be diverted and directed to existing stormwater/wastewater management systems and WWTP; • discharges from the WWTP would be within existing EPL 570 limits; • reuse of water for dust suppression or wheel washing, where appropriate; • incorporation of temporary erosion and sediment controls such as settling ponds, silt fences etc. to manage stormwater runoff where existing systems have been removed; • appropriate storage of materials being utilised for the Project, away from Duck River and the surface water drains; • ongoing monitoring of licenced discharge points, in line with EPL 570, to confirm compliance during the Project; • ongoing monitoring of licenced discharge points, in line with EPL 570, to confirm compliance during the Project; • incorporation of runoff/sediment controls, including progressive covering and vegetation of remediated areas; and • routine inspections would be incorporated in to the plan to monitor the implementation of the measures outlined above, including: - routine inspections of excavations to instigate the pump out of water accumulating in excavations; - inspections of bunding would occur during and following periods of heavy rainfall to confirm that water is being directed to the WWTP as required	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
SW2	Potential chemical pollutants (e.g. fuels, additives, stockpiles etc.), would be stored in appropriate containers and/or within bunded and lined areas to minimise the risk of spillages, or mobilisation of these pollutants into aquatic environments in the event that a storm surge or flood event impacts the Project Area.	Stage 1 to Stage 5	REMP
SW3	The Long Term Environmental Management Plan would outline: • routine inspection requirements to determine that: - vegetation is maintained; - erosion/ sediment measures are operating effectively - channelling is not occurring; - the discharge locations (i.e. the swales and overland flow into Duck River) are operating effectively; and • inspection of swales after large flood event to confirm they are still intact; • periodic inspection of mangroves and surface water discharges to note observable changes in the condition of vegetation, which may indicate lower water quality; • weed management; and • maintenance of erosion and sediment controls.	Ongoing operation	LTEMP

Reference	Mitigation and management measures	Timing	Relevant Plan
	Air quality		
AQ1	Air quality management controls would be implemented as part of the design of the Project including: • level 2 (>2 litres/m^2/h) watering of on-site haul roads; • watering with or without dust suppressants on exposed areas and stockpiles; • application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on untreated stockpiles in the DTD area and on exposed untreated biopiles (i.e. during construction of the biopile) over night; • application of odour and VOC suppressant foam (with a control efficiency of 95% or higher) on exposed excavation areas where both required and practical; • biopiles would be covered during operation and off-gas from biopiles would be passed through air filters to remove volatile hydrocarbons; • the DTD unit preliminary treatment area stockpile would be enclosed within a three sided bay; • all mobile and stationary diesel engines would be compliant with US EPA Tier 3 and EU Stage III *A Non-road Diesel Engine Emission Standards*; • off-gas from the DTD unit would be treated before it is discharged to the atmosphere through a stack; • where possible stockpiles would be covered; • enclosing the DTD screening area and placing water sprays on the outlet; and • ensuring a particulate filter is used on the mobile crushing plant.	Detailed design/ Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan

AQ2	An Air Quality Management Plan (AQMP) would be prepared and implemented for the Project. The AQMP would include:
	• ambient air quality monitoring requirements;
	• a Reactive Air Quality Management Program (RAQMP) for:
	  - particulates, specifically PM_{10} and $PM_{2.5}$; and
	  - odour.
	• mitigation measures listed in AQ1 particularly for Stage 2 to Stage 4 where air pollutant emissions are likely to be highest.
	The AQMP would also include the following details:
	• performance objectives to guide the monitoring and management of potential air quality impacts;
	• timeframe for implementation of all identified emission controls;
	• key performance indicator(s) for emission controls;
	• monitoring method(s), including location, frequency and duration;
	• response mechanisms to mitigate potential off-site impacts;
	• responsibilities for demonstrating and reporting achievement of key performance indicator(s); and
	• record keeping and complaints response register; and compliance reporting.
		Detailed design/ Stage 1 to Stage 4	REMP

AQ3	The AQMP would outline the requirement for stack emissions testing to validate the potential air quality impact against predicted impacts in the AQIA, ensure ongoing performance of ventilation systems and comply with other required limits. Stack emissions testing would include: • emissions testing of the DTD stack during commissioning and periodically post commissioning to confirm pollutant concentrations and ensure ongoing compliance; and • periodic emission testing of the biopile aeration system to ensure total VOC concentration is below 10 parts per million (ppm) and identify when air filters used to remove VOCs need to be replaced. Stack emissions testing would be carried out in accordance with the NSW EPA's *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales* (DEC, 2007).	Stage 3	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
AQ4	The RAQMP would be prepared and implemented in accordance with: • The NSW EPA's *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007);* • *AS 3580.9.8-2008 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter - PM_{10} continuous direct mass method using a tapered element oscillating microbalance analyser;* • *AS/NZS 3580.9.11:2008 Methods for sampling and analysis of ambient air – Determination of suspended particulate matter - PM_{10} beta attenuation monitors;* • *AS/NZS 3580.1.1:2007 Methods for sampling and analysis of ambient air - Guide to siting air monitoring equipment;* and • *AS 2923-1987 Ambient air - Guide for measurement of horizontal wind for air quality applications.*	Detailed design/ Stage 1 to Stage 4	REMP
AQ5	The RAQMP (PM_{10} and $PM_{2.5}$) would: • outline how monitoring stations at the boundary of the Project Area would be established, including location and number; • outline the process for collecting data from the monitoring stations; • establish and calculate trigger values; and • outline the response if trigger values are reached, e.g. investigate, implement contingency measures, review effectiveness of contingency measures and/or stop work.	Detailed design/ Stage 1 to Stage 4	REMP
AQ6	The RAQMP (odour) would include: • an operator-run odour complaints management system (as part of the wider Project complaints management procedure) to maintain and monitor air quality performance during potential odour generating activities associated with excavation and remediation of contaminated material; • in the event of an odour complaint; information would be obtained regarding the character of the odour, frequency, duration and intensity of odour observations and whether impacts of offensive odours are currently occurring; • an investigation of the odour complaint would be conducted as soon as practicable after an odour complaint has been received; and • if odour impacts are immediately occurring; action would be undertaken to reduce odour impacts; this may include: - spraying odour/VOC suppressant on exposed surface areas and/or stockpiles; - covering stockpiles; and - limiting excavation works and materials handling of highly contaminated fill while upwind of sensitive receptors during unfavourable weather conditions (e.g. dry and windy conditions).	Detailed design/ Stage 1 to Stage 3	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
	Human health		
HH1	The Occupational Health and Safety Plan within the PMP would outline the personal protective equipment and occupational health and safety measures to manage potential risks to on-site workers.	Detailed design/ Stage 1 to Stage 5	PMP
	Waste management		
W1	A WMP would be prepared as a sub-plan to the REMP. The WMP would: • identify requirements consistent with the waste and resource hierarchy and cleaner production initiatives; • include relevant measures from the revised *National Waste Policy: Less Waste, More Resources* (EPHC, 2009); • ensure resource efficiency is delivered through the design, remediation and operational practices; • provide consistent clear direction on waste and resource handling, storage, stockpiling, use and reuse management measures; • outline procedures for stockpiling of wastes (refer to W2); • set out processes for disposal, including on-site transfer, management and the necessary associated approvals; • outline that waste generated within the Project Area would be segregated at source and suitably stored in designated waste management areas within the Project Area; • include material tracking measures to track waste and recyclables generated from the Project and removed from the Project Area. Material tracking records would include types, volumes and management measures for waste and resource arising from/used for the Project; • outline an unexpected finds protocol to manage the potential for unexpected finds during the remediation of the soils (i.e., asbestos or other hazardous materials, excluding hydrocarbon contamination); and • include a process for auditing, monitoring and reporting.	Stage 1 to Stage 5	REMP
W2	Stockpiled wastes would be: • appropriately segregated to avoid mixing and contamination; • appropriately labelled; • appropriately stored to minimise risk of erosion; • less than 5 m in height; and • located more than 40 m away from any sensitive receivers, ecological areas and watercourses (refer to **Figure 1-1**).	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
W3	Liquid (excluding those that are suitable to be transferred to the WWTP) and non-liquid wastes generated from Project would be assessed, classified and managed. Wastes requiring off-site disposal would be disposed of at an appropriately licenced facility.	Stage 1 to Stage 5	REMP
W4	All contaminated soil (as defined by Waste Classification Guidelines) received into the Project Area would comply with the SAQP criteria defined as part of the Remedial Work Plan (RWP).	Stage 1 to Stage 5	RWP
W5	No waste would be stored on-site during ongoing operation. Workers undertaking maintenance activities following completion of the Project would remove any waste produced from the Western Area at the completion of the activity.	Ongoing operation	LTEMP
	Noise and vibration		
NV1	A Noise and Vibration Management Plan would be prepared as part of the REMP. This would include the following commitments: • plant and equipment with low noise emission levels would be used where practicable; • ensuring plant and equipment is properly maintained; • turning off machinery when not in use; and • vibration trials would be conducted when vibration intensive work (e.g. a 20 t padfoot roller) is proposed within 30 m of buildings. Training of the Project workforce would be undertaken and include: ensuring work occurs within approved hours.	Stage 1 to Stage 5	REMP
NV2	A 24 hour community concerns phone line would be implemented for Stage 1 to Stage 5 of the Project. This would be detailed in the PMP for the Project.	Stage 1 to Stage 5	PMP
NV3	A suitable complaints management procedure would be prepared and implemented and documented in the PMP for the Project. This would include: • maintenance of a complaints register; • if required, noise and vibration monitoring would be conducted in response to complaints received to ensure compliance with Project noise and vibration criteria; • if necessary, reasonable and feasible measures would be implemented to address noise impacts; and • a feedback process would be established to manage complaints, including responding to complainant and updating them on the action/s taken.	Stage 1 to Stage 5	PMP

Reference	Mitigation and management measures	Timing	Relevant Plan
	Traffic, transport and access		
TT1	A Traffic Management Plan (TMP) would be prepared as a sub-plan of the REMP. The TMP would include: • routes for heavy and private vehicles to access the Western Area; • appropriate routes for oversize or over-height vehicles; • on-site parking locations; and • the process for ensuring operators have the relevant permits from the NHVR, if required. The TMP would: • detail the temporary measures that would be implemented to mitigate road safety and network efficiency impacts during the Project, such as work zone speed limits and traffic control; • include a Driver Code of Conduct to outline expectations of Project related vehicles: - minimise the impacts of the Project on the local and regional road network; - minimise conflicts with other road users; and - require truck drivers use specified routes; • include a notification process for potentially affected businesses along Project haulage routes, in the event of a potential traffic disruption related to the use of vehicles larger than Class 2 GML 25/26m B-Doubles; and • vehicle management measures to manage vehicle movements on-site to reduce the likelihood of conflicts between workers and private and heavy vehicles, including a speed limit of 20 km/h for the Project Area.	Detailed design/ Stage 1 to Stage 5	REMP
TT2	Workers would be encouraged to utilise more sustainable transport modes e.g. car-pooling, where feasible to reduce the reliance on private vehicles.	Stage 1 to Stage 5	REMP
TT3	On-site car parking for the workforce, within the Western Area would be provided during the Project for up to 80 cars. The car-parking area in the Western Area would be located near the site office, where possible and would have provision for: • convenient parking spaces for authorised visitors to the Project Area (i.e. not routine workers); and • emergency vehicle parking adjacent to the first aid office.	Detailed design/ Stage 1 to Stage 5	REMP
TT4	Should vehicles with loads exceeding GML limits or comprising non-standard dimensions require access to the Project Area, a permit would be obtained from the NHVR, prior to use of any such vehicle.	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
TT5	The TMP would include a diagram outlining preferred routes to and from the Project Area which would: • avoid the intersection of James Ruse Drive, Grand Avenue and Hassall Street during peak periods for workforce and heavy vehicles; and • avoid the vehicle restrictions where Wentworth Street travels under the M4 Western Motorway for vehicles over the height of vehicles exceeding 4.6 m.	Stage 1 to Stage 5	REMP
TT6	The LTEMP would include a section on traffic management which would detail routes and access points to the Project Area and recommended parking locations.	Ongoing operation	LTEMP
	Biodiversity		
BD1	Installation of appropriate exclusion fencing protecting vegetation to be retained outside the Project Area. Exclusion fencing would be placed at a distance sufficient to minimise impacts within the vegetation's TPZs and in accordance with *AS4970-2009 Australiana Standard. Protection of trees on development sites* (Standards Australia Committee, 2009). Fencing is to include appropriate signage such as 'No Go Zone' or 'Environmental Protection Area'. The location of any 'No Go Zones' would be identified in site inductions. The above measures would be documented in the Biodiversity Management Plan (BMP).	Stage 1 to Stage 5	REMP
BD2	To mitigate against potential impacts to the GGBF population the following measures would be included in the BMP: • works inductions that focus on the potential occurrence of the species; • pre-clearance surveys by an environmental representative as needed of stockpiles and excavations to check for the presence of GGBF; • management of stockpiles to minimise the chances of frogs using them for shelter habitat (e.g. maintenance of sediment fencing around stockpiles and no ponding of water); • measures would also be implemented to minimise indirect impacts to GGBF through spread of Chytrid fungus; and • an unexpected finds protocol which outlines the need to engage a suitably qualified ecologist to relocate any GGBF encountered in the Project Area. Mitigation and management measures would be aligned with the actions currently being undertaken during the Conversion Project to maximise their successful implementation, and minimise potential confusion surrounding requirements.	Stage 1 to Stage 5	REMP
BD3	Material stockpiles, vehicle parking and machinery storage would be located within cleared areas and outside of vegetation exclusion zones.	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
BD4	Where appropriate, native vegetation cleared from the Project Area should be mulched for reuse on-site, to stabilise bare ground (or similar).	Stage 1 to Stage 5	REMP
BD5	Measures to minimise the potential for the spread of weeds would be detailed in the BMP.	Stage 1 to Stage 5	REMP
	Historic heritage		
HH1	Workers and contractors would be made aware of the heritage values of the former Clyde Refinery and the three surrounding listed items of Lower Duck River Wetlands (I47), Wetlands (I1) and Capral Aluminium (I575), during the site induction.	Stage 1 to Stage 5	REMP
HH2	As noted in the Australian Museum Consulting archaeological assessment (Australian Museum Consulting, 2015), the north-west portion of the Site has low potential to contain significant relics. Notwithstanding this, should an unexpected find of likely significance be uncovered (including artefact scatters (glass, animal bone, ceramic, brick, metal etc.), building foundations, etc.), consistent with the unexpected finds protocol from the Clyde Terminal Conversion Project (SSD 5147), the following stop work procedure would be followed: • all work in the nearby area is to cease immediately; • contact OEH Heritage Branch; and • depending on the possible significance of the relics, an archaeological assessment and an excavation permit under the NSW *Heritage Act 1977* may be required before further works can continue in that area.	Stage 1 to Stage 5	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
	Aboriginal heritage		
AH1	Any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains discovered during remediation of the Project Area would be managed in accordance with the unexpected heritage finds and human remains procedure for the Project, which would be prepared in accordance with the: • NSW Police Force Handbook (2016); and • NSW Health Exumation of Human Remains Policy (2013). The following standard unexpected heritage finds procedure should be adopted (refer to Annexure A of **Appendix K** of the EIS for further detail): 1. all works must cease immediately in the area to prevent any further impacts to the object; 2. notify the Environmental Representative; 3. engage a suitably qualified archaeologist to determine the nature, extent and significance of the find and provide appropriate management advice; and 4. prepare and submit an AHIMS site card for the site. In the event that potential human skeletal remains are identified, the following unexpected humans remains finds procedure should be followed: 1. all work in the vicinity of the remains should cease immediately; 2. the location should be cordoned off and the NSW Police notified; and 3. if the Police suspect the remains are Aboriginal, they would contact the Office of Environment and Heritage and arrange for a forensic anthropologist or archaeological expert to examine the site. Subsequent management actions would be dependent on the findings of the inspection undertaken under Point 3 (refer to Annexure A of **Appendix K** of the EIS for further detail on these actions).	Stage 1 to Stage 5 and ongoing operation	REMP

Reference	Mitigation and management measures	Timing	Relevant Plan
	Hazards and risk		
HR1	The REMP would outline the following to manage hazards and risks for the Project: • materials brought to the Project Area are not to exceed the thresholds provided in the Applying SEPP 33 guideline; • the GAC proposed to be used for biopiling would be activated carbon which is not listed as a dangerous good under the ADG Code. This would be confirmed by checking the relevant Material Safety Data Sheets before purchasing the material; • Portland cement and/or fly ash used during the Project would not be the type which is listed as dangerous good under the ADG Code. This would be confirmed by checking the relevant Material Safety Data Sheets before purchasing the material; and • in the event that a material is to be used during the Project which has not been assessed in the EIS (**Chapter 18 Hazards and risks**) or greater quantities and/or vehicle movements are required for materials used during the Project, then a screening risk assessment would need to be completed before the material can be transported, stored or used on-site.	Stage 1 to Stage 5	REMP
HR2	The transport, storage and handling of hazardous substances would be undertaken in accordance with: • *Work Health and Safety Act 2011 (NSW)*; • *Protection of the Environment Operations (Waste) Regulation 2005 (NSW);* • *Dangerous Goods (Road and Rail Transport) Act 2008 (NSW);* • *Dangerous Goods Regulation (Road and Rail Transport) Regulation 2014 (NSW);* • *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2018); • relevant Australian Standards; • the thresholds outlined in Applying SEPP 33 guidelines; and • the relevant Material Safety Data Sheets.	Stage 1 to Stage 5	REMP
HR3	The PMP would detail the process for identifying and managing services/utilities.	Stage 1	PMP
HR4	The Site Emergency Response Plan would be updated following completion of the Project to reflect the changed site conditions in the Western Area.	Ongoing operation	PMP
	Cumulative impacts		
CU1	Consultation with the Parramatta Light Rail project and Clyde Barging Facility would be undertaken to gain an understanding of project timing and traffic movements to avoid potential cumulative traffic impacts where possible.	Stage 1 to Stage 5	REMP

21.0 Project evaluation and justification

This chapter presents the evaluation of the Project and the outcomes of the Environmental Impact Statement (EIS), together with a justification for proceeding with the Project. This chapter also provides:

- an environmental risk assessment;
- an assessment of the Project against the principles of Ecologically Sustainable Development (ESD);
- consideration of the consistency of the Project against the objects of the *Environmental Planning and Assessment Act 1979* (*NSW*) (EP&A Act);
- a summary of the beneficial impacts of the Project;
- a summary of the adverse impacts of the Project;
- a justification for proceeding with the Project; and
- the conclusions of this EIS.

21.1 Environmental risk assessment

An initial qualitative scoping assessment was completed in the Viva Energy Clyde Western Area Remediation Project Preliminary Environmental Assessment (PEA) (AECOM, 2018a) and is summarised in **Chapter 7 Environmental Scoping Assessment**.

This EIS documents a number of environmental assessments for the Project (refer to **Chapter 8** to **Chapter 19**) and identifies the potential environmental impacts resulting from the Project and appropriate measures to mitigate or manage these impacts.

This environmental risk assessment provides an analysis of the potential environmental risks that have been identified in the EIS.

21.1.1 Approach

To understand the potential level of risk associated with each environmental aspect, a qualitative risk assessment was conducted. It was generally based upon the methodologies outlined in Standards Australia's document *HB 203:2006 Environmental Risk Management – Principles and Process* and *AS/NZS ISO 13000:2009 Risk Management – Principles and Guidelines.* The analysis categorised levels of risk for a given event based on significance of effects (consequences) and the manageability of those effects (likelihood).

The likelihood and consequence judgements were based on the criteria outlined in **Table 21-1** and **Table 21-2** respectively.

Table 21-1 Measures of likelihood categories

Rank	Likelihood	Description
A	Almost Certain	Happens often and is expected to occur
B	Likely	Could easily happen and would probably occur
C	Possible	Could happen and has occurred elsewhere
D	Unlikely	Unlikely to happen but may occur
E	Rare	Could happen, but only in extreme circumstances

Table 21-2 Measures of consequence categories

Rank	Consequence	Description
1	Extreme	Permanent and catastrophic impacts on the environment; large impact area; reportable incident to external agency; large fines and prosecution; operational constraints; substantial community concern.
2	Major	Permanent and detrimental impacts on the environment; large impact area; reportable incident to external agency; may result in large fines and prosecution; operational constraints; high level of community concern.
3	Moderate	Substantial temporary or minor long term detrimental impacts on the environment; moderate impact area; reportable incident to external agency; action required by reportable agency; community interested.
4	Minor	Minor detrimental impacts on the environment; small impact area; reportable incident internally; no operational constraints; some local community interest.
5	Low	Nil or temporary impacts on the environment; small or isolated impact area; not reportable incident; no operational constraints; uncontroversial project no community interest.

Table 21-3 shows the risk matrix used to identify whether the potential environmental risks associated with the Project would be considered to be Very High (VH), High (H), Medium (M) or Low (L). This matrix uses a traffic light system to highlight very high, high, medium and low risks.

Table 21-3 Risk matrix for the environmental risk assessment

		CONSEQUENCES				
		1 Extreme	2 Major	3 Moderate	4 Minor	5 Low
Likelihood	A (Almost Certain)	VH	VH	H	H	M
	B (Likely)	VH	H	H	M	M
	C (Possible)	H	H	M	M	L
	D (Unlikely)	H	M	M	L	L
	E (Rare)	H	M	L	L	L

Taking into account the location and nature of the Project, the mitigation measures described in **Chapters 8** to **18**, the cumulative impacts assessment in **Chapter 19** and the commitments provided in **Chapter 20 Environmental management**, **Table 21-4** provides an assessment of the mitigated risks associated with the Project, or the residual risk analysis. This has been completed for each potential environmental impact identified in **Table 21-4** based on the likelihood of occurrence and potential environmental consequence.

Table 21-4 Environmental risk assessment

Notes: PL: Potential Likelihood; PC: Potential Consequence; RP: Residual Likelihood; RC: Residual Consequence

Environmental aspect	Potential impacts based on unmitigated/inherent risk	PL	PC	Potential risk before mitigation	Proposed mitigation and management measures	RL	RC	Residual risk post mitigation
Soils, groundwater and contamination (**Chapter 8**)	Excavation of contaminated soil resulting in the exposure of acid sulfate soils having the potential to cause impacts to Duck River should surface water or groundwater come into contact with disturbed soils and migrate them into the river.	C	3	M	SGC1	E	4	L
	Movement of and disturbance of contaminated soils around the Project Area resulting in the contamination of previously uncontaminated areas, including areas off-site through mobilisation of sediment or dust.	B	2	H	SGC2, AQ1	D	4	L
	Spills and leaks of fuels and oils from plant and equipment resulting in unintentional additional contamination having the potential to mobilise off-site.	D	3	M	SGC2, SW1	E	5	L
	Excavations penetrating the impermeable silty clay layer leading to increased infiltration of surface water and therefore increased groundwater volumes, resulting in the migration of plumes off-site.	C	3	M	SGC2	E	3	L
	Imported fill material not meeting the applicable criteria and causing additional contamination within the Project Area.	D	3	M	SGC3	E	4	L
	Erosion impacts from the final landform.	D	4	L	SW2	E	5	L
Surface water, wastewater and flooding (**Chapter 9**)	Erosion and entrainment of dust, soil and other material in surface water from areas where ground disturbance works and excavation are required resulting in erosion and sediment impacts to surrounding water bodies including Duck River.	C	2	H	SW1, AQ1	E	4	L
	Leaks of residual matter from within redundant pipework prior to removal.	E	4	L	SW1, SGC2	E	5	L

Environmental aspect	Potential impacts based on unmitigated/inherent risk	PL	PC	Potential risk before mitigation	Proposed mitigation and management measures	RL	RC	Residual risk post mitigation
	The interaction of surface water with contaminated soils potentially exposed by excavation work.	C	3	M	SW1	D	4	L
	Poor stockpile management resulting in contaminated leachate.	E	3	L	SW1, SGC2	E	4	L
	Impact to the Duck River from discharge of contaminated wastewater due to overloading of the WWTP.	D	3	M	SW1, SGC2	E	4	L
	Flood events during operation resulting in damage to surface water management infrastructure.	E	4	L	SW2	E	5	L
Air quality and odour (**Chapter 10**)	Emissions of air pollutants including dust, combustion, VOC and stack emissions from exposed surfaces, materials handling and remediation technologies resulting in a decline of air quality within the surrounding environment.	C	3	M	AQ1, AQ2, AQ3, AQ4, AQ5	D	4	L
	Odour impacts due to exposed surfaces, materials handling and remediation technologies at residential and/or industrial receptors.	C	4	M	AQ1, AQ2, AQ4, AQ6	D	5	L
Human health risk (**Chapter 11**)	Increased human health risks for on-site workers at the Clyde Terminal including the Project Area due to exposure to chemicals of potential concern.	D	3	M	HH1	E	4	L
Waste management (**Chapter 12**)	The Project results in significant additional putrescible and non-putrescible waste which may contain hazardous materials causing land and water pollution to sensitive environments resulting in human health and environmental impacts.	C	3	M	W1, W2, W3, W4, W5	D	5	L
	Generation of waste resulting in the inefficient use of resources.	D	4	L	W1	E	5	L
Noise (**Chapter 13**)	Equipment and plant required for the Project results in significant adverse noise impacts at surrounding receivers.	E	4	L	NV1, NV2, NV3	E	5	L

Environmental aspect	Potential impacts based on unmitigated/inherent risk	PL	PC	Potential risk before mitigation	Proposed mitigation and management measures	RL	RC	Residual risk post mitigation
	Vibration intensive plant resulting in exceedances of human comfort criteria at the nearest industrial receivers.	C	4	M	NV1, NV2, NV3	D	5	L
Traffic, transport and access (**Chapter 14**)	Increase the number of private vehicles on the road network due to workers travelling to the Site.	B	4	M	TT1, TT2, TT5, TT6	B	5	M
	Number of private vehicles on the Site exceeding the number of available parking spaces resulting in parking on public roads.	E	4	L	TT1, TT2, TT3, TT6	E	5	L
	Heavy vehicles required for the Project increasing the number of vehicles on the road network.	B	4	M	TT1, TT4, TT5, TT6	B	5	M
Biodiversity (**Chapter 15**)	Impacts to areas of ecological significance including the tree protection zone of the Duck River riparian area and associated native vegetation.	C	3	M	BD1, BD2, BD3	E	4	L
	Direct or indirect impacts to the Green and Golden Bell Frog or other protected fauna through impacts to species habitat or individuals.	D	3	M	BD1, BD2, BD3	E	3	L
	Introduction of weeds and other pathogens during both remediation and ongoing operation of the Project resulting in negative ecological outcomes.	C	3	M	BD2, BD5, SW2	E	4	L
Heritage (**Chapter 16** and **Chapter 17**)	Direct impacts to the heritage values of the former Clyde Refinery, associated with the removal of refinery infrastructure.	D	4	L	HH1, HH2	E	5	L
	Indirect impacts to adjacent ecological listed heritage items through sediment and contamination migrating from the Project Area.	D	3	M	HH1, HH2	E	3	L
	Unexpected finds of items of Aboriginal heritage significance.	E	3	L	AH1	E	5	L

Environmental aspect	Potential impacts based on unmitigated/inherent risk	PL	PC	Potential risk before mitigation	Proposed mitigation and management measures	RL	RC	Residual risk post mitigation
Hazards and risk (**Chapter 18**)	Dangerous goods at Project Area exceeding SEPP 33 guideline resulting in potential risks and the need for a PHA.	B	3	H	HR1, HR2	D	4	L
	Potential spills or leaks during transport of hazardous substances.	E	3	L	HR2, SW1, SGC2	E	5	L
	Workers encountering active utilities during excavations within the Project Area.	D	4	L	HR6	E	5	L

21.1.2 Summary of risk analysis

The Environmental risk assessment in **Table 21-4** illustrates how the assessments and mitigation measures contained within **Chapters 8** to **19** have helped understand the proposed Project and reduce potential environmental risks. The implementation of the identified mitigation and management measures in **Chapter 20 Mitigation and management** would help avoid and mitigate potential impacts as far as possible.

It can therefore be concluded that, provided the mitigation and management measures presented in **Chapter 20** are implemented, remaining residual impacts would be negligible and/or unlikely.

21.2 Principles of ecologically sustainable development

This section provides a review of the Project, its impacts and associated safeguards against the principles of ecologically sustainable development (ESD) in accordance with *the Environmental Planning and Assessment Regulation 2000* (EP&A Regulation). The principles, as listed in clause 7(4) of Schedule 2 of the EP&A Regulation, are as follows:

*a. "the **precautionary principle**, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*

*b. **inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations*

*c. **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration*

*d. **improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services."*

These principles are discussed below.

21.2.1 The precautionary principle

The precautionary principle deals with certainty in environmental and technical decision making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

A State Significant Development application undergoes a public process that allows for better examination of the potential effects of proposed activities or development. Thus, the assessment process can be considered as precautionary in nature. The requirement to assess the impacts of the Project is a form of regulation designed to identify and address uncertainty about the effects of these activities.

Viva Energy has commissioned specialists to conduct detailed assessments on several environmental aspects identified during the environmental risk analysis process as outlined in **Chapter 7 Environmental Scoping Assessment**. These assessments provide sufficient scientific understanding of the Project, their interactions with the surrounding environment and implications they may have to enable a decision to be made that is consistent with this principle. Where it was not possible to accurately depict or assess aspects of the Project in their entirety, conservative assumptions have been employed to take into consideration worst case scenario impacts. This approach is consistent with the precautionary principle.

The precautionary principle has driven the development of a number of management and mitigation measures presented within this EIS. The implementation of these management and mitigation measures would reduce the severity of potential impacts and to reduce likelihood of potential impacts occurring. The Project would also comply with environmental criteria and the development consent, as well as relevant statutory requirements.

21.2.2 Intergenerational equity

Inter-generational equity requires that the present generation pass onto the next generation an environment that does not limit the ability of those future generations to attain a quality of life at least equal to that of the current generation.

Through the Project itself, and the implementation of mitigation and management measures during the execution of the Project, inter-generational social equality impacts have been addressed. Examples of matters that are relevant to the Project are described below.

Project objectives

The Project would enable the Project Area to be redeveloped for future commercial/industrial purposes permissible under the existing land use zoning. This would support the objectives of the Greater Sydney Commission providing an expanded employment centre and provide increased services within 'Central River City'.

Project safeguards

The Project would maintain inter-generational equity by ensuring components of the existing bio-physical, social and economic environment available now would also be maintained for future generations. Aspects of the Project that would assist in achieving inter-generational equity include the following:

- no ecological features, values or sensitive environments, including Duck River, would be significantly impacted as a result of the Project;
- removal of contamination from the Project Area reducing human health risk and supporting the ongoing operation of the Project Area in a safe manner; and
- the Project would not impact on the heritage significance of the Site.

21.2.3 Conservation of biological diversity and ecological integrity

This EIS includes an assessment of the ecological impacts of the Project (**Chapter 15 Biodiversity)**. The Project would not cause significant ecological impacts and would avoid impacts on nearby ecological values. Measures to further minimise impacts are outlined in the Remediation Environmental Management Plan (REMP).

21.2.4 Improved valuation, pricing and incentive mechanisms

This ESD principle is premised on an assumption that all resources should be appropriately valued and that the value of environmental resources should be considered alongside any economic or cost benefit analysis for the life of the Project.

Project objectives

The Project would allow for the improved use of the Project Area for future commercial/industrial development, as permissible under the existing land use zoning.

The value placed by Viva Energy on environmental resources is evident from the extent of site-specific investigations, planning and environmental safeguards and measures that have been undertaken and which would be implemented to prevent damage to the local environment.

21.2.5 Compatibility with the Principles of ESD

The approach taken in undertaking the Project has been multi-disciplinary. Emphasis has been placed on the avoidance of impacts through careful design as well as management and mitigation measures to minimise potential negative environmental impacts during the Project.

21.3 Objects of the EP&A Act

A consideration of the Project against the objects of the EP&A Act is outlined in **Table 21-5**.

Table 21-5 Project justification with consideration of the objects of the EP&A Act

Object of the EP&A Act	Comment
(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources	The Project would support the *Greater Sydney Region Plan: A Metropolis of Three Cities* (The Plan) (GSC, 2018a) released by the Greater Sydney Commission in 2018 through providing the capacity for additional employment lands within the spatially limited Greater Parramatta and Olympic Peninsula (GPOP) area. The ability to redevelop the Project Area in the future for commercial/industrial uses would provide improved social and economic outcomes within the GPOP area.
(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment	This EIS assesses the Project and identifies the likely impacts on the environment and surrounding community. With management and mitigation measures as outlined in **Chapter 20**, residual impacts on the environment are anticipated to be negligible. The Project would be undertaken with the goal of remediating the soil and managing the groundwater in the Western Area, where required, to enable the land to be used for commercial/industrial purposes in the future, thus providing a positive economic outcome for NSW.
(c) To promote the orderly and economic use and development of land	The Project would promote the orderly and economic development of the Western Area. The Project would remediate this area to a commercial/industrial standard that would allow it to be appropriately redeveloped.
(d) To promote the delivery and maintenance of affordable housing	Not applicable as the Project is not constructing housing or associated development and is zoned for heavy industry.
(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats	The Project would not have a significant impact on biodiversity (refer to **Chapter 15**). In summary, potential impacts on: • native vegetation have been minimised by limiting the extent of the Project Area to exclude vegetated areas along the southern and south-western boundary of the Project Area; • the local population of Green and Golden Bell Frog have been assessed as not to be significant as the Project would not remove valuable habitat for the population, and has a very low likelihood of direct impacts on the population; and • Groundwater dependent ecosystems and matters of national environmental significance have been assessed as negligible and/or non-significant.
(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)	Following the implementation of the management and mitigation measures, there would be no residual impacts from the Project on historic or Aboriginal heritage (refer to **Chapter 16 Historic heritage** and **Chapter 17 Aboriginal heritage**).
(g) To promote good design and amenity of the built environment	Not applicable as the Project would result in a vacant site, with no built structures present.

Object of the EP&A Act	Comment
(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants	Not applicable as there would be no buildings constructed or maintained as part of the Project.
(i). To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State	The Project is being assessed as SSD under Part 4 of the EP&A Act. The EIS would reviewed by Government regulators including DPE and potentially, pending the number of submissions, be submitted to the Independent Planning Commission for review and determination. Various government agencies, including City of Parramatta Council have provided input to the SEARs and have been consulted with during EIS development (refer to **Chapter 6 Stakeholder engagement**).
(j) To provide increased opportunity for community participation in environmental planning and assessment	The community has had and will have the opportunity to be involved in the environmental assessment of the Project through: • consultation activities undertaken during development of the EIS (refer to **Section 6.2**); • the public exhibition and response process. During the exhibition period a public exhibition session will be held and any person may make a submission regarding the Project, and these submissions will be considered in the assessment of the development application (refer to **Section 6.5.1** and **6.5.2**); and • ongoing consultation, should the Project be consented, in accordance with the Community Consultation Strategy and Plan (refer to **Section 6.5.3**).

21.4 Summary of impacts

The remediation of contaminated soils in the Western Area would reduce the concentrations in the soil of chemicals of potential concern (COPC) and reduce the human health and ecological risks of the Western Area.

The remediation of contaminated soils in the Western Area would also facilitate future development of the land for other purposes permissible under the existing land use zoning. This would help Viva Energy meet its regulatory requirements, business objectives and would assist with the delivery of the fifth of the GPOP Vision's 12 Strategic Directions:

"*No 5 - Transform Camellia, Rydalmere, Silverwater and Auburn into 21st Century essential urban service, advanced technology and knowledge assets*".

This EIS provides an assessment of various environmental aspects and has identified potential adverse impacts. Following the implementation of mitigation and management measures identified in **Chapter 20 Mitigation and management**, the Project is expected to have no adverse residual impacts for the following environmental aspects:

- waste management;
- biodiversity;
- historic heritage
- Aboriginal heritage; and
- hazards and risk.

In addition, the Project also has the potential to result in the following non-significant adverse residual impacts:

- Soils, groundwater and contamination. The implementation of management and mitigation measures within the REMP and the Long Term Environmental Management Plan would mean that no significant residual impacts to from contaminated groundwater and soils would be likely. Nevertheless a negligible residual impact could potentially occur (e.g. through cross contamination of soils in the Project Area, through minor groundwater flows or small amounts of contamination mobilised through dust off-site).
- Surface water, wastewater and flooding. The implementation of the proposed management measures would mean that no significant residual impacts to off-site surface water values/receptors would be likely as potential impacts would be avoided and/or mitigated.
- Air quality and odour. The remediation works are likely to result in various emissions, including dust, combustion, VOC and stack emissions which, with the exception of PM_{10}, $PM_{2.5}$ and odour, would be within criteria and therefore non-significant. The highest cumulative concentrations for both 24-hour PM_{10} and $PM_{2.5}$ are largely attributed to high background concentrations and the impact of the Project is considered minor in this context. Provided all recommended mitigation measures to minimise the Project's pollutant contribution to the local air shed and a reactive air quality management program is implemented to minimise particulate and odour impacts, no significant impacts are likely as a result of the Project.
- Human health. Remediation activities could result in increased risk of human health impacts to on-site receptors including remediation workers and workers at the Clyde Terminal. Through the implementation of an Occupational Health and Safety Plan, the residual adverse human health impacts to both on-site workers and identified off-site residents, recreational users and commercial workers are not expected.
- Noise and vibration. Potential noise impacts could result from Stages 2, 3 and 4 of the Project. The noise assessment concluded that the Project meets the applicable noise criteria. Nevertheless a negligible residual impact could still potentially occur (e.g. if the noise from the Project further increased a significant noise impact from another project), however this is considered unlikely.
- Traffic, transport and access. The Project would increase the number of trucks and private vehicles using the local road network around Camellia. The predicted residual impact on traffic, transport and access is however assessed as negligible as the Project is not expected to impact on the existing Level of Service (LoS) at key intersections. Although the Project does not impact on the LoS of this the James Ruse Drive, Grand Avenue and Hassall Street intersection, it would increase movements through this intersection and this intersection is likely to be used by other proposed projects whilst the Project is taking place. A management and mitigation measures to manage this potential residual impact is provided in **Chapter 20 Mitigation and management.**

21.5 Project justification

The remediation of the Project Area would:

1. Meet applicable regulatory requirements, including the NSW EPA's requirement that contamination legacies be addressed in a timely and comprehensive manner.
2. Reduce potential human health and ecological risks from the Western Area.
3. Meet the aspirations of GPOP through allowing the Western Area to meet its development potential, allowing for current and future economic activities.

Undertaking the Project in the manner outlined in this EIS is justified, when considering its compatibility with surrounding land uses and the aims of various strategic planning documents as well as its biophysical, social and economic benefits.

21.6 Conclusions

Viva Energy is proposing to remediate contaminated soils in the Western Area (the 'Project') to facilitate future development of the land for other purposes permissible under the existing land use zoning. This EIS provides a comprehensive assessment of the Project, including assessment of various environmental aspects and the identification of potential beneficial and adverse impacts.

The Project conforms to the principles of ESD in that:

- the decision making processes behind the Project have integrated environmental and economic considerations;
- the methodology in undertaking this EIS and the commitments made by Viva Energy to mitigate potential environmental impacts resulting from the Project embody the precautionary principle;
- the Project provides for inter-generational equity by reducing the overall environmental footprint of the Project Area while providing for potential future social and economic benefits through changed land uses;
- with the proposed mitigation measures in place, the Project would not significantly impact on the biological diversity or ecological integrity of the Project Area or its surrounds; and
- this EIS has provided for the evaluation of environmental and related factors that are relevant to the Project, and Viva Energy commits to providing appropriate mitigation measures at its own cost.

This EIS has fully considered the beneficial and adverse effects of the Project, with a full consideration of the principles of ESD as discussed above. If the mitigation and management measures outlined in **Chapter 20 Mitigation and management** of this EIS are implemented, it is unlikely that significant residual impacts would occur within the vicinity of the Project Area and its surrounding environment.

The Project would support the stated objectives through ensuring the on-going operational viability of Clyde Terminal assets. In addition the Project would allow the Western Area to meet its development potential under the GPOP vision, subject to Viva Energy's input; ensuring future development is considerate of operational requirements of the Clyde Terminal. Finally, the Project would enable Viva Energy to meet regulatory requirements to address contamination legacies in a timely and comprehensive manner.

This EIS has concluded that the Project to remediate contaminated soils and manage groundwater in the Western Area, allowing for future development of the land for other purposes as permissible under the existing land use zoning, should proceed as the Project would:

- result in no long term adverse impacts to the environment or local community;
- meet the objectives of the Project to support the ongoing operational viability of the Clyde Terminal while allowing the Western Area to meet its development potential, supporting the GPOP vision;
- satisfy the principles of ESD as described in the EP&A Regulation.

This EIS has highlighted a range of issues which would be addressed through the careful undertaking of the Project.

On the basis of the findings detailed within this EIS, the Project is considered to be justified, would result in positive economic, social and environmental outcomes and should proceed.

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