Detailed Site Investigation

Laing O'Rourke Compound, 32 - 34 Harris Street, North Saint Marys NSW 2760

Prepared for: Laing O'Rourke Pty Ltd

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Abbreviations

ACM	Asbestos Containing Material
ADE	ADE Consulting Group Pty Ltd
AHD	Australian Height Datum
ASS	Acid Sulfate Soils
BGL	Below ground level
BTEX	Benzene, toluene, ethylbenzene, xylene
BR	Blind Replicate
CoC	Chain of Custody
CoPC	Contaminants of Potential Concern
CRC CARE	Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
BYDA	Before You Did Australia
DEC	Department of Environment and Conservation
DO	Dissolved Oxygen
DP	Deposited Plan
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EC	Electrical Conductivity
EILs	Ecological Investigation Levels
EPA	NSW Environment Protection Authority
ESLs	Ecological Screening Levels
HDPE	High-Density Polyethylene
HILs	Health Investigation Levels
HSLs	Health Screening Levels
LEP	Local Environmental Plan
LNAPL	Light Non-Aqueous Phase Liquid
m BGL	meters Below Ground Level
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environmental Protection (Assessment of Site Contamination) Measure
NSW	New South Wales
OCP	Organophosphorus Pesticides
OEH	Office of Environment and Heritage
OPP	Organochlorine Pesticides
PACM	Potential Asbestos Containing Material
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPD	Relative Percent Difference
SAC	Site Assessment Criteria
SEPP	State Environmental Planning Policy
SMF	Synthetic Mineral Fibres
SLS	Sydney Laboratory Services
SWL	Standing Water Level
TOC	Top of Casing
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
USCS	Unified Soil Classification System
VOC	Volatile Organic Compounds

Executive Summary

Laing O'Rourke intends to develop a station plaza at 32-34 Harris Street, North Saint Marys NSW 2760, to be referred to as 'the Site', as part of ongoing development associated to North Saint Marys Station and as a part of Sydney Metro – Western Sydney Airport new metro railway line. The site does not include soil surface or subsoils located beneath developed or temporary building located at 32-34 Harris Street, North Saint Marys NSW 2760. Site development will encompass a carpark, station plaza, footbridge access way to North Saint Marys Station, lift shaft and staircase. (refer to *Appendix H - Site Development Plans*). ADE Consulting Group Pty Ltd (ADE) was engaged by Laing O'Rourke (the client) to undertake a Detailed Site Investigation (DSI) to assess the contamination status of the site and suitability for the proposed development while adhering to the Minister's Conditions of Approval CSSI 10051, specifically Condition E92.

The client provided ADE with previous groundwater, geotechnical and environmental reports relating to the site which were used to develop an internal Sampling Analysis and Quality Plan (SAQP). The SAQP identified the contaminants of potential concern (CoPCs) as: asbestos and Per- and Polyfluoroalkyl Substances (PFAS), heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs), Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, and Xylene (BTEX), Polychlorinated biphenyls (PCBs), Phenols, Cyanide, Organochlorine Pesticides/Organophosphorus Pesticides (OCP/OPP).

Additional analytes such as soil acidity and Cation Exchange Capacity (CEC), Total Organic Carbon (TOC), and Clay Content were added to the analytical suite as test parameters to assist ecological investigation level (EIL) development.

The objectives of the DSI are to:

- Present an assessment of the areas of concern identified in the preliminary desktop study with reference to the internal SAQP prepared by ADE in late 2023.
- Provide an assessment on the suitability of the site for the proposed development in accordance with National Environmental Protection (Assessment of Site Contamination) Measure 2013.

ADE conducted sampling at 12 soil locations across the subject area. Test pitting was advanced using an excavator provided by the client. Following a review of previous studies of soil and groundwater and soil analytical data collected during the investigation, ADE found that:

- All soil samples collected during this investigation reported chemical concentrations below the adopted site assessment criteria. Visual inspection of the subject materials did not identify indicators of PASS, hydrocarbon odours / staining and or ACM.

- Groundwater analytical data adapted from *CPBG Baseline Groundwater Report (Project-wide),* 6 June 2023 identified exceedances of zinc, nickel, lead and copper from onsite monitoring well SMGW-BH-A401 sampled December 2022 against ANZG 95% and 95% Freshwater guidelines. The source of these exceedances could not be located onsite and could not be attributed to contaminants leaching through soil due to minor detection reported in laboratory analysis of soils.

In summary, ADE is of the opinion that all areas of concern outlined in ADE's internal SAQP have been addressed in reference to soil contamination. Groundwater sample exceedances in zinc, nickel, lead and copper as identified within *CPBG Baseline Groundwater Report (Project-wide)* is not attributed to onsite contamination due to the low leachability of heavy metals within the soil samples. Furthermore, none of the analysed soil samples reported concentration of heavy metals above the site assessment criteria refer to *Appendix G – Analytical Reports and Chain of Custody Documentation.*

ADE's review of historical data has indicated that the groundwater level within SMGW-BH-A401 as reported in CPBG Baseline Groundwater Report (Project-wide), Report Reference. SMWSASBT-CPG-SWD-SW000-GE-RPT-040405, June 2023 was encountered at 2.64mbgl. Additionally, ADE Geotechnical Investigation Factual Report, Report Reference A201021.0125.02_v1f, September 2023 noted groundwater seepage in BH06 at 6mbgl, however did not encounter groundwater inflow within the adjacent bore BH07 at a depth of 9.4mbgl.

Due to the variation and uncertainty of groundwater depth encountered throughout the site, ADE cannot accurately provide an estimate of depth to groundwater. In the event of groundwater being encountered during piling and excavation, LOR will manage dewatering in accordance with the procedures outlined in the CEMP.

1 Introduction

1.1 Background and General Information

ADE Consulting Group Pty Ltd (ADE) was engaged by Laing O'Rourke (the client) to undertake a phase II detailed site investigation (DSI) at 32-34 Harris Street, North Saint Marys 2760 New South Wales (NSW) (refer to *Appendix A –Figures*) (the site). The detailed site investigation was undertaken in accordance with Minister's Conditions of Approval CSSI 10051 and under Section 105 of Contaminated Land Management Act 1997 (NSW).

The investigation was designed to assess the site regarding contaminants of potential concern (CoPCs) identified in the previous investigations (Refer to Section 3.5 Previous Investigation Reports) and in accordance with ADE's internal Sampling, Analysis and Quality Plan (SAQP) to determine if the site is suitable for the proposed development.

The fieldworks for this investigation were undertaken on 10 April 2024, which involved the collection and subsequent analysis of soil samples in accordance with relevant industry guidelines. Selected samples were analysed in NATA accredited laboratory and analytical results were compared against the adopted Site Assessment Criteria (SAC) outlined within Section 5, to determine if the site is suitable for the proposed development**.** The current investigation excluded any groundwater sampling, however ADE used monitoring data from an existing groundwater monitoring well located at site.

The purpose of this report is to assess the nature and extent of potential contamination within soil and groundwater at the site. This was undertaken through:

- Completion of a desktop review of previous investigations and known information sources
- Conduct a detailed soil investigation for the identified CoPCs
- Review of pre-existing groundwater monitoring well analytical data to assess the chemical characteristics of the local groundwater system and potential for contamination.
- Submission select collected soil samples to NATA accredited laboratories and
- Preparation of a DSI report outlining the investigations methodology and interpretation of the results to make conclusions and recommendations concerning contamination status of the site in relation to suitability for proposed development

1.2 Proposed Development

Based on conceptual plans provided by the client, ADE understands the proposed development will include a single storey carpark, station plaza, footbridge access way to North Saint Marys Station, lift shaft and staircase as well as landscaped areas. The site development will include a single storey carpark under commercial/industrial land use, and station plaza, with landscaped sections of the site as ecologically exposed portions of site. ADE notes that the proposed site operations will also include trenching for utility connections and/or services required on site.

1.3 Objectives

The primary objective of this investigation is to characterise the vertical and lateral extent of soil and groundwater contamination (if present) within the site and to determine the site suitability for the proposed development. The detailed site investigation was undertaken in accordance with the

Minister's Conditions of Approval CSSI 10051 and under Section 105 of Contaminated Land Management Act 1997 (NSW).

1.4 Scope of Work

The scope of work for the investigation generally involved the following:

- Desktop review including client supplied plans, summary of previous environmental and geotechnical investigations of the site
- Assessment of the contamination status of the site, which may have been impacted by past / present land use and/or off-site contamination from the surrounding area
- Completion of an intrusive investigation program developed in accordance with the *Contaminated Land Guidelines: Sampling design part 1 - application* (NSW EPA 2022) and National Environment Protection (Assessment of Site Contamination) Measure 1999, 2013 Amendment (NEPC 2013)
- Assessment and description of the source, type, extent and level of contamination by comparing the collected soil data against the adopted SAC outlined in guidelines including, but not limited to, NEPM (NEPC 2013), PFAS National Environmental Management Plan Version 2.0 (HEPA 2020) and other relevant guidelines, as outlined throughout this report
- Determination of the potential risks posed to human health and environment (if present) and
- Provision of an assessment of the site and development of recommendations for remedial works or ongoing management based on the findings (if required).

The scope is further split into four phases where details of each phase is provided below:

1.4.1 Phase One – Desktop Review

- Desktop review of the site plans and previous environmental investigations
- Obtain and review Before You Dig Australia (BYDA) documentation.

1.4.2 Phase Two – Field Investigation

- Understand and sign on to a job specific Safety, Health & Environmental Work Method Statement (SH&EWMS) and the completion of a toolbox talk before undertaking works
- Intrusive soil investigation of 12 test pits with a client-supplied 12 tonne excavator,
- Field logging of soil profile as per unified soil classification system (USCS) and site observations
- Soil sampling of the fill and natural profiles
- Field screening of collected samples for Volatile Organic Compounds (VOCs) using a Photo-ionisation Detector (PID) calibrated at 100ppm isobutylene gas.
- Cold storage of all soil samples collected and dispatch of samples to NATA accredited laboratory under chain of custody condition

1.4.3 Phase Three – Analytical Test Work

- Analysis of selected soil samples for the following analytes based on ADE's internal SAQP and preliminary Conceptual Site Model (CSM):
  - Asbestos (500 mL samples),
  - Per- and Polyfluoroalkyl Substances (PFAS),
  - Heavy metals,
  - Polycyclic Aromatic Hydrocarbons (PAHs),

- Total Recoverable Hydrocarbons (TRH),
- Benzene, Toluene, Ethylbenzene, and Xylene (BTEX),
- Polychlorinated biphenyls (PCBs),
- Phenols,
- Cyanide,
- Organochlorine Pesticides/Organophosphorus Pesticides (OCP/OPP),
- pH and Cation Exchange Capacity,
- Total Organic Carbon (TOC); and
- Clay Content (%).

ADE note that potential contamination sources such as former fuel and chemical storage as well as other offsite industrial land uses have been identified in the EIS. The absence of VOCs in the analytical suite may not significantly impact the overall assessment due to alternative parameters like TRH being considered and reporting concentrations below the site assessment criteria. Additionally, a photo-ionisation detector (PID) was used to screen for the presence of VOCs in which no abnormal (1.3 ppm or less) detections were observed during the investigation event, refer to *Appendix E – Data Quality Assessment* and **Table 24 -** *PID reading ranges* for further information.

1.4.4 Phase Four – Data Assessment and Conclusions

- Interpretation of analytical results and field observations in accordance with relevant guidelines described below in Section 1.5
- Preparation of a DSI report outlining the investigation, interpretation of results, and including conclusions and recommendations with reference to the suitability of proposed development with respect to contamination perspective.

1.5 Legislative Requirements and Regulatory Framework

The regulatory framework for this report is based on Australian Standards, Acts and Regulations, and federal and state guidelines that have been made or approved by the NSW Environment Protection Authority (EPA) and includes the following:

- ANZG. (2018). Australian and. New Zealand Guidelines for Fresh and Marine Water Quality
- National Environmental Protection (Assessment of Site Contamination) Measure 1999, amended in 2013
- New South Wales Environment Protection Authority. (2022). Contaminated Land Guidelines - Sampling design part 1 – application.
- New South Wales Environment Protection Authority. (2015). Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997
- New South Wales Environment Protection Authority. (2017). Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme. 3rd Ed
- New South Wales Environment Protection Authority. (2020). Guidelines for Consultants Reporting on Contaminated Land
- NSW Government State Environmental Planning Policy (Resilience and Hazards) 2021
- NSW Government, National Health and Medical Research council (2008). Guidelines for Managing Risks in Recreational Water
- Contaminated Land Management Act 1997
- PFAS National Environmental Management Plan Version 2.0 (2020)
- Protection of the Environment Operations Act 1997
- Protection of the Environment Operations (Waste) Regulation 2014

- Standards Australia. (2004). Australian Standard AS4964-2004: Method for the qualitative identification of asbestos in bulk samples. Sydney, NSW
- Western Australian Department of Health. (2009). Guidelines for the assessment, remediation and management of asbestos contaminated sites
- Work, Health and Safety Act 2011
- Work, Health and Safety Regulation 2017

2 Site Identification

2.1 Site Location

The site is located at 32 - 34 Harris Street, North Saint Marys NSW 2760. Refer to *Appendix A – Figure 1.*

Figure 1. Site layout.

2.2 Summary of Site Details

Table 1 - Summary of Site Details and Information

	Site Details
Site Address	32 - 34 Harris Street, North Saint Marys NSW 2760
Titles Identification	Lot 1, DP 1127305
Site Area	Approximately 2,635 m^2
Current Land Use Zoning	Commercial industrial: E4: General Industrial (Commuter car park and concourse)
Proposed Use	General Industrial/commercial with public access
Local Council	Penrith City Council
Local Environmental Plan (LEP)	Penrith Local Environmental Plan 2010

2.3 Site Condition Summary

The current site condition is summarised in

Table 2 .

Table 2 - Site condition and surrounding environment

Direction	Description
Current and Surrounding Land Use	The surrounding land uses currently surrounding the site are as follows: • North: Harris Street, commercial/industrial buildings are directly to the north, followed by a scrap yard. • West: Saint Marys Station multistorey commuter carpark followed by Forrester Road and further industrial/commercial properties and businesses. • East: Commercial/industrial warehouses and office spaces, with a Speedway petrol station approximately 405 meters north east of the site. • SP2 Railway (Saint Marys Station) followed by small commercial businesses.
Surface Cover and Condition	The site is predominantly covered under asphalt hardstand (former carpark) with 1 freestanding Sydney Metro office building, exposed soil mostly covered with geofabric was observed on the southern boundary of the site. ADE noted multiple temporary demountable buildings are situated on site being used for the surrounding construction activities. No vegetation was observed during the site investigation. Some building debris were observed in sporadic locations across the site. Ballast was observed to cover the southwestern portion of the site, adjacent to the rail corridor. No stockpiles of soil or other waste were observed during the site walkover (refer to *Appendix B – Photographs*).
Other Site Features	One groundwater monitoring well exists within the site from previous geotechnical investigation work. The well (identified as SMGW-BH-A401) has monument covers and appeared to be in good condition. Laing O'Rourke has installed mesh fencing and/or hoarding around the perimeter of the site.

2.4 Local Geology and regional setting

A summary of the known site geology is presented in
Table 3 below**.** This information has been sourced from previous environmental investigations as outlined in Section 3.5 *Previous Investigation Reports*. A summary of the hydrogeological and geological setting for the site is shown in **Table 4**.

Table 3 - Summary of site geology.

Layer	Material Description	Depth of the layer (m BGL)
Fill	SAND / Sandy GRAVELL	Soil surface to maximum depths of approximately 0.1-0.4 m BGL.
Natural	CLAY, medium plasticity	Below fill to maximum depths of approximately 0.4 – 0.6 m BGL.

Table 4 - Regional geological and hydrogeological setting.

Attribute	Description
Site Topography	The site is located at approximately 36 m AHD, with gentle incline to 37 m AHD on the eastern site boundary, sloping to 35 m AHD on the western site boundary. SMGW-BH-A401 is located on the southeastern corner of the site with an approximate AHD of 37 m.
Local Geology and Soils	As per the soil landscape map soil profile report located at SEED, local natural geology includes:

Attribute	Description
	Landscapes: gentle undulating rises on Wianamatta Group Shales, Local relief to 30m. Slopes usually >5%. Broad round crests and ridges with gently inclined slopes. Cleared Eucalypt and open-forest. Soils: shallow to moderately deep (>100cm) hard setting mottled texture contrast soils, Red and Brown Podzolic soils on crests, grading to Yellow Podzolic soils on lower slopes and drainage lines. Observations: moderately reactive highly plastic subsoil, low soil fertility, poor soil drainage. ADE's field observations were consistent with the above.
Acid Sulfate Soils	No indicators of PASS were observed in the materials inspected. As such, the subject soils are not considered to contain PASS/ASS.
Hydrogeology	Local groundwater flow is likely to follow the slope of the site and flow north and north-west, towards Harris Street. There were no existing off-site bores identified within 500 m of the site.
Nearby Surface Water Features	The nearest permanent watercourse, South Creek, is located approximately 930 m southwest of the site.
Salinity	Area of moderate salinity, refer to Appendix *J – Supporting Documents.*

3 Site History

This section outlines the relevant information pertaining to the site history, including a summary of previous investigations provided by the client.

3.1 Heritage Items

St Marys Railway Station Group was identified as heritage item (Listing No: 01249) was listed under the NSW Heritage Act 1977 within a 200 m radius of the site.

3.2 Contaminated Land Record Search

A review of the EPA *'Contaminated Land – Record of Notices'* listed by the NSW EPA under the *Contaminated Land Management Act 1997* (CLM Act 1997) did not identify any notices within a 1 km radius of the site.

A review of the '*List of NSW Contaminated Sites Notified to the EPA*' listed by the NSW EPA under the CLM Act (1997) identified four petrol service stations, Regulation under the CLM Act (1997) is not required for each site, one chemical industry - Regulation under CLM Act not required and four other Industry - Regulation under CLM Act not required / Under assessment within 2km from site.

3.3 Before You Dig Australia

An online search for utilities located within the site was conducted and is summarised in **Table 5.** Asset owners were notified and provided information on their utilities.

Table 5 - Summary of Utilities Located on or Adjacent to the site.

Asset Owner	Utility Type	Utility Location
Endeavour	Energy	Streetlight columns, underground cables and padmount substation are located at the northern portion of the site.

3.4 Groundwater Bore Search

There is one existing groundwater monitoring well on the site (identified as SMGW-BH-A401), as shown in Appendix A - Figures. Analytical results of SMGW-BH-A401 are provided in Annexure C - Laboratory Reports within CPB Contractors Ghella JV Baseline Groundwater Report (Project-wide), 6 June 2023.

CPB Contractors Ghella JV Baseline Groundwater Report noted exceedances of copper, lead, nickel and zinc above the adopted site assessment criteria, refer to *Section 6.2.3 – Groundwater* for additional information.

3.5 Previous Investigation Reports

Previous environmental investigations undertaken at the wider Sydney Metro ST Mary development site or related to the subject site and provided to ADE have been summarized below:

- Sydney Metro – Western Sydney Airport, Chapter 16 – Soils and Contamination
- Sydney Metro – Western Sydney Airport, Technical Paper 8 – Contamination

- Sydney Metro – Western Sydney Airport, Technical Paper Chapter 15 – Groundwater and Geology
- Sydney Metro – Western Sydney Airport, Technical Paper 7 – Groundwater
- ADE Consulting Group - Geotechnical Investigation Factual Report, St Marys Train Station, St Marys NSW 2760) A201021.0125.02_v1f | Date: 24 September 2023.

The above-mentioned reports from Sydney Metro concerning the construction of the Western Sydney Airport and associated infrastructure detail comprehensive assessments of environmental concerns, particularly focusing on soils, contamination, and groundwater.

The assessment of soils and contamination at various sites around St Marys identifies potential sources of contamination, including historical industrial activities such as fuel storage, chemical use, and manufacturing operations. The reports place emphasis on the importance of managing potential risks to prevent soil and water pollution during and after construction. Groundwater flow patterns are also evaluated, with attention to potential changes due to construction activities. Careful monitoring and management to mitigate impacts on nearby water sources and ecosystems are highlighted within the above-mentioned reports.

Detailed analyses of groundwater dynamics in the St Marys area reveal potential drawdown during construction, with measures in place to minimize impacts on groundwater levels and quality. Tanking structures are designed to control groundwater ingress, ensuring post-construction recovery of water levels. Furthermore, ongoing monitoring and management plans are outlined to address potential data gaps and ensure compliance with environmental standards.

ADE's review of historical data has indicated that the groundwater level within SMGW-BH-A401 as reported in CPBG Baseline Groundwater Report (Project-wide), Report Reference. SMWSASBT-CPG-SWD-SW000-GE-RPT-040405, June 2023 was encountered at 2.64mbgl. Additionally, ADE Geotechnical Investigation Factual Report, Report Reference A201021.0125.02_v1f, September 2023 noted groundwater seepage in BH06 at 6mbgl, however did not encounter groundwater inflow within the adjacent bore BH07 at a depth of 9.4mbgl.

Due to the variation and uncertainty of groundwater depth encountered throughout the site, ADE cannot accurately provide an estimate of depth to groundwater. In the event of groundwater being encountered during piling and excavation, LOR will manage dewatering in accordance with the procedures outlined in the CEMP.

3.6 Preliminary Conceptual Site Model

Based on the previous reports, ADE have summarised the preliminary conceptual site model in the sub-sections below.

Prior to works commencing, ADE developed a preliminary Conceptual Site Model (pCSM) in accordance with Schedule B2 – NEPM (2013) to assess the plausible connections between potential contamination source and the receptors. The CSM provides a framework to identify the potential sources of contamination and understand the migration and exposure pathways to sensitive receptors. The main components of the CSM include the sources, pathways and receptors which are discussed below.

The potential contamination sources identified during the pCSM (ADE 2023) included historical use, fill material of unknown origin and surrounding land use. The potential Areas of Environmental

Concern (AEC) and their associated Contaminants of Potential Concern (CoPCs) for the site were identified. These are summarised in Section 3.6.1 & 3.6.2.

3.6.1 Sources and Processes

Potential sources of contamination identified on site or within close proximity to the site, identified in the preliminary CSM and within Sydney Metro – Western Sydney Airport, Technical Paper 8 – Contamination included:

- Uncontrolled fill within the site
- Demolition of commercial / industrial properties
- Use of pesticides beneath/ surrounding previous residential properties
- Soil, groundwater and surface water contamination from on-site migration from offsite sources.
- Hazardous building materials in former site structures
- Former industrial businesses located north of the site (offsite)
- Past industrial land uses including a former wrecker's yard and adjacent former businesses including a bus depot with potential former underground storage tanks (USTs) and plastic manufacturing businesses along Harris Street in St Marys within the construction footprint
- Potential former fuel storage in the Sydney Trains Incident Emergency Response Depot at 1 Station Street in St Marys construction footprint
- Former rail siding within the bus interchange area in Station Street; and rail activities, stockpiling and filling within the existing rail corridor in the St Marys construction footprint
- Up-gradient off-site sources of the St Marys construction footprint and tunnel alignment in St Marys including former dry cleaners and service stations
- potential chemical storage or use and activities at the stabling and maintenance facility including:
  - chemical and oil storage and use within the infrastructure maintenance shed
  - train wash facilities (oil and grease and cleaning chemicals)
  - oil within the traction substation
  - wheel lathe (heavy metals)
  - water quality treatment and on-site detention basin (secondary source of contamination)

3.6.2 Contaminants of Potential Concern (CoPCs)

- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)
- Total recoverable hydrocarbons (TRHs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Benzene, toluene, ethyl-benzene and total xylenes (BTEX)
- Organochlorine pesticides (OCPs)
- Organophosphorus pesticides (OPPs)
- Polyfluoroalkyl Substances (PFAS)
- Perfluorooctane sulfonate (PFOS) + perfluorohexane sulfonate (PFHxS)
- Phenols
- Cyanide (Total)
- Volatile organic compounds (VOCs), and
- Asbestos

3.6.3 Potential pathways

The primary transport mechanisms for migration of contamination at the site may include:

- Transport of contaminants by human and/or mechanical disturbance (e.g., earthworks)
- On-site migration of contaminants from off-site sources via groundwater/surface water pathways
- Infiltration and leaching from unsaturated soils to groundwater
- Volatilization from soil and/or groundwater into vapour

Exposure pathways to the human receptors include:

- Potential dermal, inhalation and oral exposure to impacted soils present at the surface and shallow depths and/or accessible by future excavations within the site
- Potential dermal and oral exposure to groundwater during excavation/ dewatering works, and
- Inhalation of airborne contaminated media (e.g., vapour, dust, asbestos).

3.6.4 Potential receptors

Potential receptors include:

- Future users of the site, such as:
  - Workers at the proposed development site
  - General public
  - Commercial/ retail operators and customers
- Future maintenance workers involved in subsurface excavations
- Future construction workers during redevelopment of the site
- Vegetations introduced as part of the redevelopment
- Human and ecological receptors in nearby water bodies – South Creek (offsite).

Table 6 was developed by ADE in conjunction with Sydney Metro – Western Sydney Airport, Technical Paper 8 – Contamination (Table 1-7 Preliminary CSM – St Marys construction footprint [AEC 1: Commuter car park at 36-38 Harris Street, St Marys North]) to identify any outstanding data gaps pertaining to the site contamination status. Prior to fieldwork commencing at the site, a preliminary SAQP was developed to establish a sampling plan, methodology and investigation pattern which is detailed in the following sections.

Table 6 - Preliminary Conceptual Site Model

Potential Contamination Source	COPCs	Potential Exposure Pathways and Transport Mechanisms	Receptors
Uncontrolled fill within the site	TRH, BTEX, OCP, OPP, VOC, PCB,PAHs heavy metals and asbestos	- Dermal, oral exposure - Inhalation of dust/fibres - Leaching to groundwater and lateral migration - Disturbance during construction	- On-site construction Workers - Off-site human receptors - Future site users - South Creek - Ecological receptors (vegetation) - Off-site commercial/industrial
Demolition of commercial/industrial properties	Heavy metals, asbestos, PCB's		
Former industrial land uses including a former wrecker's yard and adjacent former businesses, underground storage tanks	TRH, BTEX, VOCs, SVOCs, heavy metals, (soil and groundwater)		

Potential Contamination Source	COPCs	Potential Exposure Pathways and Transport Mechanisms	Receptors
Use of pesticides beneath/surrounding previous residential properties	OCP/OPP	- Volatilization and inhalation of vapours - Surface water runoff - Vapour intrusion	
Soil, groundwater, and surface water (run off) contamination from on-site migration from offsite sources.	TRH, BTEX, VOCs, PFAS, heavy metals	- Workers encountering groundwater during excavation - Ecological interaction with groundwater	
Hazardous building materials in former site structures	Asbestos, PFAS, heavy metals, PCBs (in soil)	- Dermal, oral exposure - Inhalation of dust/fibres - Disturbance during construction - Volatilization and inhalation of vapours	- Construction Workers - Off-site human receptors
Potential former fuel storage in the Sydney Trains Incident Emergency Response Depot at 1 Station Street in St Marys construction footprint	TRH, BTEX, PAHs, VOCs, SVOCs, heavy metals, (soil and groundwater)	- Dermal contact - inhalation exposure - Leaching to groundwater and lateral migration - Soil contamination	Construction Workers
Former rail siding within the bus interchange area in Station Street; and rail activities, stockpiling and filling within the existing rail corridor in the St Marys construction footprint	Phenols, cyanide, TRH, BTEX, VOCs, PAHs		Construction Workers
Potential chemical storage or use and activities at the stabling and maintenance facility including	Heavy metals, TRHs, BTEX, PAH's		- Workers involved with construction, ecological receptors (vegetation)
Off-site industrial land-use, groundwater	TRH, VOCs and PFAS	Vapour intrusion	On-site intrusive maintenance workers

3.6.5 Data Gaps

Based on the available data and summary of previous reports provided above, ADE considers the following data gaps were required to be assessed in the DSI:

- Asbestos gravimetric assessment as per NEPM (2013) throughout the site to confirm suitability of soils to remain on site or be re-used in other areas of the site following basement excavation
- Additional chemical assessment of soils to provide full site coverage

- Assessment of legacy groundwater investigation data
- Waste classification of soils requiring offsite disposal

The results of the investigation and discussion of the above data gaps is presented in the following sections.

ADE's review of historical data has indicated that the groundwater level within SMGW-BH-A401 as reported in CPBG Baseline Groundwater Report (Project-wide), Report Reference. SMWSASBT-CPG-SWD-SW000-GE-RPT-040405, June 2023 was encountered at 2.64mbgl. Additionally, ADE Geotechnical Investigation Factual Report, Report Reference A201021.0125.02_v1f, September 2023 noted groundwater seepage in BH06 at 6mbgl, however did not encounter groundwater inflow within the adjacent bore BH07 at a depth of 9.4mbgl.

Due to the variation and uncertainty of groundwater depth encountered throughout the site, ADE cannot accurately provide an estimate of depth to groundwater. In the event of groundwater being encountered during piling and excavation, LOR will manage dewatering in accordance with the procedures outlined in the CEMP.

4 Sampling Plan, Methodology and Investigation Pattern

4.1 Pre-work Procedure

Before mobilisation to site, a job-specific safety, health & environmental work method statement (SH&EWMS) was developed, presented in a pre-start meeting before the commencement of works and signed on to by ADE staff and contractors.

After completing the preliminaries, an experienced environmental consultant undertook a detailed site walkover to identify potential sources of contamination or areas of concern. Upon completion, the proposed test pit locations were marked out across the site based on accessibility and observations noted during the walkover. Before the commencement of intrusive activities, each proposed test pit location was 'cleared' for underground services via persisting survey data.

4.2 Sampling Design Plan Strategy and Rationale

The site investigation and sampling procedures were developed in consultation with the NSW EPA *Contaminated Land Guidelines: Sampling design part 1 – application* (2022). The sampling plan consisted of a representative sampling approach to adequately cover the site while avoiding services and address data gaps.

4.3 Soil Sampling Methodology

Test pits were excavated using an excavator. Each test pit was visually inspected for any signs of contamination i.e., staining, odours etc. Soil samples were collected directly from the excavator bucket.

Soil samples for asbestos assessment were collected for quantitative assessment (DoH, WA 2009) as endorsed by NEPM (2013). 10L samples of soil were collected from fill materials within each test pit, directly below the asphalt hardstand, weighed, and screened on site for the presence of ACM. A 500 mL soil sample was collected from each test pit, at varying depths across the test pits All of the 12 collected samples were analysed for asbestos fines (AF) / fibrous asbestos (FA) as per NEPM (2013) guidelines.

All soil samples were screened for the presence of VOCs using a PID calibrated with isobutylene gas at 100 ppm. Procedure involved placing the soil sample in a resealable plastic zip lock bag, agitating the sample then inserting the PID tip into the headspace and recording the reading.

Test pits were logged to the Unified Soil Classification System (USCS), making appropriate observations based on visual or olfactory evidence of contamination i.e., staining or odours.

A total of 12 test pits were advanced on 10 April 2024, a total of 17 fill samples were collected for the purpose of analytical testing form from depths ranging between 0.1 – 0.4 mbgl and 8 natural samples from depths ranging between 0.4 – 0.6 mbgl.

4.4 Equipment Decontamination

ADE undertook soil sampling from an excavator bucket. ADE ensured the sampling bucket was visually free of any soil materials between sample locations, with samples collected from the centre of the bucket where the soil material was not in contact with the bucket itself. Decontamination was

undertaken for all non-disposable sampling equipment prior to sampling and between each sampling point.

4.5 Documentation

A test pit log was recorded at each sampling point. Details recorded include:

- Sample ID
- Soil profile
- Sampling methodology
- Sample identification
- Sample description
- Field measurements
- Any relevant notes or observations
- Sample point measurements

4.6 Contaminants of potential concern

Based on the review of former site history and previous investigations undertaken for the site and the contaminants of potential concern outlined in Section 3.6.2, ADE proposed the following analytical schedule for the soil assessment:

- Asbestos (500 mL samples),
- Per- and Polyfluoroalkyl Substances (PFAS),
- Heavy metals,
- Polycyclic Aromatic Hydrocarbons (PAHs),
- Total Recoverable Hydrocarbons (TRH),
- Benzene, Toluene, Ethylbenzene, and Xylene (BTEX),
- Polychlorinated biphenyls (PCBs),
- Phenols,
- Cyanide,
- Organochlorine Pesticides/Organophosphorus Pesticides (OCP/OPP),
- Soil pH and Cation Exchange Capacity,
- Total Organic Carbon (TOC); and
- Clay Content (%).

4.7 Laboratory Submission and Analytical Plan

Soil samples were analysed by Sydney Laboratory Services (SLS) (primary laboratory) and Envirolab (secondary laboratory) specifically:

- 23 primary soil samples collected by ADE on 10 April 2024 for analysis of Heavy Metals, TRHs, PAHs, BTEX, PCB, OCPs, OPPs, pH/EC, asbestos, PFAS, Cyanide, and Phenols (4 samples analysed for PFAS, Cyanide, and Phenols) were submitted to SLS
- 2 secondary soils samples collected by ADE on 10 April 2024 for analysis of pH/EC, Total Organic Carbon (TOC), Iron, Carbon Exchange Capacity (CEC) and Clay Content were submitted to Envirolab
- 2 blind replicate soil sample (QAQC) collected by ADE on 10 April 2024 for analysis of Heavy Metals, TRHs, PAHs, BTEX, PCBs, OCPs, and OPPs were submitted to SLS
- 2 split replicate soil collected by ADE on 10 April 2024 for analysis of Heavy Metals, TRHs, PAHs, BTEX, OCPs, OPPs were submitted to Envirolab.

- 1 trip blank/spike samples (QAQC) collected on 10 April 2024 for analysis of BTEX were submitted to SLS

The fill and natural materials encountered throughout the investigation were consistent across the site and were observed visually to be consistent. Samples were collected and analysed at a density which was in accordance with the *Contaminated Land Guidelines: Sampling design part 1 - application* (NSW EPA 2022).

4.7.1 Deviations from the SAQP (ADE 2022)

ADE notes that the original proposed test pit locations were amended onsite and ground truthed against a service location investigation to avoid contact with live or redundant services. The test pit frequency was also reduced from 13 to 12 test pit locations.

All test pit locations remained representative of the subject area post amendment.

4.7.2 Sample Analytical Program

Table 7 outlines the sampling and analytical program for analysis of soil, sediment and groundwater samples collected during this investigation. Refer to *Appendix G – Analytical Reports* and *Chain of Custody* for the analytical methods by the selected laboratories.

Table 7- Sampling and Analytical Program (Soil)

Sample ID	Depth (m)	Sample Type	Analysis												
			Standard Chemical	Asbestos[2] 500mL	Asbestos 10L Screen	PID Field Screening	On Hold	PFAS Short Suite	Cyanide	Phenols	pH/EC	Total Organic Carbon	Iron	Cation exchange	Clay Content
21.0125.DSI_TP1_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP1_Fill(0.3)	0.3	Fill	X												
21.0125.DSI_TP1_NAT(0.4)	0.4	Natural					X								
21.0125.DSI_TP2_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP2_Fill(0.4)	0.4	Fill					X								
21.0125.DSI_TP2_NAT(0.5)	0.5	Natural	X												
21.0125.DSI_TP3_Fill(0.1)	0.1	Fill	X	X	X	X		X	X	X					
21.0125.DSI_TP3_Fill(0.4)	0.4	Fill	X												
21.0125.DSI_TP3_NAT(0.5)	0.5	Natural					X								
21.0125.DSI_TP4_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP4_Fill(0.3)	0.3	Fill													
21.0125.DSI_TP4_NAT(0.4)	0.4	Natural	X												
21.0125.DSI_TP5_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP5_Fill(0.2)	0.2	Fill					X								
21.0125.DSI_TP5_NAT(0.3)	0.3	Natural					X								
21.0125.DSI_TP6_Fill(0.1)	0.1	Fill	X	X	X	X		X	X	X					
21.0125.DSI_TP6_Fill(0.3)	0.3	Fill	X												
21.0125.DSI_TP6_NAT(0.5)	0.5	Natural	X												
21.0125.DSI_TP7_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP7_Fill(0.2)	0.2	Fill					X								
21.0125.DSI_TP7_NAT(0.3)	0.3	Natural					X								
21.0125.DSI_TP8_Fill(0.1)	0.1	Fill	X	X	X	X									

Sample ID	Depth (m)	Sample Type	Analysis												
			Standard Chemical	Asbestos[2] 500mL	Asbestos 10L Screen	PID Field Screening	On Hold	PFAS Short Suite	Cyanide	Phenols	pH/EC	Total Organic Carbon	Iron	Cation exchange	Clay Content
21.0125.DSI_TP8_Fill(0.3)	0.3	Fill	X												
21.0125.DSI_TP8_NAT(0.4)	0.4	Natural	X												
21.0125.DSI_TP9_Fill(0.1)	0.1	Fill	X	X	X	X		X	X	X					
21.0125.DSI_TP9_Fill(0.3-0.4)	0.3-0.4	Fill					X								
21.0125.DSI_TP9_NAT(0.5)	0.5	Natural					X								
21.0125.DSI_TP10_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP10_Fill(0.2)	0.2	Fill					X								
21.0125.DSI_TP10_NAT(0.4)	0.4	Natural	X												
21.0125.DSI_TP11_Fill(0.1)	0.1	Fill	X	X	X	X									
21.0125.DSI_TP11_Fill(0.4)	0.4	Fill					X								
21.0125.DSI_TP11_NAT(0.5)	0.5	Natural					X								
21.0125.DSI_TP12_Fill(0.1)	0.1	Fill	X	X	X	X		X	X	X					
21.0125.DSI_TP12_Fill(0.3)	0.3	Fill	X												
21.0125.DSI_TP12_NAT(0.6)	0.6	Natural	X												
21.0125.01_TP3	0.1	Fill									X	X	X	X	X
21.0125.01_TP12	0.1	Fill									X	X	X	X	X
21.0125.DSI_BR1	0.1	Fill	X												
21.0125.DSI_BR2	0.1	Fill	X												
21.0125.DSI_SR1	0.1	Fill	X												
21.0125.DSI_SR2	0.1	Fill	X												

Notes to Table 7

1 – Standard suite of analysis includes BTEX, Heavy Metals, OCPs / OPPs, PAHs, PCB, TRHs, vTRHs

2 – 500 mL asbestos sample, as per NEPM (2013)

3 – Replicate suite of analysis includes Heavy Metals, OCPs / OPPs, PAHs, TRH and BTEXN

5 Site Assessment Criteria

5.1 Soil Assessment Criteria

The assessment criteria specified in the following publications were considered for this assessment:

- National Environment Protection Council [NEPC], National Environmental Protection Measure [NEPM] Schedule B1 (2013)
- New South Wales EPA [NSW EPA], Waste Classification Guidelines. Part 1: Classifying Waste (2014)
- Heads of the EPA, PFAS National Environmental Management Plan [PFAS NEMP], Version 2.0 (2018)

5.1.1 Soil Health Investigation Levels (HILs)

The NEPM (NEPC 2013) guidelines stipulate four generic land use settings for assessment used in the first stage (Tier 1 or 'screening') of potential risks to human health for a broad range of metals and organic substances. The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The four HIL categories are used to assess human health risk via all relevant pathways of exposure for the following broad land use categories:

- HIL-A - Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, no poultry, also includes children's day care centres, preschools, and primary schools
- HIL-B - Residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats
- HIL-C - Public open space such as parks, playgrounds, playing fields (e.g., ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate
- HIL-D - Commercial / industrial such as shops, offices, factories, and industrial sites

Based on available information, which includes future land use as commercial/industrial, a summary of the decision-making process is provided in **Table 8**. Noting that there will be access to soils through landscaped areas and garden beds, ADE considers that adopting the HIL-D assessment criteria at this location is warranted.

Table 8 - Decision making process for health investigation/screening level application.

Site area	Applicable HIL / HSL criteria
Commercial / industrial	HIL-D / HSL-D

5.1.2 Soil Health Screening Levels (HSLs)

HSLs have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation and direct contact pathways. The HSLs depend on specific soil physicochemical properties, land use scenarios, and the characteristics of building structures.

Health screening levels for petroleum hydrocarbon compounds are outlined in Section 2.4 of Schedule B1 of NEPM (NEPC 2013). These include tier 1 screening criteria for BTEX, naphthalene, TRH fractions C_6-C_{10} and C_{10}-C_{16} for vapour intrusion as well as TRH fractions C_{16}-C_{34} and C_{34}-C_{40} for direct contact. HIL-D screening levels will be adopted across the site (**Table 9**) for both vapour intrusion and direct contact pathways.

The soil HSLs that have been adopted for the site are for shallow depth (0m to <1m) as it is expected that natural soils will be encountered at depths less than 1 mBGL and/or be covered in hardstand. The soil type selected for the assessment criteria is sand to adopt a conservative approach.

5.1.3 Management Limits

In accordance with Section 2.9 of Schedule B1 of the ASC NEPM (NEPC 2013), consideration of Management Limits for petroleum hydrocarbons will be undertaken to assess whether the reported soil conditions have the potential to pose a risk to buried infrastructure, or the formation of non-aqueous phase liquid (NAPL). Values for coarse grained soils from Table 1 B(6) of Schedule B1 of the NEPM (NEPC 2013) will be adopted.

A summary of the adopted TRH management limits for this site is provided in **Table 9**.

Table 9 - Summary of adopted TRH Management Limits

Chemical	Units	Management Limits (commercial/industrial)	HSL-D for Direct Contact
F1 C_6-C_{10}	mg/kg	700	26,000
F2 C_{10}-C_{16}	mg/kg	1,000	20,000
F3 >C_{16}-C_{34}	mg/kg	3,500	27,000
F4 >C_{34}-C_{40}	mg/kg	10,000	38,000
Benzene	mg/kg	NL	430
Toluene	mg/kg	NL	99,000
Ethylbenzene	mg/kg	NL	27,000
Xylene	mg/kg	NL	81,000
Naphthalene	mg/kg	NL	11,000

5.1.4 Soil HSLs for Asbestos

Further characterisation of in-situ fill material was assessed against NEPM (NEPC 2013) for asbestos in soils. The action criteria outlined in **Table 10** was adopted as per the specific land use scenario for the specific portion of the site.

Table 10 - Summary of adopted HSLs for asbestos contamination in soil

Form of Asbestos	Health Screening Level (w/w) – Commercial/Industrial D
Bonded ACM	0.05%
FA and AF (friable asbestos)	0.001%
All forms of asbestos	No visible asbestos for surface soils

5.1.5 PFAS NEMP 2.0

The HEPA *PFAS National Environmental Management Plan Version 2.0 (2020)* provides guidance on the management of PFAS impacted soils. The classes of soil criteria defined in the PFAS NEMP Version 2.0 (HEPA 2020) for human Health Investigation Levels (HIL) and ecological investigation levels are presented in **Table 11**.

Table 11 – Summary of PFAS Human Health Soil Criteria

Soil Criteria (Human Health)	PFOS + PFHxS (mg/kg)	PFOA (mg/kg)
Commercial/Industrial (HIL-D)	20	50

Table 12 - Summary of PFAS Ecological Soil Criteria

Soil Criteria (Ecological) – all land uses	PFOS (mg/kg)	PFOA (mg/kg)
Ecological direct exposure	1	10
Ecological indirect exposure	0.01	N/A
Ecological indirect exposure in areas of low accessible soil	0.14	N/A

The proposed development will have a significant proportion of the land covered by hard surfaces however, majority of the site will be accessible by the public as per the provided site development plans given to ADE. Using a conservative approach, ADE will apply PFAS NEMP (HEPA 2020) commercial / industrial exposure guideline values to all areas of the site.

ADE notes that there is a PFAS NEMP 3.0 draft (HEPA, unpublished) which is released for public consultation and has reviewed these guidelines for updates to assessment criteria. The only guideline value to have changed is for ecological indirect exposure for PFOA to be 0.005 mg/kg. The results for this assessment showed no detections of PFOA at the LOR of 0.005 mg/kg, thus ADE considers the updated guidelines to not have an impact on the assessment of the site's suitability for the proposed development.

5.1.6 Ecological investigation and screening levels (EILs / ESLs)

Generally, Ecological Investigation Levels (EILs) are associated with selected metals and organic compounds and have been developed for assessing risk to terrestrial ecosystems under areas of ecological significance, urban residential/open space, and commercial/industrial land use scenarios. They apply to the top 2 m of accessible soil, which corresponds to the root zone and habitation zone of many species.

The proposed development as outlined in Section 5.1.1 contains commercial/industrial land use with accessible soils only present within the garden bed and landscaped areas of the site. As such, assessment of ecological risks against recreational ecological criteria is warranted for these areas.

Additionally, ecological screening levels (ESLs) have been developed for selected petroleum compounds and fractions and are applicable for assessing risk to terrestrial ecosystems. The ESLs broadly apply to coarse-grained soils and are applicable to the top 1 m of accessible soil.

The EILs and ESLs (commercial/ industrial) for TRH, BTEX and benzo(a)pyrene in soils from Schedule B1 in the ASC NEPM (NEPC 2013) are summarised in **Table 13**.

Using a conservative approach, ADE has adopted generic EILs for commercial, industrial uses, using the lower criteria for coarse or fined-grained soils as limited site data currently exists.

Table 13 - Ecological Investigation and Screening Levels in Soil

Chemical	Units	Ecological Investigation Level (EIL) For Commercial/ Industrial	Ecological Screening Level (ESL) for Commercial/ Industrial
Arsenic	mg/kg	160	
Chromium (III)	mg/kg	680	
Copper	mg/kg	330	
Lead	mg/kg	1,800	
Nickel	mg/kg	770	
Zinc	mg/kg	1200	

Chemical	Units	Ecological Investigation Level (EIL) For Commercial/ Industrial	Ecological Screening Level (ESL) for Commercial/ Industrial
Naphthalene	mg/kg	370	
DDT[1]	mg/kg	640	
F1 C_6-C_{10} (minus BTEX)	mg/kg		215
F2 C_{10}-C_{16}	mg/kg		170
F3 >C_{16}-C_{34}	mg/kg		1,700
F4 >C_{34}-C_{40}	mg/kg		3,300
Benzo(a)pyrene[2]	mg/kg		0.7
Benzene	mg/kg		75
Toluene	mg/kg		135
Ethylbenzene	mg/kg		165
Xylenes	mg/kg		180

5.2 Groundwater Criteria

The criteria specified below have been adopted for the groundwater investigation as shown in **Table 14** and **Table 15**.

- Assessment of Site Contamination, National Environment Protection (Assessment of Site Contamination) Measure, 2013 (NEPC 2013)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018 (ANZG, 2018)
- PFAS National Environmental Management Plan [PFAS NEMP], Version 2.0 (HEPA 2020)
- PFAS National Environment Management Plan [PFAS NEMP] draft Version 3.0 (HEPA)

Fresh water criteria have been adopted for both NEPM GILs and ANZG 2018 water quality guidelines due to the locality of the St. Marys catchment being influenced by freshwater conditions. As such, groundwater criteria of 95% species protection have been adopted. Groundwater HSLs for vapour intrusion for residential and commercial/industrial land use scenarios are also provided for assessment of the inhalation exposure pathway.

PFAS NEMP 2.0 (2020) guidelines were adopted for the assessment of PFAS in the groundwater. While there were no guideline exceedances in the soil, it should be noted that low levels of PFAS can leach into the groundwater and potentially exceed acceptable thresholds. However, no PFAS exceedances were reported during soil analytical testing, the leaching risk to groundwater is considered low. This was supported by groundwater analysis conducted in December 2022 by CPBG Baseline Groundwater Report, which found zero PFAS detections.

Table 14 - Site Assessment Criteria (NEPM and ANZG) for groundwater (µg/L)

Analyte	NEPM 2013, Groundwater Investigation Levels (GILs)	NEPM 2013, Groundwater HSLs for vapour intrusion (sand) 2m to < 4m	ANZG 2018, Water Quality Guidelines	CPBG Baseline Groundwater Report (Project-wide) SMGW-BH-A401
	Fresh Waters (µg/L)[3]	Commercial/Industrial (µg/L)	Toxicant Default Guideline Values for Freshwater Level of Protection (95% species) (µg/L)	
Arsenic (total)	24 (As III) 13 (As V)	-	24 (As III) 13 (As V)	<10
Cadmium[1]	0.2	-	0.2	<1[7]
Chromium Cr (VI)	1[2]	-	1.0	<10[7]
Copper[1]	1.4	-	1.4	**3240**
Lead[1]	3.4	-	3.4	**45**
Mercury (Total)	-	-	0.6	<0. 1
Nickel[1]	11	-	11	**107**
Zinc[1]	8[3]	-	8	**207**
DDT	0.006[1]	-	0.006[5]	<4[7]
Benzo(a)pyrene	-	-	-	<0.5
Aldrin and Dieldrin	-	-	-	<0.4
Chlordane	0.08[1]	-	0.03[5]	<0.5[7]
Endosulfan	0.02[1]	-	0.2[2]	<0.5[7]
Endrin	0.02[1]	-	0.01[5]	<2[7]
Heptachlor	0.09[1]	-	0.01[5]	<2[7]
Chlorpyrifos	0.01[1]	-	0.01	<2[7]
Benzene	950	5000	950	<1
Toluene	NL	NL	180	<2
Ethyl Benzene	NL	NL	80	<2
P Xylene	200[4]	NL	200[4]	<2
m Xylene	-	-	75	<2
o Xylene	350	-	350	<2
Lindane	0.2	-	0.2	NR
Styrene	-	-	-	<5
Bromophos-ethyl	-	-	-	<0.5
Diazinon	0.01	-	0.01	<2[7]
Dichlorvos	-	-	-	<2
Dimethoate	0.15	-	0.15	<2[7]
Ethion	-	-	-	<2
Fenitrothion	0.2	-	0.2	NR
Methoxychlor	-	-	-	<2.0
Phenol	320	-	320	<2
Naphthalene	16	NL	16	<5
1,2-dichlorobenzene	160	-	160	<2
1,4-dichlorobenzene	60	-	60	<2
Chlorobenzene	55	-	-	<5
1,1-dichloroethene	700	-	-	<5
1,2-dichloroethane	1,900	-	-	<5
Hexachlorobutadiene	-	-	-	<2[7]

Analyte	NEPM 2013, Groundwater Investigation Levels (GILs)	NEPM 2013, Groundwater HSLs for vapour intrusion (sand) 2m to < 4m	ANZG 2018, Water Quality Guidelines	CPBG Baseline Groundwater Report (Project-wide) SMGW-BH-A401
	Fresh Waters (µg/L)[3]	Commercial/Industrial (µg/L)	Toxicant Default Guideline Values for Freshwater Level of Protection (95% species) (µg/L)	
Tetrachloroethene	70	-	-	<5[7]
TRH C6-C10	-	6000	-	<20
TRH C10-C16	-	NL	-	<100
PFHxS	-	-	-	<0.01
PFOS	-	-	-	<0.01
PFOA	-	-	-	<0.01

Notes to Table 14
NL Not Limiting
NR Not Reported
1 – Chemical for which possible bioaccumulation and secondary poisoning effects should be considered.
2 – Figure may not protect key species from chronic toxicity.
3 – Investigation levels apply to typical slightly-moderately disturbed systems.
4 – Xylene as p-xylene.
5 – Due to the bioaccumulative nature of these toxicants, the 99 protection level is recommended
6 – Based on the updated ADWG (NHMRC 2011)
7 – Value of LOR (Limit of Reporting)

Table 15 - PFAS Groundwater Criteria

Soil Criteria (Ecological)	Units	PFOS	PFOA	PFHxS	Sum of PFOS and PFHxS
PFAS NEMP 2020 Freshwater – 95% Species protection	µg/L	0.13	220		

5.3 Aesthetics

As outlined in Section 3.6 of NEPM Schedule B1, the aesthetic quality of accessible soils should be considered even if analytical testing demonstrates that concentrations of CoPCs are within the SAC.

There are no quantifiable guidelines in determining if soils are appropriately aesthetic. As advised by the NEPM, professional judgement should be employed regarding quantity, type, and distribution of foreign materials and/or odours in relation to the specific land use.

The following examples would trigger further aesthetic assessment:

- Hydrocarbon sheen on groundwater
- Presence of anthropogenic materials and/or soil staining
- Odorous soils or groundwater (i.e., hydrocarbon or hydrogen sulphide odours)
- Asbestos or other foreign materials on soil surface

6 Results

6.1 Field Observations

6.1.1 Site Soil and Sub-Surface Geology

The typical soil stratigraphy encountered during the field investigation is detailed in **Table 16** (refer *Appendix B – Photographs* and *Appendix F – Borehole Logs*). The upper soil profile around the site varied depending on the location. The depths of fill across the site were generally shallow, limited to the top 400mm below soil surface. The fill was predominantly consistent across the site, majority of test pits encountered demonstrated more than one fill lithology.

Table 16 - Encountered sub-surface lithology

Layer	Depth Range (mBGL)	Material Description	General Observations
Fill/Topsoil	0.0 – 0.3	SAND: medium grained sand, poorly sorted with mixed gravels, dark brown, moist.	Topsoil was encountered within all test pits across all areas of the site. This was typically limited to the top 0.3 lithological strata. Building debris and other foreign materials were encountered in select western test pit locations.
Fill / Reworked Materials	0.3 - 0.4	Sandy GRAVEL: medium grained sand, light and dark brown in colour, small to large size gravels, moist.	Imported fills encountered throughout the entirety of the site. This ranged from beneath the topsoil and beneath other imported fill materials down to the natural layers.
Natural Clay	0.4 – 0.6	CLAY: moderate plasticity, light brown with grey orange and red inclusions, some fines.	Typically occurred below layers of imported local material or imported fill material.

6.1.2 Groundwater

Groundwater analytical data adapted from *CPBG Baseline Groundwater Report (Project-wide),* 6 June 2023 identified exceedances of heavy metals including zinc, lead, nickel and copper from onsite monitoring well SMGW-BH-A401 sampled in December 2022 against ANZG 2018 (95% species protection - Freshwater guidelines). The source of these exceedances may not be attributed to on-site contamination leaching through soil.

ADE's review of historical data has indicated that the groundwater level within SMGW-BH-A401 as reported in CPBG Baseline Groundwater Report (Project-wide), Report Reference. SMWSASBT-CPG-SWD-SW000-GE-RPT-040405, June 2023 was encountered at 2.64mbgl. Additionally, ADE Geotechnical Investigation Factual Report, Report Reference A201021.0125.02_v1f, September 2023 noted groundwater seepage in BH06 at 6mbgl, however did not encounter groundwater inflow within the adjacent bore BH07 at a depth of 9.4mbgl.

Due to the variation and uncertainty of groundwater depth encountered throughout the site, ADE cannot accurately provide an estimate of depth to groundwater. In the event of groundwater being encountered during piling and excavation, LOR will manage dewatering in accordance with the procedures outlined in the CEMP.

6.2 Summary of Analytical Results

6.2.1 Soil Chemical Results

A total of 12 soil test pits were excavated at a selected rate of 12 test pits, 27 soil samples assessed for chemical contamination with 12 test pit location assessed and screened for asbestos within the top fill horizon.

Soil analytical results from the 12 test pits submitted for chemical analysis are presented in *Appendix G – Analytical Results* at the end of this report. For full analytical suite of test pits assessed see **Table 7-** Sampling and Analytical Program (Soil). Chemical concentrations reported for soil samples were less than the adopted health and ecological-based investigation and screening levels, a total of 27 soil samples were analysed for the suite of analysis Refer to **Table 7-** Sampling and Analytical Program (Soil).

6.2.2 Asbestos

10L screening was undertaken at all 12 test pit locations, with one 10L sample collected for screening form the top fill horizon within each test pit. No Fragments of fibre cement were observed within any of the 10L samples collected or visually identified during fieldworks.

ADE collected twelve, 500 mL soil samples for analysis of asbestos fines (AF) and fibrous asbestos (FA) in accordance with NEPM guidance. There were no detections of AF/FA within any of the twelve, 500mL soil samples submitted for analysis. Collection of 500 mL samples was undertaken within the fill layer at each location, noting that fill did not exceed 0.4 m depth at any of the test pit locations. No soil samples were collected for asbestos analysis from the natural profile.

6.2.3 Groundwater

The historical data from groundwater monitoring well SMGW-BH-A401 collected by CPBG noted exceedances of heavy metals (refer to *Appendix A - Figures, Appendix D – Results Table* and *Appendix G – Analytical Reports and Chain of Custody*). **Table 17** below identifies the exceedance the subject monitoring well.

The exceedances of the CoPCs analysed included the following:

- Heavy Metals: exceedances of ANZG 95%, and ANZG 95% Freshwater for copper, lead, nickel and zinc.

Table 17 - Groundwater Exceedances for Dissolved Heavy Metals (SMGW-BH-A401) dated 15-Dec-2022.

Contaminant	Units	Analyte Result	Exceedance Criteria
Copper	µg/L	3,240	ANZG Freshwater 95% LOSP Toxicant DGVs (0.0014 mg/L)
Zinc	µg/L	207	ANZG Freshwater 95% LOSP Toxicant DGVs (0.008 mg/L)
Nickel	µg/L	107	ANZG Freshwater 95% LOSP Toxicant DGVs (0.0011 mg/L)
Lead	µg/L	45	ANZG Freshwater 95% LOSP Toxicant DGVs (0.0034 mg/L)

7 Revised Conceptual Site Model

7.1 Current contamination status of site

None of the CoPC's identified within the pCSM exceeded the SAC, ADE consider the potential sources of contamination identified within the pCSM appropriately addressed within this investigation. ADE considers that the risk of chemical contamination on human and ecological health to be low. Refer to **Table 24** for PID reading ranges.

Table 18, which was developed in conjunction with Sydney Metro – Western Sydney Airport, Technical Paper 8 – Contamination (Table 1-7 Preliminary CSM – St Marys construction footprint [AEC 1: Commuter car park at 36-38 Harris Street, St Marys North]) below shows the relevant contaminated sources, CoCPs, potential exposure pathways, receptors, and an assessment of the status of the pathway.

Table 18 – Revised Conceptual Site Model.

Potential Contamination Source	COPCs	Potential Exposure Pathways and Transport Mechanisms	Receptors	SPR Link Comments	Potentially Complete SPR	Potential Risk
Uncontrolled fill within the site	TRH, BTEX, OCP, OPP, PCB,PAHs heavy metals and asbestos	- Dermal, oral exposure - Inhalation of dust/fibres - Leaching to groundwater and lateral migration - Disturbance during construction - Volatilization and inhalation of vapours	Construction Workers - Future site users - South Creek - Ecological receptors (vegetation)	COPCs were not detected above the SAC .	No	Low
Demolition of commercial/industrial properties	Heavy metals, asbestos, PCB's				No	Low
Former industrial land uses including a former wrecker's yard and adjacent former businesses	TRH, BTEX, VOCs, heavy metals				No	Low
Use of pesticides beneath/surrounding previous residential properties	OCP/OPP				No	Low
Soil, groundwater, and surface water (run off) contamination from on-site migration from offsite sources.	TRH, BTEX, VOCs, PFAS, heavy metals	- Workers encountering groundwater during excavation - Ecological interaction with groundwater		COPCs were not detected above the SAC Groundwater well SMGW-BH-A401, located in the upgradient part of the site (capturing	No	Low

Potential Contamination Source	COPCs	Potential Exposure Pathways and Transport Mechanisms	Receptors	SPR Link Comments	Potentially Complete SPR	Potential Risk
				water from offsite sources), did not exceed any SAC, with the exception of some heavy metals which are attributed to regional groundwater.		
Hazardous building materials in former site structures	Asbestos, PFAS, heavy metals	- Dermal, oral exposure - Inhalation of dust/fibres - Disturbance during construction - Volatilization and inhalation of vapours	Construction Workers	COPCs were not detected above the SAC	No	Low
Potential former fuel storage in the Sydney Trains Incident Emergency Response Depot at 1 Station Street in St Marys construction footprint	TRH, BTEX, VOCs, PAHs	- Dermal contact - inhalation exposure - Leaching to groundwater and lateral migration - Soil contamination	Construction Workers		No	Low
Former rail siding within the bus interchange area in Station Street; and rail activities, stockpiling and filling within the existing rail corridor in the St Marys construction footprint	Phenols, cyanide, TRH, BTEX, VOCs, PAHs		Construction Workers		No	Low
Potential chemical storage or use and activities at the stabling and maintenance facility including	Heavy metals, TRHs, BTEX, PAH's		- Workers involved with construction, ecological receptors (vegetation)		No	Low

Potential risks are considered limited and manageable and are presented in Table 18 (Workers encountering groundwater during excavation, Ecological interaction with groundwater). Therefore, there is low potential human health and ecological impact if groundwater is encountered during piling.

ADE has been advised by LOR if groundwater is encountered during piling works, the groundwater will be transferred to on-site detention tanks for holding until piling works are completed and thereby discharged in

line with CEMP. If encountered, workers will be wearing appropriate PPE (i.e. splash guards), and spill kits will be available (provided, proper controls are implemented).

Soil samples reported concentrations below the adopted health and ecological criteria, against ecological screening levels for commercial/industrial, coarse-grained soils. Additionally, all 27 samples analysed for BTEX, TRH, Phenols, PFAS, OCP/OCP, PAH, PCBs and TPH reported concentrations below the limit of reporting.

All samples submitted for heavy metals analysis reported concentrations above the limit of reporting, however, did not exceed the site assessment criteria.

7.1.1 Asbestos

During this investigation, no bulk asbestos fibre cement fragments were identified at any of the 12 test pit locations, or during visual inspection of the soil surface and test pit walls. Although ACM was not encountered during ADE's investigation, there is a possibility to encounter ACM across the site due to historic activities on site. Where offsite disposal of soils is considered, the potential widespread nature of ACM must be accounted for.

8 Discussion

8.1 Soil

Health and ecological investigation levels and health screening levels from Schedule B1 of the NEPM (2013) have been adopted to assess the soil contamination of the site. HILs and HSL-D for commercial and industrial land uses were selected as the appropriate criteria based on the proposed development.

None of the samples exceeded the respective site assessment criteria. Based on the information collected during this assessment, no significant or widespread contamination was identified in soil samples that may have caused risk of groundwater contamination.

ADE considers that the soils onsite are within the adapted site assessment criteria. The investigation has assessed the site as a whole and the soils were consistent throughout the site. The soil composition and characteristics are not likely to change with the proposed land uses at the site.

8.2 Asbestos

ADE undertook a robust sampling regime for asbestos onsite to investigate the extent of asbestos contamination due to the site history. 12 test pits were excavated for the purpose of chemical and asbestos assessment whereby all 12 test pits were screened onsite using a 10L sample through a sieve (7mm*7mm) and visually inspection for the presence of asbestos. No ACM was observed visually during the site investigation or within samples submitted for analytical testing.

8.3 Groundwater

Groundwater level of monitoring well SMGW-BH-A401 was reported to be 32.9 mAHD within the CPBG Baseline Groundwater Report (Project-wide), 6 June 2023. SMGW-BH-A401 is located within the north-eastern corner of the site. ADE had adopted groundwater analytical data from CPBG Baseline Groundwater Report (Project-wide), 6 June 2023.

Groundwater analytical data adapted from *CPBG Baseline Groundwater Report (Project-wide),* 6 June 2023 identified exceedances of zinc, nickel, lead and copper from onsite monitoring well SMGW-BH-A401 sampled December 2022 against ANZG 95% and 95% Freshwater guidelines. The exceedances above the SAC reported within the groundwater sample is most likely attributed to the regional industrial setting of site. The soils on site are of low leachability and hence unlikely contributing to the heavy metal exceedances in the groundwater.

ADE's review of historical data has indicated that the groundwater level within SMGW-BH-A401 as reported in CPBG Baseline Groundwater Report (Project-wide), Report Reference. SMWSASBT-CPG-SWD-SW000-GE-RPT-040405, June 2023 was encountered at 2.64mbgl. Additionally, ADE Geotechnical Investigation Factual Report, Report Reference A201021.0125.02_v1f, September 2023 noted groundwater seepage in BH06 at 6mbgl, however did not encounter groundwater inflow within the adjacent bore BH07 at a depth of 9.4mbgl.

Due to the variation and uncertainty of groundwater depth encountered throughout the site, ADE cannot accurately provide an estimate of depth to groundwater. In the event of groundwater being encountered during piling and excavation, LOR will manage dewatering in accordance with the procedures outlined in the CEMP.

8.4 Duty to Report under Section 60 CLM Act 1997

Under Section 60 of the Contaminated Land Management Act 1997, the owner of the land is required to notify contamination in circumstances as indicated in the NSW EPA (2015) *Guidelines on Duty to Report Contamination under the Contaminated Land Management Act 1997*. Each requirement of Sections 2.3.1, 2.3.5 & 2.3.6 of the NSW Guidelines was assessed with the evidence collected and a summary of that assessment is shown in the following tables **(**Table **19, Table 20** and **Table 21)**

Table 19 - Trigger Notification Assessment (Chemical Contamination - Soil)

Section 2.3.1 Notification Triggers On-site soil contamination	Findings	Trigger
The concentration of a contaminant in an individual soil sample is equal to or more than 250% of the HIL / HSL, and	All results were below the health investigation/screening criteria or LOR	No
A person has been or foreseeably will be exposed to the contaminant or a by-product of the contaminant	As above	No

Table 20 - Trigger Notification Assessment - Asbestos in soil

Section 2.3.3 Notification Triggers Asbestos in, or on, soil	Findings	Trigger
Asbestos fragments present on soil on the land; and	No ACM was located within any of the 10 L screening samples or analytically identified within the 12 500mL samples.	No
A person has been, or foreseeably will be, exposed to elevated levels of asbestos fibres by breathing them into their lungs	As above	No

Table 21 - Trigger Notification Assessment – Groundwater and Surface water

Section 2.3.5 Notification Triggers Groundwater or surface water	Findings	Trigger
The contaminant has entered or will foreseeably enter groundwater or surface water, and	Heavy metals were detected across the site exceeding the adopted criteria (NEPM and ANZG guidelines). Should groundwater be encountered, LOR will manage dewatering as per requirements outlined in the CEMP.	No
The concentration of the contaminant in the groundwater or surface water is, or will foreseeably be, above the groundwater investigation level for that contaminant as specified in Section 6, Schedule B1 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC 2013), and	As above	No
The concentration of the contaminant in the groundwater or surface water will foreseeably continue to remain above the specified concentration.	As above	No

Due to limitations in data reliability, and unknown source of exceedances in groundwater, ADE considers that there is no duty to report to the NSW EPA under Section 60(3)(a) of the CLM Act.

9 Materials Analysis and Classification

9.1 Waste Classification Assessment

ADE was engaged by the client to conduct a Waste Classification & Analysis Report to the subject in-situ materials. A sampling event was conducted 10 April 2024 where 25 soil collected and analytically compared against the Waste Classification Guidelines Part 1: Classifying Waste 2014 (NSW EPA 2014) and VENM Assessment as per the POEO Act 1997. Samples reported concentrations of all analytes below the adopted contaminant threshold (CT) 1 criteria with the exception of lead (Pb) in samples TP11_Fill(0.1), TP12_Fill(0.1) and TP12_Fill(0.3), which were run for TCLP - lead analysis. The TCLP - lead results were reported to be below the adopted TCLP1 criteria. ADE notes that all soil results were below the adopted specific contaminant concentration (SCC) 1 criteria, as well as the TCLP1 criteria. **Table 22** below represents a summary of the classification details, Refer to ADE Material Classification Report *A101021.0125.01.MAC1* for further information.

Table 22 - Material classification and ADE comments.

	Horizon A	Horizon B
Waste description:	• (FILL) SAND: medium grained sand, poorly sorted with mixed gravels, dark brown, moist. • (FILL) Sandy GRAVEL: medium grained sand, light and dark brown in colour, small to large size gravels, moist.	• (NATURAL) CLAY: moderate plasticity, light brown with grey orange and red inclusions, some fines.
Approximate waste volume:	1,053m^3 as provided by client survey by ADE (refer to *Appendix A – Figure*)	TBC
Waste classification:	**General Solid Waste (Non-putrescible)**	**Virgin Excavated Natural Materal**
ADE comments:	ADE notes that all soil results were below the adopted specific contaminant concentration (SCC) 1 criteria, as well as the TCLP1 criteria, the materials may be suitable for recycling at a suitably licensed facility. It is at the discretion of the client to determine the suitability dependent upon the receiving facilities license conditions.	Includes horizon B layer only, and does not include upper fill. It is the responsibility of the client to ensure removal of Horizon A material prior to export of VENM

10 Conclusions and Recommendations

Based on the findings of the site investigation the following is concluded:

10.1 Soil and Groundwater Assessment

- All soil samples collected during this investigation reported concentrations below the site chemical assessment criteria
- No ACM were visually located on the ground surface during site walkover or within any of the subject test pits excavated for screened for asbestos fragments. Analytical results did not identify any ACM in any of the 12 *500mL samples submitted for testing.
- Should groundwater be encountered, LOR will manage dewatering as per requirements outlined in the CEMP.
- Potential risks are considered limited and manageable and are presented in Table 18 (Workers encountering groundwater during excavation, Ecological interaction with groundwater). Therefore, there is no potential human health and ecological impact if groundwater is encountered during piling.
- ADE has been advised by LOR if groundwater is encountered during piling works, the groundwater will be transferred to on-site detention tanks for holding until piling works are completed and thereby discharged in line with CEMP. If encountered, workers will be wearing appropriate PPE (i.e. splash guards), and spill kits will be available (provided, proper controls are implemented).

10.2 Site Suitability

Based on the information and data collected as part of this assessment, ADE considers that the low likelihood of onsite contamination and the site is suitable for proposed development.

Any soils requiring removal from the site as part of future site works should be disposed of in accordance with ADE Material Classification Report A101021.0125.01.MAC1.

11 Limitations and Disclaimer

This report has been prepared for the exclusive use of the client and is limited to the scope of the work agreed in the terms and conditions of contract (including assumptions, limitations and qualifications, circumstances, and constraints). ADE has relied upon the accuracy of information and data provided to it by the client and others.

ADE has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia. No other warranty, expressed or implied, is made or intended. No one section or part of a section, of this report should be taken as giving an overall idea of this report. Each section must be read in conjunction with the whole of this report, including its appendixes and attachments. The report is an integral document and must be read in its entirety.

To the fullest extent permitted by law, ADE does not accept or assume responsibility to any third party (other than the client) for the investigative work, the report or the opinions given.

The scope of work conducted, and report herein may not meet the specific needs (of which ADE is not aware) of third parties. ADE cannot be held liable for third party reliance on this document. Any third party who relies upon this report does so at its own risk.

The subsurface environment can present substantial uncertainty due to it complex heterogeneity. The conclusions presented in this report are based on limited investigation of conditions at specific sampling locations chosen to be as representative as possible under the given circumstances. However, it is possible that this investigation may not have encountered all areas of contamination at the site due to the limited sampling and testing program undertaken.

The material subject to classification pertains only to the site and subject area outlined within the report and must be consistent with the waste description reported. If there are any unexpected finds that are not consistent with this classification, ADE must be notified immediately.

ADE does not verify the accuracy or completeness of, or adopt as its own, the information or data supplied by others and excludes all liability with respect to such information and data. To the extent that conditions differ from assumptions set out in the report, and to the extent that information provided to ADE is inaccurate or incomplete or has changed since it was provided to ADE, the opinions expressed in this report may not be valid and should be reviewed.

ADE's professional opinions are based upon its professional judgement, experience, training, and results from analytical data. In some cases, further testing and analysis may be required, thus producing different results and/or opinions. ADE has limited its investigation to the scope agreed upon with its client.

This Limitation and Disclaimer must accompany every copy of this report.

12 References

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