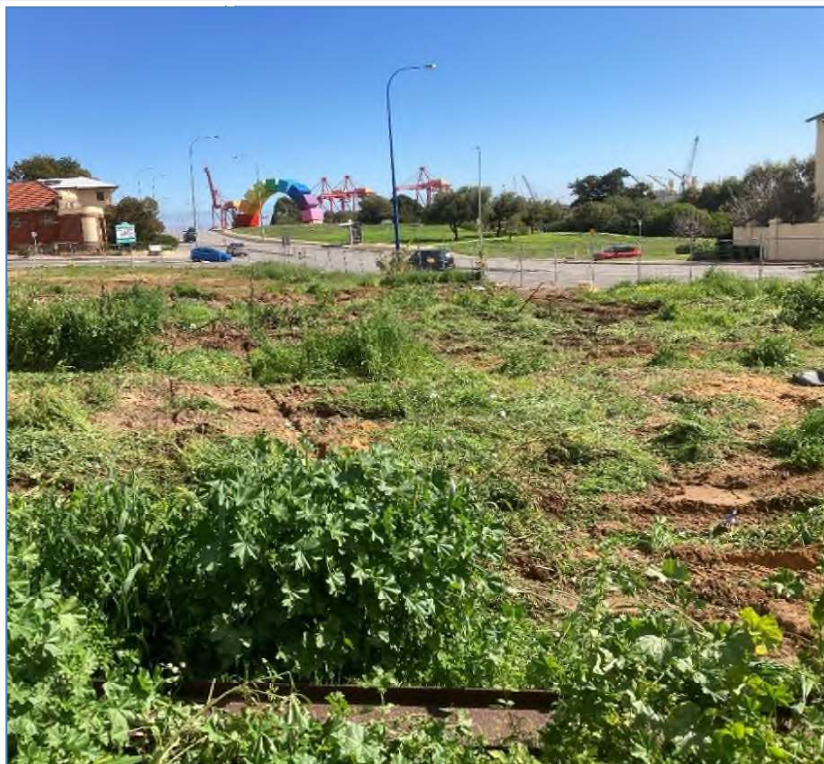


Remediation Action Plan Lots 14 to 19 Canning Highway, East Fremantle



Prepared For:	Department of Planning, Lands and Heritage 140 William Street, Perth WA 6000
Report Number:	AP2024-019
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16/12/2024

Signature

Date

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16/12/2024

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1 INTRODUCTION

Aurora Environmental (Aurora) was engaged by the Department of Planning, Lands and Heritage (DPLH) (the “Client”) to prepare a Remediation Action Plan (RAP) relating to soil contamination identified across Lots 14 to 19 Canning Highway, East Fremantle, Western Australia (the Site). The location of the Site is illustrated in Figure 1.

1.1 BACKGROUND

The Site has been identified in the State Government’s Housing Diversity Pipeline initiative. The intent is to redevelop the Site for residential use (likely to be medium density), with a small portion of the Site to be used for future widening of Canning Highway (located adjacent to the north of the Site).

1.1.1 Investigation Context

Aurora (2023) completed an Environmental Due Diligence Investigation which identified potential constraints associated with redevelopment of the Site, whereby subsequent Detailed Site Investigation (DSI) (Aurora, 2024a) identified the following in soil which posed a potential risk to human health (with respect to future residential land use):

- Asbestos containing material (ACM) across the Site (resultant of the demolition of former residential houses / structures and fence lines on-Site).
- Metals (within fill material – Site-wide) and polycyclic aromatic hydrocarbons (PAHs) associated with wrapping on the outer wall of an underground storage tank [UST] on-Site.

1.1.2 Regulatory Context

It is understood that the Site was reported to the Department of Water and Environmental Regulation (DWER) under the *Contaminated Sites Act 2003* (the *CS Act*) on 8 January 2024, with a notification of classification from DWER outstanding at the time of issue of this document.

DPLH have engaged a DWER accredited Contaminated Sites Auditor (the Auditor) to prepare a Voluntary Auditors Report (VAR) and provide non-statutory advice regarding investigation and remedial works. In January 2024, the Auditor provided Interim Audit Advice (IAA) (Australian Environmental Auditors [AEA], 2024) to DPLH on 16 January 2024, following review of Aurora investigation reports (refer Section 3) and a Remedial Options Appraisal (ROA) (Aurora, 2024c) prepared for the Site.

1.2 OBJECTIVES

1.2.1 DPLH

DPLH’s primary objective is to restore land use on-Site for residential land use, whereby the key project driver is to mitigate potential risks currently posed to human health by soil contamination on-Site. As such, DPLH is ultimately seeking to attain a satisfactory endpoint reclassification of the Site under the *CS Act* to ‘Decontaminated’.

1.2.2 Remedial Strategy

Regarding the overall remedial strategy for the Site, the objectives of this RAP are to:

- Define the purpose and specific objectives of management / remediation.
- Evaluate possible options for management and / or remediation of the identified contamination which includes options with an environmentally sustainable approach as defined by DWER (2021) and Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) (2018) remediation hierarchy principles.
- Specify how the remediation will be carried out and validated (including roles / responsibilities) and how risks to the identified receptors will be mitigated (including management controls to be adopted during the works).
- Detail the strategy for community consultation.

1.3 REFERENCE MATERIAL

This RAP was prepared with reference to the following legislation, regulations, codes of practice and guidance:

- *Contaminated Sites Act WA 2003.*
- *Contaminated Sites Regulations 2006.*
- CRC CARE (2018) National Remediation Framework document '*Guideline on Performing Remediation Options Assessment*'.
- Department of Environmental Conservation (now DWER) (2011) *A Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities.*
- Department of Health (DoH) (2021) *Guidelines on the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.*
- DWER (2022) *Controlled waste fact sheet 13 – Asbestos.*
- DWER (2021) *Assessment and Management of Contaminated Sites: Contaminated Sites Guidelines.*
- *Environmental Protection Act WA 1986.*
- *Environment Protection (Noise) Regulations WA 1997.*
- *Health (Asbestos) Regulations 1992.*
- National Environment Protection Council (NEPC) (2021) *National Environment Protection (Ambient Air Quality) Measure.*
- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure* (1999 as amended in 2013) (ASC NEPM).
- National Occupational Health and Safety Commission (NOHSC) (2005) *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2ND Edition.*
- *Workplace Health and Safety Regulations 2022.*

- WorkSafe (2020) *How to safely remove asbestos: Code of Practice*.
- Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) [Information sheet - Asbestos contaminated soils | Department of Energy, Mines, Industry Regulation and Safety \(commerce.wa.gov.au\)](https://www.commerce.wa.gov.au/energy-mines-industry-regulation-and-safety/information-sheet-asbestos-contaminated-soils).

2 SITE INFORMATION

2.1 IDENTIFICATION

The Site is located on the Traditional Lands of the Whadjuk People of the Noongar Nation. Relevant site identification details are provided in Table A.

TABLE A: SITE IDENTIFICATION DETAILS

ASPECT	DETAILS
Street address	7, 9, 15, 17 and 19 Canning Highway, East Fremantle WA.
Local government	Town of East Fremantle.
Site details	<ul style="list-style-type: none">• Lot 14 (Deposited Plan [DP] 3954) – Certificate of Title (CoT): 1502/195.• Lot 15 (DP 3954) – CoT: 1224/370.• Lot 16 (DP 3954) – CoT: 1692/370.• Lot 17 (DP 3954) – CoT: 1026/405.• Lot 18 (DP 3954) – CoT: 1739/285.• Lot 19 (DP 3954) – CoT: 1083/446.
Site area	3,663m ² .
Site owner	<ul style="list-style-type: none">• Lots 14, 15, and 17 – Commissioner of Main Roads.• Lot 16 – The Metropolitan Region Planning Authority.• Lot 18 – State Planning Commission.• Lot 19 – Western Australian Planning Commission.
Current zoning	<ul style="list-style-type: none">• Metropolitan Region Scheme (MRS) – The Site is mostly zoned ‘Urban’, except for a narrow strip adjacent to Canning Highway (‘Other Regional Road Reserve’).• Town of East Fremantle Town Planning Scheme No. 3 – The Site is zoned ‘Residential’ (R)20 however designated as capable of a maximum density of R80.
Current Site Use	Vacant block (albeit for informal vehicle parking on Lot 19).

The Site has an extended history of low-density residential uses for Lots 15 to 19, and commercial land use for Lot 14. Buildings on-Site were progressively demolished, with the last structures demolished / removed circa 2023.

2.2 ENVIRONMENTAL SETTING

The environmental setting (obtained through previous investigations by Aurora) is summarised below:

- **Topography:** The surface elevation of the Site is situated between approximately 10m Australian Height Datum (AHD) and 12m AHD, with a north-south gradient. However, localised variations to this are expected on Lot 19 which was observed to have been filled with road base (blue metal gravels).
- **Ground surfacing:** The Site is unsealed, with the surface covered with sand / blue metal and weeds.
- **Surrounding land use:** Predominately residential, with road reserves adjacent to the north and west of the Site.

- **Surface water and drainage:** There are no surface water bodies on-Site, with surface / storm water on-Site expected to infiltrate through the unsealed ground surface.
- **Geology:** Three fill types have been encountered on-Site (described below), which overlay limestone (variable depth and thickness):
 - **Fill Type 1:** Brown, fine to medium grained, poorly graded Silty SAND / SAND (with trace limestone gravels), encountered from ground surface to 0.2m below ground level (bgl). Generally collocated with construction and demolition (C&D) waste (concrete and brick, with sporadic timber, glass, plastic, and metal).
 - **Fill Type 2:** Brown, fine to medium grained, poorly graded SAND, encountered between 0.2m bgl and 0.8m bgl. Consistently encountered across the Site, relatively thin along the northern boundary, and greater in thickness through the central and southern portions. It is inferred that this fill material was imported as part of historical Site establishment and is of unknown origin.
 - **Fill Type 3:** Brown / yellow, fine to medium grained, poorly graded SAND, ranging between 0.4m bgl and 0.8m bgl. Appeared to be a mixed profile (Soil Type 2 and natural underlying soils).
 - **Inferred natural soils:** Yellow / pale yellow, fine to coarse grained, poorly graded SAND, encountered between 0.1m bgl and 1.1m bgl. This profile commonly overlaid limestone bedrock with the shallowest encountered depth at 0.1m bgl, and the deepest encountered depth at 2.1m bgl. Variable depth profile suggests that the original ground surface of the Site (prior to fill importation) likely featured surface outcrops of limestone.
- **Hydrology:** No wetlands that intersect the Site.
- **Hydrogeology:** Groundwater is likely to be encountered on-Site at approximately 9m bgl / 1m AHD and is not currently abstracted on-Site. Groundwater mapping indicates that the flow direction is to the Swan River located approximately 100m to the north.
- **Environmental sensitivity:** No mapped Environmentally Sensitive Areas (ESAs) are present on-Site.

3 CONTAMINATION STATUS

Environmental investigations which are known to have been completed at the Site are summarised below which have been used to inform the contamination status of the Site:

- Aurora (2023) *Environmental Due Diligence Investigation Lots 14 - 18 East Street, East Fremantle Western Australia*. Version 1 dated 8 June 2023 (Report number: AP2023-051).
- Aurora (2024a) *Detailed Site Investigation, Lots 14 to 19 East Street, East Fremantle Western Australia*. Version 3 dated 27 February 2024 (Report number: AP2023-146).
- Aurora (2024b) *RE: 27 Canning Highway, East Fremantle: Interim Asbestos in Soil Management Response*. Version 2 dated 27 February 2024 (reference DOL-PP03464_IMR_004_SM_V2).

Pertinent findings relating to the contamination status of the Site are summarised below.

3.1 DETAILED SITE INVESTIGATION

Aurora (2024a) completed a test pitting and soil sampling program to address potential risks posed to human health on-Site by ACM, with findings summarised below:

- C&D waste was observed across the ground surfaces of a majority of the Site, and except for Lot 14, included the presence of ACM fragments which was attributed to demolition of former residential houses / structures and fence lines on-Site. ACM materials were identified within shallow fill material (maximum depth of 0.4m bgl), with fragments described as being in good condition, bonded and between 2cm² and 20cm²).
- Whilst concentrations of mid / long chain total recoverable hydrocarbon (TRH) in soil in the central area of Lot 14 were detected above Tier 1 human health criteria, these were localised / limited to near surface soils and considered immaterial regarding potential risk posed to human health.
- A UST was unexpectedly encountered within the footprint of the former structure on Lot 14:
 - Approximate dimensions were 2.1m (length) by 1.1m (diameter).
 - The top of the UST was encountered at approximately 0.4m bgl, with the tank pit appearing to have been excavated into the underlying limestone.
 - The contents appeared to be yellow sand, with no staining / odours observed in the sand.
 - A creosote coating was observed on the outer wall of the UST and was identified as the source of elevated PAHs in in-situ soils surrounding the tank, including benzo(a)pyrene concentrations which potentially pose a risk to human health for residential land use (to maximum investigated depth of 1.3m bgl).
- Concentrations of metals (specifically, copper, lead, and zinc) potentially pose a risk to human health for residential land use within fill material across most of the Site, with impacts generally encountered within the shallow soil profile (with a maximum depth of 1m bgl).

- The inferred lateral extent of contaminated soils is illustrated in Figure 2 (figure taken from the DSI [Aurora, 2024a]), with the inferred volumes (in-situ)¹ estimated on-Site as follows:
 - **ACM:** Approximately 430m³.
 - **PAHs and metals:** Approximately 405m³.
 - **Metals:** Approximately 200m³.
 - **ACM and metals (i.e., co-located contamination):** Approximately 200m³.
- Preliminary waste classification for off-Site disposal (with reference to the *Landfill Waste Classification and Waste Definitions 1996* [as amended 2019] [DWER, 2019]) is summarised in Table B.

3.2 INTERIM ASBESTOS IN SOIL MANAGEMENT RESPONSE

It was identified during the DSI (Aurora, 2024a) that deterioration of ACM fragments encountered in near surface soils on Lot 19 could occur through unrestricted access / use of this area of the Site for vehicle parking, resulting in a potential risk to human health (i.e., inhalation of asbestos fibres).

Aurora (2024b) implemented an Interim Asbestos Management Response (IAMR) (specific to Lot 19) which included a walkover / emu-pick of ACM fragments and visual validation (post-removal of ACM fragments on the ground surface), with findings summarised below:

- Occasional fragments of ACM were observed within areas primarily devoid of grass, with two localised areas of bulk / scattered ACM fragments were observed.
- No evidence of asbestos fibres / fibrous asbestos was observed.
- Characteristics of ACM fragments collected were like those described in the DSI (Aurora, 2023b).
- At the completion of the retrieval of ACM fragments, the amount of ACM at the near surface was visually estimated to be less than the DoH (2021) asbestos screening level for recreational land use.

It is important to note that the DSI (Aurora, 2024a) encountered ACM fragments below the near ground surface whereby if not remediated / removed from Site, are likely to pose a legacy issue requiring management (i.e., fragments likely to be exposed through erosion / exposure of unsealed ground surface through traffic movements).

¹ Based on the distribution of the data points during investigation. Given the relatively heterogenous distribution of ACM in soil resulting from demolition works, it's anticipated the actual distribution of impacts may vary (at least to some extent from what has been mapped).

TABLE B: PRELIMINARY WASTE CLASSIFICATION SUMMARY

AREA OF SITE	MEDIA	CONTAMINANT	AREA	INFERRED SPATIAL EXTENT DEPTH	INFERRED IN-SITU VOLUME ²	PRELIMINARY WASTE CLASSIFICATION	SAMPLES USED IN WASTE ASSESSMENT
Lot 14	UST Wrapping	PAHs	-	-	-	Class V	-
	Soil	Metals and PAHs	-	Soils surrounding UST impacted with fragments of wrapping	5m ³	Class III	Two
	Soil	Metals and PAHs	680m ²	0.6m bgl	400m ³	Class III	31 (including 10 ASLP)
Lot 15	Soil	ACM and metals*	250m ²	0.6m bgl	150m ³	Class I, Special Waste Type 1	19
	Soil	Metals	50m ² ^	0.7m bgl^	60m ³	Class I [#]	
Lot 16	Soil	ACM	660m ²	Variable – 0.2m bgl to 0.4m bgl	200m ³	Class I, Special Waste Type 1	19
Lot 17	Soil	ACM and metals*	50m ²	0.2m bgl	10m ³	Class I [#] , Special Waste Type 1	11
	Soil	ACM	100m ²	0.2m bgl	20m ³	Class I [#] , Special Waste Type 1	
	Soil	Metals	200m ²	0.2m bgl	40m ³	Class I [#]	
Lot 18	Soil	ACM and metals*	130m ²	Variable – 0.2m bgl to 0.4m bgl	40m ³	Class I [#] , Special Waste Type 1	13
	Soil	ACM	200m ²	0.3m bgl	60m ³	Class I [#] , Special Waste Type 1	
	Soil	Metals	200m ²	0.5m bgl	100m ³	Class I [#]	
Lot 19	Soil	ACM	400m ²	0.4m bgl	150m ³	Class I, Special Waste Type 1	12
^ Includes 0.1m beneath co-located ACM contaminated soil which is solely metals contaminated. * Co-located metals and ACM contamination. # No leachate analysis undertaken to verify classification. ASLP – Australian Standard Leachate Procedure.							

²Based on the distribution of the data points during investigation. Given the relatively heterogeneous distribution of ACM in soil resulting from demolition works, it's anticipated the actual distribution of impacts may vary (at least to some extent from what has been mapped).

4 PRE-REMEDIATION CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) describes the sources, pathways, and receptors. Where there is a complete linkage between a hazard source, exposure pathway and receptors there may be potential risks to human health or the environment.

A preliminary CSM has been developed for the Site based on available information and with consideration to the proposed future land use and desired endpoint site classification under the *CS Act* (Decontaminated). The CSM provides a framework for understanding the contamination status of the Site, and any potential unacceptable human and environmental health risks to identified receptors which may preclude the proposed land use.

The CSM and associated exposure pathway assessment and residual gaps are summarised in Table C, which are as outlined in the DSI (Aurora, 2024a) (noting there were no material changes to the CSM following the IAMR [Aurora, 2024b]).

TABLE C: PRE-REMEDIATION CONCEPTUAL SITE MODEL

SOURCE	MIGRATION PATHWAY	EXPOSURE PATHWAY	RECEPTOR	SPR LINKAGE?	COMMENTS
S1: Uncontrolled demolition of previous buildings / structures resulting in ACMs within surface and sub-surface soils.	(MP1) Soil disturbance and dust generation.	(EP1) Inhalation of airborne asbestos fibres.	R1: Current residents within vicinity of Site.	Possibly complete, requires management.	Much of the Site (Lots 14 to 18) has been fenced to prevent unauthorised access, but at the time of writing the DSI Lot 19 was still accessible and used a for carparking. The ACM fragments encountered on the ground surface and shallow soils at Lot 19 were in a good, bonded condition. However, it was noted during the field program residents / visitors associated with adjacent buildings to the Site regularly drove onto the Lot 19 surfaces for parking. It is considered that this activity could over time result in the deterioration of the ACM fragments, increasing associated risk. Therefore, management activities are required to mitigate the potential risk. It is noted that an emu-pick to remove surface ACM fragments was recently undertaken by Aurora (2024b) on Lot 19.
			R2: Current visitors (adults / children) to Site.		
			R3: Future on-Site Workers.		
			R4: Future residents / visitors (adults / children) to the Site.		
S2: Historically imported soils with elevated heavy metals and benzo(a)pyrene (BaP) above human health criteria.	(MP1) Soil disturbance and dust generation.	(EP2) Incidental ingestion of impacted soils.	R1: Current residents within vicinity of Site.	Possible, but currently incomplete.	The source-pathway-receptor (SPR) linkage is currently considered to be possible, but incomplete as most of the Site has been fenced to prevent unauthorised access. It is noted that Lot 19 is still accessible to the public, but no heavy metal or PAH concentrations were identified on this lot above human health assessment criteria for residential land use. If access to Lots 14-18 is continued to be prevented this SPR is considered incomplete.
			R2: Current visitors (adults / children) to Site.		
			R3: Future on-Site Workers.		
	(MP2) Vertical migration of contaminants to groundwater. (MP3) Lateral migration of contaminants through groundwater.	(EP3) Abstraction of groundwater.	R4: Future residents / visitors (adults and children) to the Site.	Complete.	The extent of the heavy metal / PAH impacts at the Site are such that there is an unacceptable risk to future occupants under a residential land use scenario. Where impacts have been identified (lots 14, 15, 17 and 18) remedial / management actions are required to ensure that the Site is suitable for future residential use. It is noted that soil impacts are relatively well defined and generally confined to surface and shallow soils (on average > 0.5m bgl).
			R3: Future on-Site Workers.		
			R5: Down gradient aquatic flora / fauna.		
S3: Creosote coated UST on Lot 14 with elevated PAHs in soils exceeding ecological and human health criteria.	(MP1) Soil disturbance and dust generation.	(EP2) Incidental ingestion of impacted soils.	R1: Current residents within vicinity of Site.	Possible, but currently incomplete.	The SPR linkage is currently considered to be possible, but incomplete. The impacts are exclusively present on Lot 14 which is fenced off from the public. In the event where access to Lot 14 is continued to be prevented this SPR is considered incomplete.
			R2: Current visitors (adults / children) to Site.		
			R3: Future on-Site Workers.		
			R4: Future residents / visitors (adults and children) to the Site.		

SOURCE	MIGRATION PATHWAY	EXPOSURE PATHWAY	RECEPTOR	SPR LINKAGE?	COMMENTS
	(MP2) Vertical migration of contaminants to groundwater.	(EP3) Abstraction of groundwater (if impacted).	R3: Future on-Site Workers. R4: Future residents / visitors (adults and children) to the Site.	Likely incomplete.	<p>Whilst groundwater quality has not been quantitatively assessed at the Site currently available evidence (well defined shallow soil impacts, elevated soil pH of 8.5, limestone geology, depth to groundwater (8m bgl – 9m bgl) suggests that there is not a significant risk of gross impacts to groundwater quality either on-Site or off-Site.</p> <p>The possibility of abstraction of groundwater for non-potable use (landscape irrigation) for redevelopment of the Site has not been confirmed but is considered unlikely due to the resource likely being saline or having increased hardness due to a limestone hosted aquifer. Additionally, it is anticipated that the potential use of water for dust suppression as part of any remedial works and landscape irrigation will be sourced from the reticulated mains water supply. It is therefore considered plausible that there is no SPR linkage.</p>
	(MP3) Lateral migration of contaminants through groundwater.	(EP4) Uptake by off-Site aquatic flora / fauna.	R5: Down gradient aquatic flora / fauna.		

5 REMEDIATION STRATEGY

5.1 REMEDIATION OPTIONS

5.1.1 Remediation Hierarchy

The ASC NEPM outlines a preferred hierarchy of options for remediation and management to achieve desired environmental outcomes. DWER (2021) requires that this preferred hierarchy is duly considered during remediation planning which is (in order of preference):

- On-Site treatment.
- Off-Site treatment with return of remediated soils to the Site.
- On-Site containment.
- Off-Site disposal.

5.1.2 Contaminant Linkages

SPR linkages identified in the CSM (refer Table C) include inorganic (i.e., metals), organic (i.e., hydrocarbon) and physical (e.g., asbestos) contaminants which have unique characteristics. In evaluating remedial options, potential contaminant linkages identified at the Site have been considered with respect to the need for remedial options to manage / mitigate potential risks posed by all contaminants on-Site and in context to the below:

- Reducing, modifying, containing, or removing the source.
- Managing or eliminating the preferential pathway.
- Modifying or removing exposed populations.

5.1.3 Evaluation Criteria

In addition, the parameters for consideration when assessing remedial options, as outlined in CRC CARE (2018), have been considered as part of the review of potential remedial strategies. These parameters include practicability, long-term outcomes, legal requirements, cost, benefits, sustainability, time efficiencies and duration, impacts to stakeholders, and remediation risks.

DPLH's objectives, along with consideration to the hierarchy and other intrinsic parameters (e.g., public perception), have also been considered in evaluating the potential remedial options, which are summarised below and considered in more detail in Table D.

- **Option 1:** Off-Site treatment – resource recovery (prior to off-Site disposal).
- **Option 2:** On-Site treatment – screening.
- **Option 3:** On-Site in-situ encapsulation.
- **Option 4:** Off-Site disposal – landfill.

Regarding the Table D, the following should be recognised:

- Placement of contaminated materials (excluding the UST) into an engineered cell was not considered to be a viable option due to the shallow limestone geology at the Site.
- Emu-pick (i.e., hand removal) of ACM fragments has not been considered / evaluated as a long-term remedial option given it will have no material effect on mitigating potential risks posed by

sub-surface ACM or other contaminants in soil on-Site (either as a standalone option or combined with one of the options listed above).

- Management of the UST has not been included in the ROA given the remedial options are limited to civil works (i.e., exhume the UST) and subsequent off-Site disposal.

5.2 PREFERRED REMEDIATION OPTION

The preferred option for ACM in shallow soils is off-Site treatment – resource recovery based on the following key advantages:

- ACM fragments are within shallow / near surface soils and accessible with conventional plant and sandy soils considered to be suitable for screening.
- Removes contaminant mass (i.e., metals and hydrocarbons) from the Site and proven approach with certain outcome (ACM fragments identified are in good [bonded] condition).
- Sustainable option and consistent with the preferred State Government policy for waste management including the *Waste Avoidance and Resource Recovery Act 2007 (WARR Act)*.
- No legacy management requirements on Site.

TABLE D: REMEDIAL OPTIONS EVALUATION

STRATEGY		DESCRIPTION	ADVANTAGES	DISADVANTAGES	COMMENTS
Option 1: Off-Site treatment – resource recovery.		<ul style="list-style-type: none"> Excavate contaminated soils and undertake waste characterisation to verify the preliminary waste classifications (refer Table B)³. Transport waste material off-Site to an approved location for mechanical screening, to remove ACM / reduce oversize volume to go to landfill and reuse of undersize soils. Validate excavations (i.e., verify in-situ conditions post-remedial excavation are suitable for residential use). Import certified ‘clean fill’ material to Site, to balance the volume lost through off-Site disposal and return Site to preferred development design levels. 	<ul style="list-style-type: none"> Soil contamination is within shallow / near surface soils and accessible with conventional plant. ACM impacts hosted in sandy soils and fragments identified are in good (bonded) condition facilitating screenability. Removes contaminant mass from the Site and proven approach with certain outcome. No legacy management requirements with the potential for the Site to be classified as ‘Decontaminated’ under the CS Act (subject to DWER and DoH approval). Involves relatively simple materials handling, and earthworks exercises (with management controls). Costs to procure / mobilise plant likely to be low due to the Site’s metropolitan location. More sustainable than landfill option in comparison to direct disposal of contaminated soil to landfill. 	<ul style="list-style-type: none"> Potential for adverse (real and perceived) amenity impacts to surrounding community / residences (e.g., dust, noise) during earthworks will need to be managed. Large number of truck movements requiring management with constrained access. The volume of import material required to backfill excavations (and associated costs for importing / transport) are high (albeit better than disposal of all ACM affected material directly to landfill). More sustainable option in comparison to disposal of all ACM affected material directly to landfill. 	Cost effective rate for haulage and disposal for each preliminary waste type / class in comparison to landfill disposal (see Option 4 below), with the treated material reused off-Site and an ultimate reduction in the total volume destined for landfill.
	Option 2: On-Site treatment – screening.	<ul style="list-style-type: none"> Excavate affected soils for on-Site mechanical screening to remove ACM. Validate excavations (i.e., verify in-situ conditions post-remedial excavation are suitable for residential use). Dispose of the oversize fraction off-Site to licensed facility (Special Waste Type 1). Characterise / validate the undersize fraction for potential reuse on-Site (with respect to residential land use). Import certified ‘clean fill’ material to Site to balance the volume lost through disposal of oversize fraction. 	<ul style="list-style-type: none"> With respect to ACM, removes contaminant mass from the Site and proven approach with certain outcome (all ACM fragments identified are > 20mm and in good [bonded] condition). ACM fragments are within shallow / near surface soils and accessible with conventional plant. ACM impacts hosted in sandy soils facilitating screenability and tends to remove other geotechnical unsuitable particles. With respect to ACM, no legacy management requirements. Costs to procure / mobilise screening machinery likely to be relatively low due to the Site’s metropolitan location. Involves relatively simple materials sorting, handling, and earthworks exercises (with management controls). The volume of import material required to backfill excavations (and associated costs for importing / transport) are relatively low. On-Site in-situ options generally preferred (i.e., low waste generation, lower transport risks). Sustainable option and consistent with the preferred State Government policy for waste management, including the <i>WARR Act</i>. 	<ul style="list-style-type: none"> Not suitable for remediation of metals and hydrocarbons in soils (i.e., undersize fraction unable to be reused on-Site due to concentrations of relevant contaminants of potential concern [CoPCs] above applicable Tier 1 screening criteria for future site use [residential]). Potential for adverse (real and perceived) amenity impacts to surrounding community / residences (e.g., dust and noise) during earthworks will need to be managed. Other C&D wastes have been encountered on-Site (concrete, brick, timber, glass, plastic, and metal), along with surface vegetation (e.g., grasses / weeds) which would be captured in the oversized material requiring disposal / management (albeit managed no differently to ACM). 	<p>Considered a conventional, practical, and effective option to remove ACM.</p> <p>Reduction in overall material destined for disposal will greatly reduce the costs associated with the remediation.</p> <p>Not a suitable option however where remediated soils (i.e., soils free of ACM) are also impacted with metals and hydrocarbons (i.e., concentrations above applicable Tier 1 screening criteria for future site use [residential]).</p>
Option 3: On-Site In-situ encapsulation.		<ul style="list-style-type: none"> Install a “break” layer at the ground surface (e.g., crushed rock). Import certified ‘clean fill’ material to Site and place on top of break layer (i.e., encapsulate contaminated soil - land raising) – approximately 0.5m thick. 	<ul style="list-style-type: none"> Soil contamination is within shallow / near surface soils and accessible with conventional plant. ACM is not leachable and does not pose a risk to groundwater quality. Allows for all contaminated soil to be retained on-Site and reduce disposal and transport costs. No waste disposal costs associated with the strategy. Costs to procure / mobilise plant likely to be low due to the Site’s metropolitan location. 	<ul style="list-style-type: none"> Whilst there is not considered to be a risk posed to groundwater by metal impacts in soil (i.e., through leaching), there is a risk that this is perceived as a risk by third-party / purchaser of the Site. Potential for adverse (real and perceived) amenity impacts to surrounding community (e.g., dust, vibration, and noise) during on-Site treatment will need to be managed. Increased Site levels may not be practical with respect to design of the proposed development (along with adjacent land users, e.g., residents). 	<p>Encapsulation of ACM affected soils is likely to effectively manage long-term risks associated with waste materials and contaminated soils and therefore, meet regulatory requirements.</p> <p>Excavation of a containment cell to consolidate impacted soils into a smaller footprint is not considered practically feasible due to the variable depth of limestone bedrock (encountered between</p>

³ To be determined – subject to recycling facility endorsing the preliminary waste classification obtained as part of the DSI (Aurora, 2023b) (i.e., if preliminary waste classification accepted by recycling facility, further waste classification / assessment may not be required).

STRATEGY	DESCRIPTION	ADVANTAGES	DISADVANTAGES	COMMENTS
	<ul style="list-style-type: none"> On-Site in-situ options generally preferred (i.e., no waste generation, lower transport risks). Subject to engineering / development design, there is likely to be sufficient space on-Site to encapsulate soil contamination on-Site. Sustainable option and consistent with the preferred State Government policy for waste management including the <i>WARR Act</i>. 	<ul style="list-style-type: none"> Engineering design and controls are likely to be required to manage post development ground conditions / surety of break layer, compaction, and surface water drainage. The encapsulation footprint would require a Site Management Plan (SMP) (in accordance with DWER [2021]) (i.e., address the memorial on CoT for the Interest Only Deposited Plan [IODP]). Effectiveness and continuity of management legacy via third-party (if Site sold) to be demonstrated to achieve regulatory approval. May not be an advantageous outcome in consideration of relatively large area required for containment, requirement for engineering controls (e.g., retaining structures) and future divestment / use of the Site (e.g., restriction on area where intrusive works can take place, development design). If encapsulation footprint proposed to be public open space risk that the land may not be accepted by Local Government, as part of normalisation process. 	<ul style="list-style-type: none"> Potential for adverse (real and perceived) amenity impacts to surrounding community / residences (e.g., dust and noise) during earthworks will need to be managed. Large number of truck movements requiring management with constrained access / egress. Poorest sustainability and potentially most expensive option associated with off-Site transport and landfilling. The volume of import material required to backfill excavations (and associated costs for importing / placement / compaction) are high. Least preferred option from a State Government Waste Management Policy <i>WARR Act</i> perspective. 	<p>0.1m bgl and 2.1m bgl), with capping in-situ the only viable option if soil contamination were to remain on-Site.</p> <p>Encapsulation may not be a practical option in consideration of long-term management requirements to control risk of future exposure from disturbing contained materials (responsibility of the landowner) and a reduced effective area / impost for the proposed development design.</p>
Option 4: Off-Site disposal – landfill.	<ul style="list-style-type: none"> Excavate / stockpile contaminated soils on-Site and undertake a waste classification assessment to verify the preliminary waste classes detailed in Table B. Dispose of contaminated soils off-Site to appropriate landfill facility. Validate excavations (i.e., verify in-situ conditions post-remedial excavation are suitable for residential use). Import, place and compact certified 'clean fill' material to Site, to balance the volume lost through off-Site disposal and return Site to preferred development design levels. 	<ul style="list-style-type: none"> Soil contamination is within shallow / near surface soils and accessible with conventional plant. Removes contaminant mass from the Site and proven approach with certain outcome. No legacy management requirements with the potential for the Site to be classified as 'Decontaminated' under the CS Act (subject to DWER and DoH approval). Costs to procure / mobilise screening machinery likely to be low, due to the Site's metropolitan location. Involves relatively simple materials sorting, handling, and earthworks exercises (with management controls). 	<ul style="list-style-type: none"> Potential for adverse (real and perceived) amenity impacts to surrounding community / residences (e.g., dust and noise) during earthworks will need to be managed. Large number of truck movements requiring management with constrained access / egress. Poorest sustainability and potentially most expensive option associated with off-Site transport and landfilling. The volume of import material required to backfill excavations (and associated costs for importing / placement / compaction) are high. Least preferred option from a State Government Waste Management Policy <i>WARR Act</i> perspective. 	<p>Suitable option for the management of small volumes of impacted materials (say < 100m³) however, least preferred option with respect to feasibly sustainable remedial options.</p>

6 REMEDIATION MANAGEMENT

6.1 ROLES AND RESPONSIBILITIES

General responsibilities for key project personnel in relation to the remediation / environmental management are outlined in Table E. These responsibilities do not replace any other regulatory responsibilities of the parties in undertaking works at the Site and may not include all project specific responsibilities. The project team should be aware of their obligations under *Workplace Health and Safety Regulations 2022* and *Health (Asbestos) Regulations 1992* (i.e., management of works and risks associated with asbestos removal).

TABLE E: ROLES AND RESPONSIBILITIES

ROLE	CONTACT	RESPONSIBILITIES
Proponent / Client	DPLH	The Proponent has responsibility for the overall remediation of the Site and maintaining compliance with the environmental management controls established for the Project. In addition, the Proponent has responsibility for stakeholder engagement / management (or as otherwise delegated to an appropriate member of the project team).
Superintendent / Client Representative	DPLH or other nominated party	The Superintendent (i.e., client's representative) is responsible for managing the Remediation Contract, issuing Site Instructions, ensuring response to Requests for Information (RFI's) are dealt with and generally overseeing the implementation of the Project.
Environmental Supervisor	To be confirmed	The Environmental Supervisor will oversee the remediation, guide the Remediation Contractor, and record relevant information, site conditions, the progress of works and the progress regarding removal of contamination, including conducting necessary validation inspections and sampling (as per this RAP) as part of fulfilling the role of Independent Competent Person (ICP) under the <i>Workplace Health and Safety Regulations 2022</i> . The Environmental Supervisor will seek the necessary direction / approval from the Superintendent / Client Representative where there is likely to be a variation to the work scope due to reasons including environmental management and emergent field / laboratory findings during implementation of the RAP.
Remediation Contractor	To be confirmed	The Remediation Contractor will perform the remediation works in accordance with the Contract and methodologies outlined in this document, and at the direction of the Environmental Supervisor (in consultation with / subject to the approval of the Superintendent). The Remediation Contractor's requirements also include complying with all environmental management controls established for the project; reporting directly to and liaising with, the Environmental Supervisor on environmental / contamination issues.
Auditor	Shandel Coleman (Australian Environmental Auditors)	The Auditor will prepare a VAR and provide non-statutory advice relating to the remedial works (based on information provided by the Environmental Supervisor, Superintendent and/ or DPLH).
Regulator	DWER	Regulate the site/ outcome of the remedial works under the <i>CS Act</i> with respect to classification of the site.

6.2 REMEDIATION TARGETS

For remediation of the Site to achieve the objectives (refer Section 1.2), the following targets have been established for the project.

1. Manage the environment and contamination in accordance with State requirements including but not limited to those listed in this RAP.
2. Minimise the volume of soil / materials disposed to landfill by:
 - a. Hand-picking (i.e., emu-pick) of ACMs at the ground surface (where ACM impacts are not entrained within soils).
 - b. Using emergent field findings (e.g., C&D material suggestive of potential ACM presence, visual and olfactory evidence of hydrocarbon impacts) to refine / delineate the extent of remedial excavations.
 - c. Implement a material / stockpile and waste tracking system which minimises the potential for cross-contamination.
 - d. Using machinery / equipment appropriate for the scope.
3. Demonstrate that the validation criteria (see Table I) have been achieved.

6.3 REMEDIATION AND VALIDATION METHODOLOGIES

6.3.1 Remediation Staging

Table F presents a proposed staged approach to remediation at the Site, noting:

- Multiple sub-tasks in each stage (i.e., 3a and 3b) can be undertaken concurrently / the same mobilisation (subject to implementation of management controls detailed in Section 6).
- The proposed approach is suggested, and it is recognised that a Remediation Contractor may propose an alternative approach provided it is compliant with this RAP (and approved by the Proponent / Superintendent).

TABLE F: PROPOSED REMEDIATION STAGING

STAGE	OVERVIEW
1a	Establish preliminaries (e.g., obtain third-party approvals, temporary fencing / secure the Site, Site Office) and access to the Site.
1b	Seek clarification / obtain endorsement from the recycling facility regarding suitability of waste material to be accepted based on preliminary waste classification results (refer Table B).
1c	Identify a suitable source of “clean fill” for backfilling excavations post-in-situ validation and provide suitable evidence for endorsement (refer Table J) prior to importing to Site.
2	Subject to nature of ground cover on-Site, spray / slash grass cover to facilitate inspection / emu-pick.
3a	Mark out areas of known ACM soil impacts that are to be subject of remedial excavations (i.e., Figure 2).

TABLE F: PROPOSED REMEDIATION STAGING

STAGE	OVERVIEW
3b	Undertake a Site Walkover (in accordance with DoH [2021] requirements) and emu-pick / remove ACM fragments on the ground surface across the Site. ACM fragments encountered in areas beyond those marked out areas in Stage 3a are to be mapped / added to Figure 2 ⁴ .
4a	Demarcate area/s for temporary stockpiling of excavated / waste material and personnel / machinery decontamination area. Consideration at this stage to be made for likely volumes / number of temporary stockpiles and duration they are to be retained on-Site in context of managing logistics on-Site (refer Table G for further detail).
4b	Setup Airborne Fibre Monitors (AFMs) as per locations illustrated in Figure 2.
5a	Commence excavating and stockpiling contaminated soils for waste characterisation assessment, with consideration for the following (referring also to Table G): <ul style="list-style-type: none"> Excavating / segregating material of similar waste streams (i.e., collocated PAH and metal impacted soils separate from ACM impacted soils. Commencing in areas where waste classification has not been established / requires further characterisation. Very large items of inert materials (timber, concrete blocks etc.) that may be encountered are to be removed and stockpiled separately for separate disposal as inert waste.
5b	<ul style="list-style-type: none"> Undertake waste characterisation sampling to verify the classifications provided in Table G⁵.
6	Validate excavations (i.e., verify in-situ soil conditions post-remedial excavation are suitable for site use). Order of excavation validation to be determined during works based on emergent findings (noting some excavations may need to be re-validated if soil impacts are identified during the initial validation sampling rounds).
7a	Dispose of excavated soils off-Site to recycling facility (in accordance with classification determined in Stage 5b).
7b	Validate base of stockpiles (post-removal of all stockpiles off-Site).
7c	Import and place certified 'clean fill' material to Site to balance the volume lost through off-Site disposal.

⁴ The presence of ACM fragments on the surface does not necessarily mean ACM is present below the ground surface. However, its presence may warrant further investigation and / or inform lateral extents of remedial excavations (i.e., delineation extent).

⁵ Refer Table D – subject to recycling facility endorsing the preliminary waste classification obtained as part of the DSI (Aurora, 2023b).

TABLE G: SUGGESTED APPROACH TO STOCKPILING WASTE MATERIALS¹

CONTAMINANT	AREA OF SITE	MEDIA	INFERRED IN-SITU VOLUME	PRELIMINARY WASTE CLASSIFICATION	FURTHER WASTE CLASSIFICATION REQUIRED?
Metals	Lot 15	Soil	200m ³	Class I	Yes – metals* (ASLP)
	Lot 17				
	Lot 18				
ACM and metals*	Lot 17	Soil	50m ³	Class I, Special Waste Type 1	Yes – metals* (ASLP)
	Lot 18				
	Lot 15				
ACM*	Lot 15	Soil	150m ³	Class I, Special Waste Type 1	No
	Lot 17	Soil	80m ³	Class I, Special Waste Type 1	Yes – metals* (ASLP)
	Lot 18				
	Lot 16	Soil	350m ³	Class I, Special Waste Type 1	No
	Lot 19				
Metals, TRH, and PAHs	Lot 14	Soil	405m ³	Class III	Yes – TRH specification (aliphatic / aromatics)
PAHs	Lot 14	UST Wrapping	-	Class V	No
Note 1: Stockpiling regime may be varied by contractor subject to approval by the Environmental Supervisor and Superintendent. * Metals = copper, lead, and zinc.					

6.3.2 Soil Validation Methodology

Initial remedial extents will extend 0.25m beyond the spatial extent of soil impacts presented in Figure 2. Exception to this will be where hard limits to excavation exist; the site boundary (i.e., potential to undermining infrastructure adjacent to the Site) and limestone / rock (at depth).

6.3.2.1 Asbestos

The asbestos in soil validation methodology is summarised below:

- Systematic inspection of excavated surfaces for the presence of ACM and / or other possible indicators such as C&D wastes.
- Validation samples will comprise the collection of 10L of soil representative of the remediation surface at a particular location⁶. All soil samples will be described / logged.
- The 10L sample will be passed through a sieve ($\leq 7\text{mm} \times \leq 7\text{mm}$) with $\geq 7\text{mm}$ sized fragments visually assessed for the potential presence of ACM. In the unlikely event that soils are unable to be sieved (e.g., high clay content), the 10L sample will instead be spread out on a plastic sheet (contrasting colour to the soils) and inspected.
- Where ACM ($\geq 7\text{mm} \times \geq 7\text{mm}$) is identified, the fragments will be collected and inspected, and their condition and weight recorded. In accordance with DoH (2021), the concentration of asbestos in soil will be calculated using either of the equations presented in Figure A.

Equation 1:

$$\text{mg/kg} = \frac{\text{proportion of asbestos} \times \text{weight of bonded ACM or AF or FA (mg)}}{\text{Soil weight (kg)}}$$

Equation 2:

$$\% \text{ (w/w) asbestos} = \frac{\text{proportion (expressed as \%) of asbestos} \times \text{weight of bonded ACM or AF or FA (kg)}}{\text{Soil weight (kg)}}$$

FIGURE A: DOH (2021) EQUATIONS TO CALCULATE ASBESTOS CONCENTRATION IN SOIL

In estimating concentrations, a suitable soil bulk density value (typically 1.65kg/L for sandy soils will be applied but this may be adjusted to Site-specific conditions) will be used to calculate soil weight. On the basis that the ACM identified to date has comprised cement bonded asbestos, the asbestos content of cement fragments will be assumed to be 15% w/w. If material other than fibre cement is encountered (e.g., vinyl), a conservative asbestos content will be estimated under direction of the Environmental Supervisor (or more specifically, a suitable specialist in assessment of asbestos and hazardous materials such as an Occupational Hygiene consultant).

6.3.2.2 Metals and Hydrocarbons

The soil validation methodology for metals and hydrocarbons in soil is summarised below:

- Systematic inspection of excavated surfaces as follows:
 - Presence of visual / olfactory evidence of soil impact (e.g., soil staining).

⁶ Where limestone / rock is encountered, validation will comprise visual inspection only.

- For hydrocarbons, field screening of suspected contaminated material using a photo-ionisation detector (PID).
- Collection of soil samples by hand (from excavator bucket) at systematic intervals (along with describing / logging).
- A three-dimensional systematic grid sampling design will be applied to account for spatial variability during soil sampling from stockpiles (by hand) for waste classification, with sampling uniformly distributed throughout the stockpile, including sampling at depth.

6.3.2.3 Sampling Density Summary

Sampling densities for soils subject of remediation are summarised in Table H.

TABLE H: VALIDATION SAMPLING DENSITY OVERVIEW

PHASE	OVERVIEW
Ex-situ waste classification	<p><u>Asbestos</u></p> <p>During material excavation and stockpiling, the Environmental Supervisor will visually inspect soils where ACM have not been identified (e.g., soil impacts correspond with metals only) to verify the absence of ACM / suspected presence of ACM (e.g., C&D wastes).</p> <p><u>Metals and TRH</u></p> <p>In accordance with DWER <i>Landfill Waste Classifications and Waste Definitions 1996</i> (as amended 2019), whereby sampling frequencies (for foreseeable / realistic stockpile sizes based on likely volumes stated in Table G) as follows:</p> <ul style="list-style-type: none"> • 0 to 100m³ – four samples. • 200 to 500m³ – six samples • 500 to 1,000m³ – eight samples
In-situ validation	<p><u>Asbestos</u></p> <p>Areas where ACM impacted soils are present solely on the ground surface and have been emu-picked and ACM impacted stockpile footprints (after they have been removed), will be validated as follows:</p> <ul style="list-style-type: none"> • Initial systematic inspection for ACM (2m grid, two pass, 90° change in direction between passes). • Where significant ACM fragments (>10 fragments) are observed, an additional soil scrape will be required. • Once no visible ACM fragments are identified within the scraped area and / or excavation, collection, sieving and inspection of 10L samples for ACM at a minimum sampling rate of one per 50m² of the remediated (scraped) surface will be undertaken (10L sampling will be undertaken as per methodology described above). <p>For excavations, collection, sieving and inspection of 10L samples for ACM, at a minimum sampling rate of one per five linear metres where walls have been created by the soil excavation process around the perimeter of the remediated area will be undertaken.</p> <p>The decontamination area and any haulage tracks will also be validated through inspection and 10L soil sampling for ACM as per above.</p> <p>Validation sampling will be biased towards locations/ areas where signs of potential contamination are observed (e.g., non-hazardous inert materials).</p> <p><u>Metals and TRH</u></p> <p>Validation samples will be collected as follows:</p> <ul style="list-style-type: none"> • Base of excavation – one per 50m².

TABLE H: VALIDATION SAMPLING DENSITY OVERVIEW

PHASE	OVERVIEW
	<ul style="list-style-type: none"> Walls of excavation – one per ten linear metres (per 1m face / depth of wall – i.e., one per 10m²). <p>Validation sampling will be biased towards locations/ areas where signs of potential contamination are observed (e.g., non-hazardous inert materials).</p>
Reinstated Site	The Site in its entirety is to be subject to a grid-based asbestos in soil walkover as outlined above) following reinstatement of excavations to verify the Site surface remains visibly free of ACM or potential ACM.

6.3.3 Remediation Targets / Validation Criteria

Recognising the objectives of the RAP / management of legacy matters being a key consideration (i.e., potential encumbrances on future land use), the remediation targets / validation criteria summarised in Table I have been adopted.

TABLE I: SUMMARY OF REMEDIATION TARGETS / VALIDATION CRITERIA

COPC	GUIDANCE	CRITERIA
Asbestos	DoH (2021)	<ul style="list-style-type: none"> Upper 100mm of the Site's surface is required to be demonstrated to be 'free of visible asbestos' (including post-backfill or remedial excavations). ACM in soils intended to remain on-Site: 'Residential-A' criterion (0.01% w/w).
	ASC NEPM and DWER (2021)	Where practicable, Site free of various inert wastes present as a result of historical demolition, consistent with aesthetic considerations.
Metals and hydrocarbons⁷	ASC NEPM	<ul style="list-style-type: none"> Health Investigation Level (HIL) A – residential land use. Health Screening Level (HSL) A – residential land use (direct contact). HSL A – residential land use (vapour intrusion).
Hydrocarbons	CRC CARE (2011)	<ul style="list-style-type: none"> HSL – intrusive maintenance worker (direct contact). HSL – intrusive maintenance worker (vapour intrusion).

With reference to Table I, it should be recognised that HSLs are dependent on depth and dominant soil type (e.g., sand).

With respect to aesthetic considerations, these apply following works which have resolved risks posed to human health (i.e., DoH [2021] remediation targets / validation criteria above). Noting there are no specific numeric aesthetic guidelines ASC NEPM or DWER (2021), assessment of aesthetic considerations will be undertaken using multiple lines of evidence (e.g., quantity, type and distribution of foreign material, odours) to establish whether inert wastes suggest the presence of gross contamination (e.g., soil profile dominated by inert waste rather than being predominately soil), where remediation / removal may be warranted to mitigate potential future management. Small quantities

⁷ Noting environmental receptors are likely to be displaced by the proposed residential development (i.e., trees removed, and growth media / plants imported to Site), Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) (as referenced in the ASC NEPM) are not considered to be relevant.

of non-hazardous inert material are unlikely to be a cause of concern or limit the use of Site in most circumstances and in such circumstances, are not required to be remediated.

A summary of remedial methodologies and targets / validation criteria are summarised in Table J.

TABLE J: ADOPTED VALIDATION CRITERIA – SOIL IMPACTS AND CLEAN FILL

ASPECT OF WORKS		REMEDIALATION / VALIDATION STEPS		REMEDIALATION / VALIDATION TARGETS	
ACM on the ground surface	1. Following spraying / ACM will be emu-picked and placed in dedicated asbestos disposal bags. The bagged ACM will be disposed of to landfill along with the large / bulk ACMs (if encountered).			Remediated Ground Surfaces	<ul style="list-style-type: none"> No visible asbestos in top 100mm of the ground surface. 10L soil samples collected at densities detailed in Table H. Estimated ACM concentration in soils to be below Residential A criterion (0.01% w/w). Where practicable, free of inert wastes present because of historical demolition.
	2. In the event the remediation target cannot be achieved via emu-picking, localised scraping soil / excavation may be undertaken, at the direction of the Environmental Supervisor, until no visible ACM is observed. The remediation and validation remediation steps outlined for remaining areas (detailed below) will be adhered to.				
	3. Where vegetation precludes a thorough visual inspection of the ground surface during emu-picking and / or in validation visual inspections, vegetation removal and soil scraping may be required. Where soil scraping and vegetation removal occurs, remediation steps detailed below will be adhered to.				
	Note: Clusters of larger fragments / sections of sheeting will be collected and bagged / wrapped. The bagged ACM will be disposed of to landfill along with other ACM impacted waste.				
Contaminants in shallow soils	1. Known areas of impacted soils (i.e., Figure 2 and potentially emergent areas identified during the emu-pick) will be initially scraped to an approximate depth of 0.25m below the existing surface, however the actual depth of excavation will be subject to advice by the Environmental Supervisor based on field observations and progressively validation inspections and sampling. Where visible ACM is observed, additional soil will be progressively scraped at minimum 0.2m intervals, at the direction of the Environmental Supervisor, until no visual / olfactory evidence of soil impacts are observed. The remediation and validation process will be repeated until such time as the validation criteria are achieved.			In-situ Validation	<ul style="list-style-type: none"> No visible asbestos in top 100mm of the ground surface. 10L soil samples collected at densities detailed in Table H. Estimated ACM concentration in soils to be below Residential A criterion (0.01% w/w). Where practicable, free of inert wastes present because of historical demolition. Concentrations of metals, TRH, and PAHs below HIL A, HSL As and HSLs for intrusive maintenance workers.
	2. Scraped material will be transported to the designated stockpile area/s on-site (for waste characterisation – as required to verify preliminary waste classification) prior to loading into trucks / off-site disposal.				
	Notes:			Waste / Stockpiled Material	<ul style="list-style-type: none"> Waste disposal dockets confirm fate / destination of all waste materials excavated from Site.
				Stockpile Footprints	<ul style="list-style-type: none"> No visible asbestos in top 100mm of the ground surface. Where practicable, free of inert wastes present because of historical demolition. Concentrations of metals, TRH, and PAHs below HIL A, HSL As and HSLs for intrusive maintenance workers.
				Decontamination Area	<ul style="list-style-type: none"> No visible asbestos in top 100mm of the ground surface. Where practicable, free of inert wastes present because of historical demolition.
Backfilling excavations with clean fill	Demonstrate (through certification) that any material imported to Site for backfilling remedial excavations (i.e., the volume of oversize material disposed of off-site) is “Clean Fill” as defined in the DWER <i>Landfill Waste Classifications and Waste Definitions 1996</i> (as amended 2019) (2019) whereby clean fill means raw excavated natural material such as clay, gravel, sand, soil, or rock fines that:			<ul style="list-style-type: none"> Has been excavated or removed from the earth in areas that have not been subject to potentially contaminating land uses including industrial, commercial, mining, or intensive agricultural activities; and Has not been processed except for the purposes of: <ul style="list-style-type: none"> Achieving desired particle size distribution; and / or Removing naturally occurring organic materials such as roots. Does not constitute any acid sulfate soils; and Does not contain any other type of waste. <p>Material used for backfilling of excavations (as maybe required) will also be subject to approval by the Superintendent to ensure suitability from an engineering and aesthetic perspective. Material imported for internal roadways (if not used for backfilling of excavations) is to be removed off-site as part of site reinstatement at the completion of works.</p>	

7 COMMUNITY ENGAGEMENT

DoH (2021) recommends that consultation with the surrounding community be undertaken as part of remediation works. Members of the community who live, work, or visit the area in the vicinity of the Site may be directly or indirectly affected by remediation activities and are stakeholders.

The Site is located with a predominately residential area (west, south and east of the Site), with high-volume trafficked roads located adjacent to the north (Canning Highway). Based on the identified surrounding land uses and proposed remediation work, the following key stakeholders (in addition to those directly associated with the administration of the Site / surrounding area – Town of East Fremantle and Main Roads) have been identified:

- Commercial property adjacent to the east of the Site (corner of Canning Highway and Glyde Street).
- Residents adjacent to the:
 - East and south of the Site (on Glyde Street).
 - West and south of the Site (on East Street).
 - North of the Site (on Canning Highway).

As part of the overall community engagement strategy, the following actions are proposed:

- Preparation of a letter which will include a brief description of the activities associated with the remediation, timeframe for the work to be completed, monitoring that will be undertaken and contact details for the project team should there be any further queries. A copy of this letter will be issued as follows:
 - Initially to the Auditor for review (prior to distribution/ for endorsement).
 - One week before the remediation work commences:
 - Letter drop to buildings / residences adjacent to the Site (as identified in Figure 3⁸), including persons who could be affected by associated traffic movements.
 - To the Town of East Fremantle Environmental Health Officer.
- The Air Quality Management strategy (see Section 7.12) considers potential impacts to these receptors. It is proposed to also undertake Airborne Fibre Monitoring (AFM) along with dust monitoring and management. The results will be provided to the Superintendent regularly and upon request, to relevant residents (i.e., those identified in Figure 3), Town of East Fremantle and as required / legislated to other agencies.

7.1 PROGRAM

The remediation program is currently expected to commence during autumn (between March and April) 2025 and is estimated to take approximately 10-14 working days to complete (subject to program confirmation by the Remediation Contractor and requirement for spraying / slashing of weeds

⁸ It is suggested that the strata company (or body corporate) relating to residences within the apartment complexes on Canning Highway be advised.

/ grass – discussed further below). The Site is to be accessed / exited from Glyde Street / East Street subject to Local Government approval.

Based on the absence of vegetation on-Site (albeit for invasive species / weeds), there is not considered to be a risk posed by the remedial works on vegetation. Grasses / weeds may need to be managed (sprayed / slashed) to facilitate inspections of the ground surface. The Remediation Contractor is to:

- Attend Site to inspect ground conditions and in consultation with the Environmental Supervisor, evaluate and nominate the most effective vegetation management strategy that also supports the appropriate management of ACM (and demonstrates how implementation of the approach fits into the schedule / staging of works [refer Table F).
- At the approval of the Proponent, implement the vegetation management strategy, noting this may take place prior to remediation being undertaken (e.g., spraying / slashing to enable visual inspection of ACM on the ground surface).

Vegetation removed during soil works is expected to be disposed of to landfill as ACM impacted waste by the Remediation Contractor unless the Environmental Supervisor can demonstrate the material to be free of asbestos / ACM (and in turn, disposed of as green waste).

7.2 REMEDIATION MANAGEMENT REQUIREMENTS

A summary of the key tasks to be completed during the remediation (excluding any contract preliminaries that maybe required) are presented in Table K.

TABLE K: SUMMARY OF REMEDIATION MANAGEMENT REQUIREMENTS

REMEDICATION		TASK	RESPONSIBILITY
ACM on the ground surface		<ul style="list-style-type: none">Manage vegetation (clearing of grasses / weeds).	Remediation Contractor (consulting with Environmental Supervisor / Superintendent)
		<ul style="list-style-type: none">Emu-pick ACM from ground surface and dispose of material to an appropriately licenced landfill as Special Waste (Type 1).At completion of remedial works (including backfilling) undertake a Site Walkover to verify absence of ACM on the ground surface across the entirety of the Site.	Environmental Supervisor
	Contaminants in shallow soils	<ul style="list-style-type: none">Excavate remaining impacted soils under direction from Environmental Supervisor.Segregate soils according to contamination characteristics.Dispose of waste material / stockpiles under direction from Environmental Supervisor.Direct the Remediation Contractor in terms of the spatial extent of remediation required.Validate cut / excavated surfaces (see Table J for additional information regarding validation requirements).	Remediation Contractor Environmental Supervisor
Stockpiles		<ul style="list-style-type: none">Prepare dedicated temporary soil stockpile area/s.	Remediation Contractor (consulting with Environmental Supervisor / Superintendent)
		<ul style="list-style-type: none">Rake 0.1 m below stockpile footprint and inspect for ACM (emu-pick as required) for subsequent validation by Environmental Supervisor post-stockpile removal off-Site.	Remediation Contractor
		<ul style="list-style-type: none">Undertake waste classification sampling.Advise Remedial Contractor regarding fate of materials subject to waste classification sampling.Validate stockpile footprints post-removal from Site (see Table J for additional information regarding validation requirements).	Environmental Supervisor
IMPORTED CLEAN FILL			
		<ul style="list-style-type: none">Prior to importation to Site, provide documentation which certifies material used for backfilling excavations (to supplement undersize fraction) is certified as clean fill (refer Table J).	Remediation Contractor

TABLE K: SUMMARY OF REMEDIATION MANAGEMENT REQUIREMENTS

TASK		RESPONSIBILITY
AIR QUALITY		
Undertake dust management for duration of remediation works.		Remediation Contractor
Conduct dust monitoring and AFM throughout the remediation. Provide data to the Client, Remediation Contractor, and other nominated stakeholders (refer to Section 7).		Environmental Supervisor
WASTE DISPOSAL		
<ul style="list-style-type: none">Dispose of contaminated materials (as well as vegetation and C&D materials) to appropriately licenced facilities, as per the waste classification assigned by the Environmental Supervisor. Refer Table J for additional information.Retain all disposal dockets / receipts and provide to the Superintendent and Environmental Supervisor.		Remediation Contractor
GENERAL ENVIRONMENTAL MANAGEMENT		
<ul style="list-style-type: none">Take all necessary steps to prevent cross-contamination.Manage noise and vibration throughout the remediation.Manage vehicle movements in accordance with local by laws.Record all community complaints / queries and report to the Environmental Supervisor within 24 hours.Report all ‘Unexpected Finds’ to the Environmental Supervisor within two hours and manage as directed (see Section 7.13 for additional information). Cease work in that area (as maybe advised by Environmental Supervisor and / or Superintendent) until instruction issued by Superintendent.		Remediation Contractor

7.3 WORK ZONE MANAGEMENT

7.3.1 Access and Security

The Remediation Contractor will be responsible for ensuring the security of all work areas, as well as all plant and equipment maintained on-Site during remediation works. Prior to the commencement of remediation works, temporary fencing (including gate/s) should be placed where need to prevent unauthorised access to the Site (i.e., restrict public access).

The Remediation Contractor should consider measures (e.g., shade cloth) to restrict public viewing when establishing temporary fencing, with such measures capable of withstanding prevailing winds / not resulting in fencing being knocked over.

Signage including personal protective equipment (PPE) requirements and contact information for the Remediation Contractor will be placed on gates on the western and eastern site boundaries (East Street and Glyde Street, respectively). Signage indicating 'Warning Asbestos' and / or 'Warning Asbestos Remediation in Progress' will also be placed along the fencing and remain for the duration of the remediation program.

Site access will generally be restricted to the Remediation Contractor, Environmental Supervisor, Superintendent and Proponent, but also may require other personnel during the works / visitors (e.g., truck drivers) subject to appropriate site inductions.

All Site Visitors are required to report to the Site Office (safe work zone), undergo a site familiarisation / induction and will be escorted by the Remediation Contractor's Site Supervisor when on-Site. All Site Visitors are required to wear standard construction PPE specified by the Remediation Contractor such as high vis, long sleeved shirt and trousers, steel capped boots, and a hard hat.

Persons operating in the safe zone (i.e., remediated, and validated areas), will be exempt from the control measures (including PPE requirement) that are in place for the remediation areas. See Section 7.4 for additional information pertaining to PPE.

Personnel decontamination zones will be established at entry / exit points of remediation zones. The designated decontamination zones will enable any persons required to wear PPE to remove PPE, decontaminate footwear and dispose of the PPE in clean area outside of the remediation zones and safe works zone.

A separate equipment decontamination zone will also be established where machinery can be inspected and decontaminated (if required). Decontamination requirements are outlined in Section 7.5.

7.3.2 Utilities

Prior to conducting any works relating to decommissioning, the Remediation Contractor must conduct a search for utilities (particularly underground) and document the known locations / alignments (above and below ground). As a minimum, this will include the following:

- Inspection of utility plans provided by the Proponent or Superintendent (if available).
- Conducting a search for utilities using the Before You Dig Australia search facility.
- Employing the professional services of an underground utility locating company using equipment including a cable avoidance tool (CAT) and ground penetrating radar (GPR) device.

It should be noted that a live gravity sewer line was identified in the southern portion of Lots 14, 15 and 16 along with an observation point visible on the ground surface in Lot 16 during the DSI (Aurora, 2023b).

Further, the Remediation Contractor must ensure relevant utilities servicing the Site are disconnected / isolated prior to excavation taking place on-Site. Further, the Remediation Contractor must evaluate the potential risk that overground utilities (i.e., electricity cables) pose in context to the activities undertaken during remedial works on-Site.

7.3.3 Amenities

The Remediation Contractor must establish and maintain temporary amenities including toilets and a Site Office (as required) to support Site Personnel during the entirety of the remediation works.

7.4 PERSONAL PROTECTIVE EQUIPMENT

All Site Workers / Visitors that enter the remediation zones (excluding those within closed cabs of vehicles / machinery with air flow on recirculate), are required to wear respiratory protection (Class P2 half face mask, either disposable or reusable), in addition to Site-specific PPE requirements specified by the Remediation Contractor (e.g., hard hat, high visibility shirt, steel toe capped boots).

All Site Workers / Visitors that will be undertaking tasks which may result in close contact with asbestos contaminated soils or ACM that could potentially adhere to their hands, footwear, or clothing, must wear the following additional PPE: disposable coveralls, gloves, and boot covers (or washable boots e.g., gum boots that can be decontaminated before exiting the remediation zone).

All disposable PPE is required to be placed in heavy duty plastic dedicated asbestos disposal bags immediately following use and disposed to landfill as 'asbestos contaminated material' (i.e., Special Waste – Type I).

7.5 DECONTAMINATION

Earthworks machinery must be decontaminated following handling of ACM contaminated soils i.e., before handling remediated and validated soils. Machinery should also be inspected within the designated Decontamination Area (as illustrated in Figure 2, attached) prior to leaving Site.

If soils become adhered to earthworks machinery, there may be a requirement to decontaminate the machinery's tracks / wheels and underside prior to moving into non contaminated areas.

To remove any adhered soils that may contain ACM, the machine should be washed down using a low-pressure hose and scrubbing brush and inspected for ACM prior to continuing with the next task.

The work should be planned to maximise the amount of material / time a machine is required to handle clean / contaminated material and minimise the number of changes between zones.

The wash down areas are required to be remediated and validated as directed by the Environmental Supervisor.

7.6 TRAFFIC AND TRANSPORT ROUTE MANAGEMENT

A Traffic Management Plan (TMP) should be prepared which documents proposed vehicle ingress / egress points, signage requirements, and identify the receiving landfill for any off-Site disposal and to provide details on off-Site transport routes. This plan may require provision to and approval by the Town of East Fremantle and Main Roads (approval requirements to be determined by DPLH [in consultation with relevant stakeholders] and prescribed in the contract for the Remediation Contractor).

The designated transport route within the Site should be marked out using high visibility flagging. At the end of use, the haulage route must be thoroughly inspected, to confirm that no contaminated soils have been accidentally spilled from the haulage trucks, or unintentionally transported as adhered soils on the haulage truck wheels to clean / remediated areas of the Site. The haulage route is required to be remediated, as maybe required, following direction from the Environmental Supervisor and Superintendent.

The designated transport route must follow a path through the safe work zone outside of the remediated zones.

7.7 PLANT AND EQUIPMENT

It is important that contaminated soils are excavated with a machine fitted with a toothless bucket to facilitate an even scrape.

A mechanical digger is preferential over a front-end loader for the excavation of impacted soils, as a front-end loader has a greater potential to significantly disturb / rework / spill soils and thereby increase the overall volume (and cost) of material required to be disposed of off-Site. Due to the open environment of the Site, the Remediation Contractor may deem a front-end loader more efficient. In the event of this being the preferred method, the Remediation Contractor is required to implement a methodology that prevents significant ground disturbance / over excavation of remediation areas beyond the currently delineated vertical extent of excavation as well reducing spillage from the bucket. The Superintendent will have the authority to instruct the Remediation Contractor to utilise a mechanical digger if a front loader is producing more material to be disposed of off-Site than is deemed required to achieve remediation objectives.

It should also be noted that the depth to the natural limestone underlying the fill materials to be removed is uneven and highly undulating with the limestone potentially can be as shallow as 0.1m bgl. This may impact on the ability of larger machines to remove impacted soils and the use of smaller machinery where such instances occur will be to be taken into account by the Remediation Contractor.

7.8 FLORA

It is expected that invasive grasses / weeds may need to be managed (sprayed / slashed) to facilitate inspections of the ground surface. Noting an absence of sensitive flora species on-Site, there is not considered to be a risk posed by the remedial works.

7.9 MATERIAL HANDLING PROCEDURES

All practical measures must be taken to prevent cross contamination of materials. Material movements (soil and C&D) within the Site are required to be tracked in a register with reference to the location / origin from which it was sourced and stockpiles (e.g., metals impacted soil from Lot 14).

The following should be adhered to as a minimum:

- All trucks must be roadworthy and comply with statutory requirements.
- All trucks must be operated by appropriately licensed personnel.
- All trucks must be fitted with sealed tailgates and 'wind-on' tarps or equivalent to prevent the loss of soil during transport. Each load should be dampened and the 'wind-on' tarp is required to be rolled out and cover the load prior to exiting the Site.
- Any trucks transporting contaminated material from Site are required to utilise the major road network as far as practicable.
- All trucks must hold a description of the soil / material in transit, plus contact details and procedures in the event of an emergency.
- In the event of a vehicle incident resulting in lost load, the driver is to immediately contact emergency services (including advising whether the load contains asbestos). The driver must also advise the Remediation Contractor of the incident, who will in turn notify the Environmental Supervisor and Superintendent. The Remediation Contractor will be responsible for any cleanup works that are required because of a vehicle incident (as directed by the relevant regulatory authorities).

7.10 STOCKPILE MANAGEMENT

All material movements (soil and C&D) within the Site are required to be tracked in a register with reference to the areas and individual contaminated soil stockpiles. Stockpiles of contaminated material must be kept damp to manage dust generation. The following system (or equivalent agreed with the Environmental Supervisor) is to be implemented by the Remediation Contractor:

- Stockpiles of impacted soil which are designated Class I material – no flagging.
- Stockpiles of impacted soil which are designated Class I, Special Waste Type 1 material – pink flagging.
- Stockpiles of impacted soil which are designated Class III material – green flagging.
- Stockpiles of impacted soil which are designated Class III material, Special Waste Type 1 – orange flagging.
- Stockpiles of impacted soil which are designated Class IV material – red flagging.

7.11 NOISE AND VIBRATION MANAGEMENT

The *Environmental Protection (Noise) Regulations 1997* specify allowable sound levels that should not be exceeded. The following management controls are required to be implemented by the Remediation Contractor to minimise noise and vibration impacts to surrounding residents, noting all works must also comply with the Town of East Fremantle policies and regulations:

- Construction work (which includes the proposed remediation) is permitted between the hours of 7am to 7pm from Monday to Saturday inclusive, without the usual restrictions that apply to other noise sources. Noise from construction work is not permitted on Sundays or public holidays (without the appropriate license / approval from the Town of East Fremantle and Proponent / Superintendent [including Noise Management Plan]).

- The following restrictions that apply to noise from remediation work required to be complied with:
 - Carry out the work in accordance with Section 6 of Australian Standard (AS) 2436 – 2010 *'Guide to Noise Control on Construction, Maintenance and Demolition Sites'*.
 - Use equipment that is the quietest reasonably available and in a manner that minimises any impacts due to noise.
- The allowances for noise from construction / remediation sites only apply to noise directly resulting from the work itself. Noise from other sources such as music being played by workers is not exempt and the usual restrictions apply to these types of noise. Refer to Town of East Fremantle [Noise Pollution » Town of East Fremantle](#) for additional information.
- The Remediation Contractor is required to limit ground vibrations in adjoining buildings and properties by ensuring that ground particle velocities arising from the operation of vibratory or percussion equipment do not exceed any such limit that would result in nuisance or damage to buildings or property.
- All noise and vibration related complaints will be immediately reported to the Environmental Supervisor and Superintendent. The Environmental Supervisor will record the issue, advise the Auditor, and track its resolution by the Remediation Contractor (where applicable).

7.12 AIR QUALITY MANAGEMENT

7.12.1 Dust

Remediation activities which have the potential to impact air quality include excavation, raking transporting, stockpiling, and loading of waste material into trucks. A Dust Risk Assessment has been completed in accordance with *'A guideline for managing the impacts of dust and associated contaminants from the land development sites, contaminated sites remediation and other related activities'* (Department of Environmental Conservation [DEC], 2011) (see Appendix 1). The proposed remediation works (localised excavation and temporary stockpiling areas) together with the features and location of the Site and environmental setting (i.e., wind directions) have resulted in a site classification of 'Medium Risk' with respect to dust.

Based on this classification, the provisions, contingency arrangements, and monitoring requirements of the Remediation Contractor are summarised in Table L are required to be in place for the duration of the remediation works. It is understood that remedial works is expected to be undertaken during autumn (between March and April) 2025 which coincides with high seasonal rainfall and as such the provisions and contingency measures proposed reflect this. In the event the remediation is postponed and undertaken earlier / within summer, the provisions and contingency measures will need to be reviewed and adjusted to suit expected climatic conditions.

TABLE L: DUST MANAGEMENT REQUIREMENTS – REMEDIATION CONTRACTOR

OVERVIEW	
MANAGEMENT REQUIREMENT	
Provisions	<ul style="list-style-type: none"> • Soils will be dampened down prior to and during excavation within all areas / stockpiles which require remediation together with internal haulage tracks. • The speed of all vehicles on-Site shall be restricted to 10km/hr. This speed shall be further reduced for safety reasons or if large amounts of dust are still being generated, until additional dust management measures are put in place and demonstrated to be effective. • The Remediation Contractor will only disturb areas which can be actively managed. • Whilst the classification of 'Medium Risk' requires the disturbed areas to be stabilised, this is impracticable and unnecessary given the expected timing and duration of the program. Instead, the Remediation Contractor will include provision for a water cart on-Site which will be available to suppress dust during the remediation program. • After the Site has been remediated and validated (and before the Remediation Contractor has vacated the Site), the Superintendent / Proponent sight evidence / be satisfied that ground conditions have been suitably stabilised on-Site. The project budget will include a provisional allowance for surface stabilisation. This may be required to be implemented if the time lag between the remediation phase finishing and the construction phase commencing extends over the spring / summer season. The Proponent will retain responsibility for site stability whilst the Site is vacant until construction commences. • A complaints management system will be in place for the duration of the remediation phase. Complaints are to be recorded and acted upon promptly.
Monitoring	<ul style="list-style-type: none"> • The Remediation Contractors and the Environmental Supervisor will undertake regular inspections of the Site to visually confirm dust is not migrating beyond the site boundary. • Prevailing wind directions in August are expected to be to the south-west (9am) and east (3pm). On this basis, it is proposed to place a dust (particulate matter [PM] size 10 and 2.5) monitoring station on the western boundaries of the Site and northern boundary (see Figure 2). The dust monitoring stations will be readily movable to capture prevailing wind directions / work zones each individual day. • There is potential for false positives if the dust monitor is placed immediately within the earthworks zone (or similarly along haulage routes) (i.e., an over estimation of dust generation due to the immediate proximity of works, but not necessarily representative of what is migrating beyond the site boundary). As such, when remedial works are being undertaken on-Site, the preferred approach (where practicable) is to be proactive by planning dust generating activities (and particularly those in proximity to adjacent residences / commercial premises to the west / south / east) on days with notably less wind and or / during times of day when the wind is blowing in the opposite direction (i.e., afternoon). This will be undertaken in conjunction with ensuring soils / ground disturbed is kept damp (either by climatic conditions and / or water cart). • The PM₁₀ and PM_{2.5} monitoring units will have the following features: <ul style="list-style-type: none"> – Simultaneous PM_{2.5} and PM₁₀ measurement. – One-minute logging interval.

TABLE L: DUST MANAGEMENT REQUIREMENTS – REMEDIATION CONTRACTOR

MANAGEMENT REQUIREMENT	OVERVIEW
	<ul style="list-style-type: none">- 24-hour rolling averages.- Humidity correction.- Run via portable battery connected to solar panels.- Cellular telemetry.• Informal Site-specific management criteria (based on 15-minute average) and official performance criteria (based on 24-hour averages) presented in Table M, will be adopted for the remediation phase.
Contingency	<ul style="list-style-type: none">• Wind fencing shall be erected within 24-hours of the Remediation Contractor being required to do so by the Environmental Supervisor or regulator (e.g., DWER). Dust generating activities on the Site shall cease in the interim.• Dustex™ or a non-seeded hydromulch will be applied to stabilise the site surface (within 24-hours) if required (i.e., water cart is not effective at preventing dust migrating across the site boundary).
Complaints	<ul style="list-style-type: none">• Stop relevant work activity and investigate the cause of excessive dust generation or complaint.• Review dust monitoring data and climatic conditions.• Implement additional appropriate dust control measures, which may include limiting the quantity of machinery / vehicles in operation; further wetting down of haulage routes / stockpiles / excavations; Remediation Contractor removing dust source material within 24-hours; and / or waiting until wind conditions improve to continue work.• Monitor effectiveness of control measures. If the measure is inadequate, implement additional alternative measures.• Environmental Supervisor to update Auditor on nature of complaint (and outcomes/ resolution).

TABLE M: PARTICULATE MATTER MONITORING CRITERIA

PARTICULATE SIZE	ADOPTED MONITORING CRITERIA	ACTIONS WHEN EXCEEDENCES REPORTED
PM ₁₀	<p>Informal Site-specific management criteria will be based on 15-minute average set at the following levels:</p> <ul style="list-style-type: none">• Alert Level: 240µg/m³.• Management Intervention Level: 480µg/m³.• Stop Work Level: 960µg/m³.	<ul style="list-style-type: none">• Alert Level: Remediation Contractor to inspect and observe area upwind of Site where monitor has detected elevated levels of dust to identify activity / circumstances which are contributing to increased dust emissions and whether dust emissions are visibly migrating beyond the site boundary. In the event any of the exceedances are attributed to external sources, this will be recorded in the Air Quality Register (maintained by the Environmental Supervisor) with no Site-specific actions required.• Management Intervention Level: Remediation Contractor to evaluate if additional controls are required taking into consideration the expected duration of the particular activity which may be contributing to the dust and the prevailing winds, and any forecast increases in wind strength for the remainder of the day. Remediation Contractor to record observations and actions and report via email to Environmental Supervisor by the end of the day. Environmental Supervisor to review dust monitoring data (one-minute logging) for any observed increasing trends and advise Remediation Contractor and Superintendent. Environmental Supervisor to check the 24-hour-average the following day and identify if there was an exceedance. Exceedances to be actioned as per below.• Stop Work Level: Remediation Contractors to inspect and observe area upwind of Site where monitor has detected elevated levels of dust to identify activity / circumstances which are contributing to increased dust emissions and whether dust emissions are visibly migrating beyond the site boundary. In the event any of the exceedances are attributed to external sources (e.g., bush fire), this will be recorded in the Air Quality Register with no Site-specific actions required. Remediation Contractor to contact Environmental Supervisor and Superintendent and report on activities which are being undertaken and modifications which can be made in the first instance. If stop work levels continue to be exceeded after 30-minutes of implementing the modified activities and increased dust suppression, the activity which is contributing to increased dust at that location is to cease until prevailing winds reduce, additional controls can be implemented, and dust levels return to below Alert Levels. Additional controls may include an additional monitoring point at the nearest receptor likely to be impacted by activities and prevailing winds to determine actual impacts. Environmental Supervisor to review dust monitoring data (one-minute logging) for any observed trends and advise Remediation Contractor. Environmental Supervisor to check the 24-hour-average the following day and identify if there was an exceedance. Exceedances to be actioned as per below.
PM _{2.5}	<p>Informal Site-specific management criteria will be based on 15-minute average set at the following levels:</p> <ul style="list-style-type: none">• Alert Level: 120µg/m³.• Management Intervention Level: 240µg/m³.• Stop Work Level: 480µg/m³.	

TABLE M: PARTICULATE MATTER MONITORING CRITERIA

PARTICULATE SIZE	ADOPTED MONITORING CRITERIA	ACTIONS WHEN EXCEEDENCES REPORTED
PM ₁₀	Maximum of 50ug/m ³ expressed as a 24-hour average (NEPC, 2021).	<ul style="list-style-type: none">The Environmental Supervisor will notify the Remediation Contractor and Superintendent via email.The Environmental Supervisor will contact the Remediation Contractor to discuss the activities which were being undertaken within the vicinity of the monitor which recorded the exceedance, evaluate what additional controls may be required with due consideration to the weather forecast for that day / coming week.In the event any of the exceedances are attributed to external sources (e.g., bush fire), this will be recorded in the Air Quality Register with no Site-specific actions required. If the 24-hour average for PM₁₀ is regularly exceeded (>1 per week in a one-month period), the short-term trigger levels will be reviewed and made more stringent resulting in management actions being triggered more promptly / frequently.
PM _{2.5}	Maximum of 25ug/m ³ expressed as a 24-hour average (NEPC, 2021).	

7.12.2 Airborne Fibre Monitoring

The Environmental Supervisor will implement an AFM program which will comprise static AFMs located in areas of the Site as summarised in Table N and illustrated in Figure 2 which are to be operated as follows:

- Baseline monitoring prior to site establishment for remedial works taking place (i.e., as part of provision allowed for in Table N).
- The duration of relevant ground / soil disturbing activities.

TABLE N: SUMMARY OF PROPOSED AIRBORNE FIBRE MONITOR LOCATIONS

AREA OF SITE	LOCATION OF AFM
Northern	<ul style="list-style-type: none">• One roughly in the centre of the site boundary.
Eastern	<ul style="list-style-type: none">• Two evenly spaced on the site boundary.
Southern	<ul style="list-style-type: none">• Total of three; one along each directional change of the site boundary.
Western	<ul style="list-style-type: none">• One in the southern area of the site boundary.

The position of the AFMs has sought to capture conditions in areas proximal to identified human receptors adjacent to the Site in context to prevailing wind directions, but also protection / buffering capacity of vegetation on-Site. To this degree, AFMs will be positioned each day based on the Environmental Supervisor's review / consideration the prevailing wind directions / forecasts and the areas being excavated on-Site relative to the identified receptors off-Site. This type of monitoring is referred to as 'control' monitoring and is required to be undertaken along the boundaries of the Site, as a minimum, until all ACM has been removed from Site. Static AFMs will be on a minimum six-hour cycle and covering all or a portion of the work shift each day and operated in accordance with NOHSC (2005).

The following procedures are required to be implemented with respect to Quality Control (QC) during AFM operation:

- Standardised field sheets will be utilised to record the serial numbers of the AFM pumps and rotameters utilised each day and verify each piece of monitoring is within calibration before use.
- The pump inlet will be positioned near the human breathing zone (i.e., 1m to 2m above ground level).
- Flow rates will be set using a calibrated rotameter. Flow rates will be recorded at commencement and completion of monitoring each day with sampling start and finish times also recorded. This data will be used to calculate the volume of air processed through each filter each day.
- Each cowl / filter holder utilised will be assigned a unique sample identification.
- Airborne fibre estimation analysis of samples will be conducted by the Environmental Supervisor's in-house laboratory which is accredited by National Association of Testing Authorities (NATA) to International Organisation for Standardisation (ISO) / International

Electrotechnical Commission (IEC) 17025⁹ for asbestos fibre counting and volume measurement (air). Samples will be analysed in accordance with the NOHSC (2005).

- In terms of protecting public health, the adopted target background level will be the NATA collection and detection limit of 0.01 fibres/mL (10 times below the occupational limit). Remediation works will cease while dust management procedures were reviewed if this target level is exceeded. In the event this target is exceeded (≥ 0.01 fibres/mL), Scanning Electron Microscopy (SEM) analysis will be undertaken to assess if the fibres are in fact asbestos.
- In the event any of the exceedances of background are attributed to external sources, this will be recorded in the Air Quality Register (maintained by the Environmental Supervisor) with no Site-specific actions required.
- The Environmental Supervisor is to update Auditor in the event remediation works are ceased due to unacceptable fibre results.

7.13 UNEXPECTED FINDS

Unexpected Finds' may include previously unidentified areas / sources of contamination and should be managed conservatively in the first instance until the Environmental Supervisor has inspected and provided the necessary advice on how to proceed. The following procedure will apply to 'Unexpected Finds' identified by the Remediation Contractor:

- Upon discovery of the 'Unexpected Find', work shall cease in the area and access restricted to prevent potential spread of contamination and mitigate risk to human health while the find is being assessed.
- The discovery of an 'Unexpected Find' is required to be reported to the Environmental Supervisor and the Auditor.
- The Environmental Supervisor will liaise with the Superintendent to determine what is the action required and to arrange for the 'Unexpected Find' to be recorded, location and physical description (and sampling if considered necessary).
- Works shall not proceed within the area of impact until an appropriate management approach has been determined and authorisation has been received by the Remediation Contractor from the Environmental Supervisor to proceed with the 'Unexpected Find Action Response'.
- The Environmental Supervisor will monitor the management procedure employed to ensure works are completed in accordance with relevant legislation and will subsequently validate the works employed to mitigate the assessed risk (as specified by the 'Unexpected Find Action Response').

7.14 DEMOBILISATION

In addition to adhering to contractual obligations, the Superintendent is to approve demobilisation from the Site following review of evidence which verifies the following from Site Personnel:

- Environmental Supervisor to demonstrate:
 - All waste material has been disposed of off-Site.

⁹General requirements for the competence of testing and calibration laboratories.

- All areas of contaminated soils subject of this RAP (including footprints of stockpiles and decontamination areas used for remedial works) have been verified / validated / backfilled with material suitable for residential land use.
- Remediation Contractor to demonstrate that any damaged infrastructure has been suitably reinstated.

Further, the Superintendent is to be satisfied that any complaints / stakeholder management issues which have arisen during the remediation works have either been resolved or suitable steps have been taken to resolve complaints / stakeholder management issues.

8 REPORTING

The Remediation Contractor is required to report the following to the Environmental Supervisor / Superintendent:

- All 'Unexpected Finds' of potential sources of contamination (e.g., suspect asbestos containing infrastructure such as utility pits and pipes).
- All environmental incidents (e.g., spills, hydraulic hose leaks, cross contamination).
- Complaints from the community / stakeholders (also required to be reported to the Contaminated Sites Auditor on behalf of the Environmental Supervisor).

The Remediation Contractor is required to provide the following documents at completion of the Project (or during the remediation works if requested by the Environmental Supervisor):

- Material tracking register and any associated survey documents.
- Waste materials / disposal register.

Upon completion of the remediation, a Site Remediation and Validation (SRV) Report will be prepared by the Environmental Supervisor in general accordance with the following guidelines: ASC NEPM, DWER (2021) and DoH (2021). In addition to data collected during validation / waste characterisation purposes, the Environmental Supervisor is to retain all monitoring data collected prior to and during the remedial works (e.g., dust and AFM) for inclusion within the SRV Report.

8.1 QUALITY ASSURANCE

Site personnel comprising representatives of the nominated Environmental Supervisor must have appropriate asbestos qualifications and experience consistent with DoH (2021) guidance.

Several actions, procedures, checks and decisions will be required to be undertaken by the Environmental Supervisor to ensure the representativeness, completeness, comparability, accuracy, and precision of collected data with respect to the remediation and specifically the validation inspections, sampling, and laboratory analyses.

These actions and procedures will form part of the Environmental Supervisors Quality Assurance (QA) processes, reference the methods described in the ASC NEPM. QC processes are used to monitor and measure the effectiveness of QA procedures and include operational techniques used to meet the guidelines and quality requirements. The Environmental Supervisor is only to use NATA accredited laboratories for laboratory analysis. Table O outlines the QA procedures and QC indicators that will be implemented during the remediation and documented in the Remediation and Validation Report to be prepared by the Environmental Supervisor.

TABLE O: SUMMARY OF QA PROCEDURES AND QC INDICATORS – ENVIRONMENTAL SUPERVISOR

QA PROCEDURE / QC INDICATOR	DETAILS
Record keeping	<ul style="list-style-type: none">• Detailed records of all field activities including, observations, sample collection and results of field-based sampling will be maintained on standard field sheets.• Plans / figures which demonstrate the location of pertinent features (e.g., stockpiles and excavations) and sampling locations.

TABLE O: SUMMARY OF QA PROCEDURES AND QC INDICATORS – ENVIRONMENTAL SUPERVISOR

QA PROCEDURE / QC INDICATOR	DETAILS
	<ul style="list-style-type: none"> • Soil types will be logged consistent with the Unified Soil Classification System (USCS) and AS 1726-2017. • ACM will be described and recorded in accordance with DoH (2021).
Sample labelling	<ul style="list-style-type: none"> • Unique sample numbers will be used for each sample to clearly specify the sample origin (source, date, and sample type code).
Prevention of cross-contamination and decontamination	<ul style="list-style-type: none"> • It is expected that most of the samples will be collected directly from the wall or base of the excavations (if $\leq 0.5\text{m}$ bgl) or excavator bucket (if $> 0.5\text{m}$) by hand, whilst wearing disposable gloves (changed between samples). Care will be taken to ensure that the soil samples collected have not directly touched the excavator bucket. • In the event equipment is used to collect a sample (e.g., a trowel or shovel), all non-disposable sampling equipment will be cleaned and decontaminated between sampling locations to avoid the potential for cross-contamination. • The bucket used to collect 10L samples for ACM inspection, will be 'shaken out' between samples. The sieve will be wiped down with a dry cloth / brush to remove any adhering debris. It is not proposed to wash the sieve between samples as the moisture makes it difficult to process material through the sieve. In the event soils are difficult to sieve (for example due to clay content, or comprise large gravels), the 10L sample will be spread on plastic sheeting and inspected.
Duplicate / split Samples	<ul style="list-style-type: none"> • For metals and TRH analyses in soil, a duplicate and split sample pair will be collected for every 20 primary samples collected and analysed by the primary and secondary laboratory, respectively.
Sample Storage	<ul style="list-style-type: none"> • All soil samples collected for analysis will be stored in a chilled esky on-Site immediately after collection / prior to submission to the analytical laboratory.
Chain of Custody	<ul style="list-style-type: none"> • Chain of Custody documentation will be used for all sample transfers between the Environmental Supervisor and the laboratory(s). • Chain of Custody forms include sample numbers, description, sample date and will be signed by the persons transferring and accepting custody of the samples.
Laboratory Internal QA / QC	<ul style="list-style-type: none"> • Where appropriate, the laboratory will use internal standards to check the consistency of the analytical processes. • The laboratories and the methods employed for sample analysis will be NATA accredited. • All samples will be analysed within the holding times.

9 REFERENCES

Aurora (2023). Environmental Due Diligence Investigation Lots 14 - 18 East Street, East Fremantle Western Australia. Version 1 dated 8 June 2023 (Report number: AP2023-051).

Aurora (2024a). Detailed Site Investigation, Lots 14 to 19 East Street, East Fremantle Western Australia. Version 3 dated 27 February 2024 (Report number: AP2023-146).

Aurora (2024b). RE: 27 Canning Highway, East Fremantle: Interim Asbestos in Soil Management Response. Version 2 dated 27 February 2024 (reference DOL-PP03464_IMR_004_SM_V2).

Aurora (2024c). RE: Lots 14 to 19 East Street, East Fremantle: Remediation Options Appraisal and Cost Estimate. Version 2 dated 27 February 2024 (reference DOL-PP03464_ROA_003_SM_V2).

Australian Environmental Auditors (2024). Auditor Review - Due Diligence, Detailed Site Investigation & Remediation Option Assessment Housing Diversity Pipeline-East Street, East Fremantle, WA (reference EA1078 C1 DD DSI IAMR & ROA Auditor Review).

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) (2018) National Remediation Framework document 'Guideline on Performing Remediation Options Assessment'.

CRC CARE (2011) Health screening levels for petroleum hydrocarbons in soil and groundwater.

Department of Environment and Conservation (2011) A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.

Department of Health (2021) Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia. August 2021.

Department of Water and Environmental Regulation (2019) Landfill Waste Classification and Waste Definitions, 1996 (as amended 2019).

Department of Water and Environmental Regulation (2021) Assessment and Management of Contaminated Sites, Contaminated Site Guidelines.

Environmental Protection Authority Victoria (2009) Industrial Waste Resource Guidelines 702: Soil Sampling.

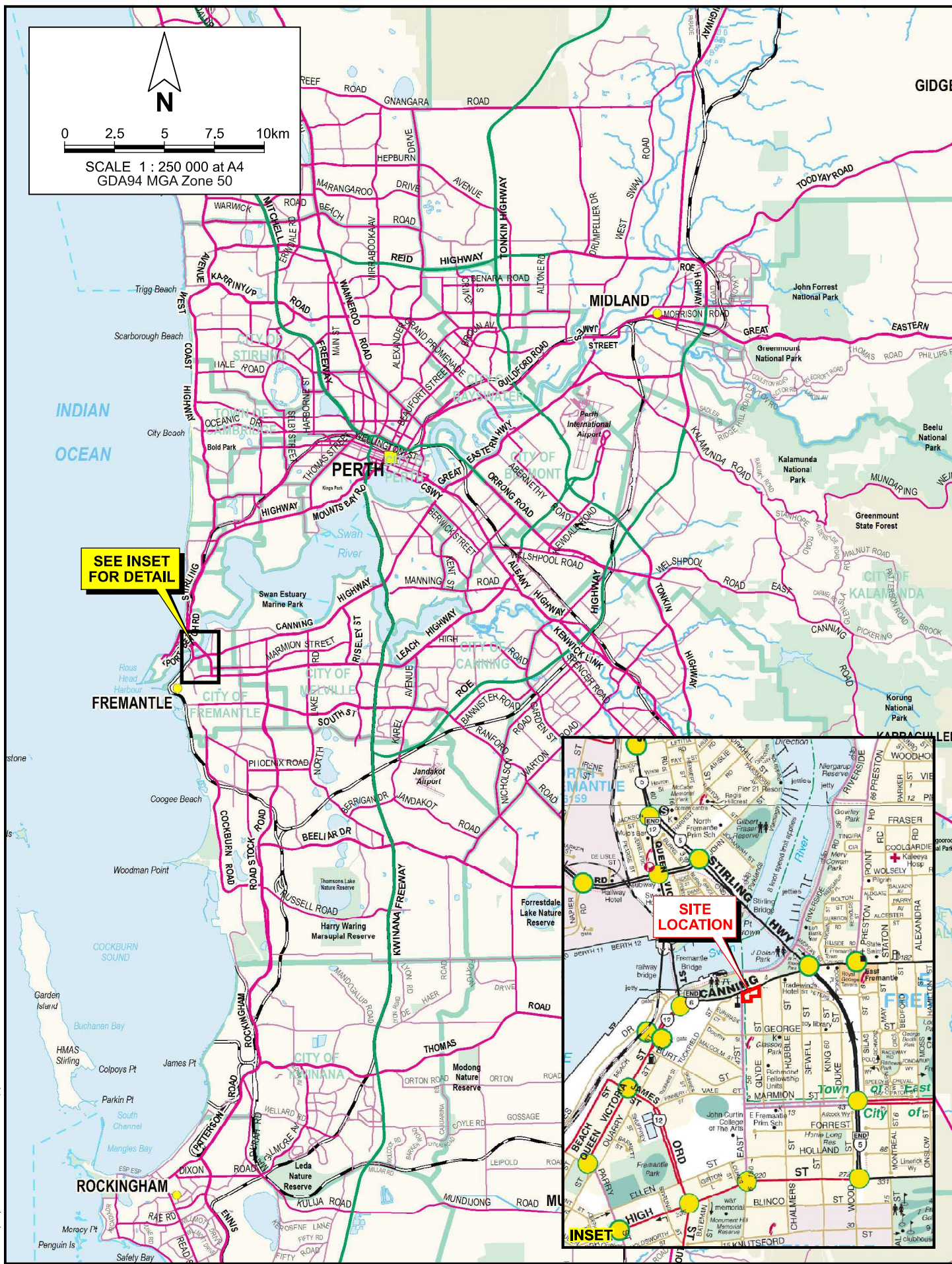
National Occupational Health and Safety Commission (2005) Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2ND Edition.

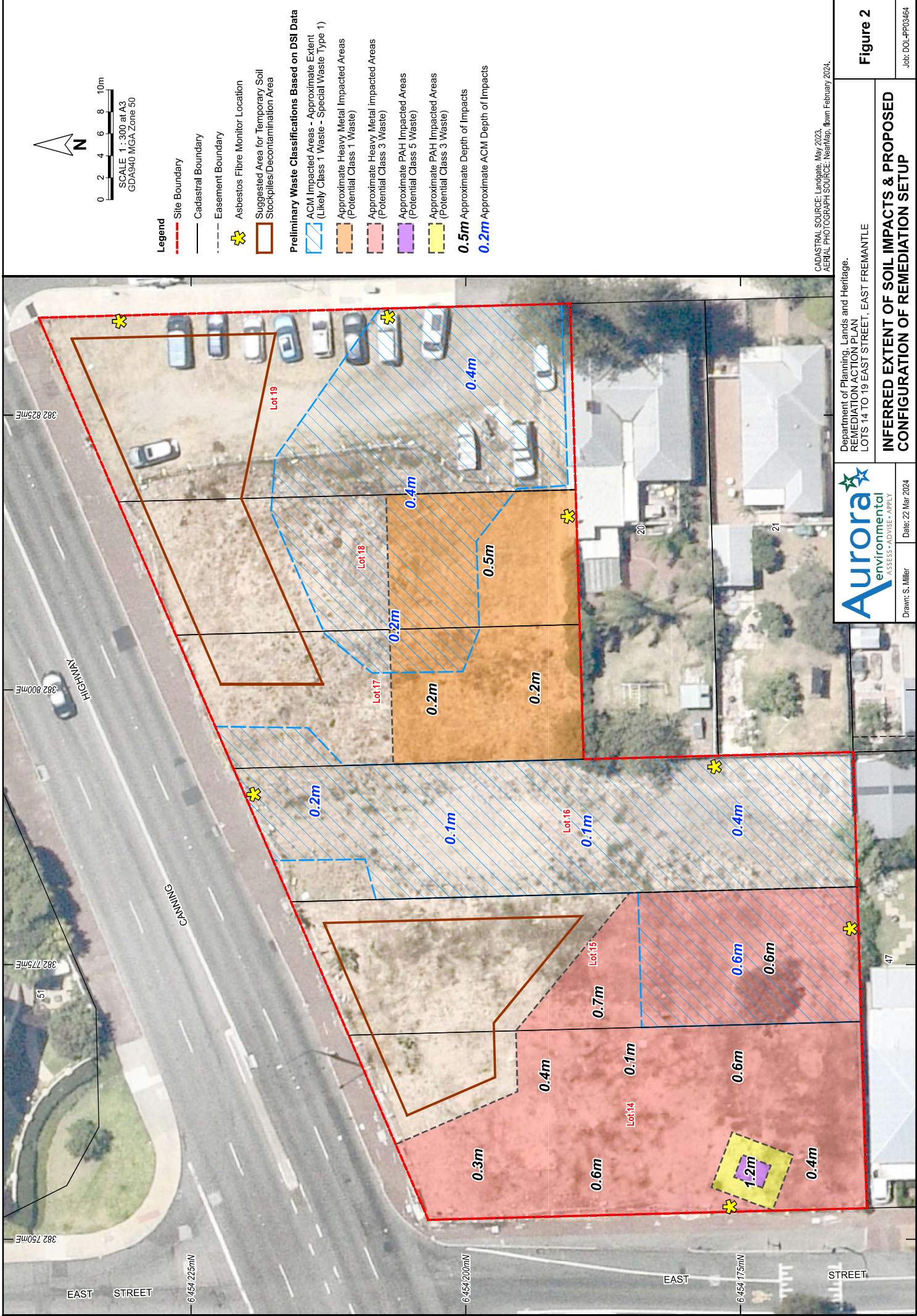
National Environment Protection Council (2013) National Environment Protection (Assessment of Site Contamination) Measure, 1999 as amended 2013 (ASC NEPM).

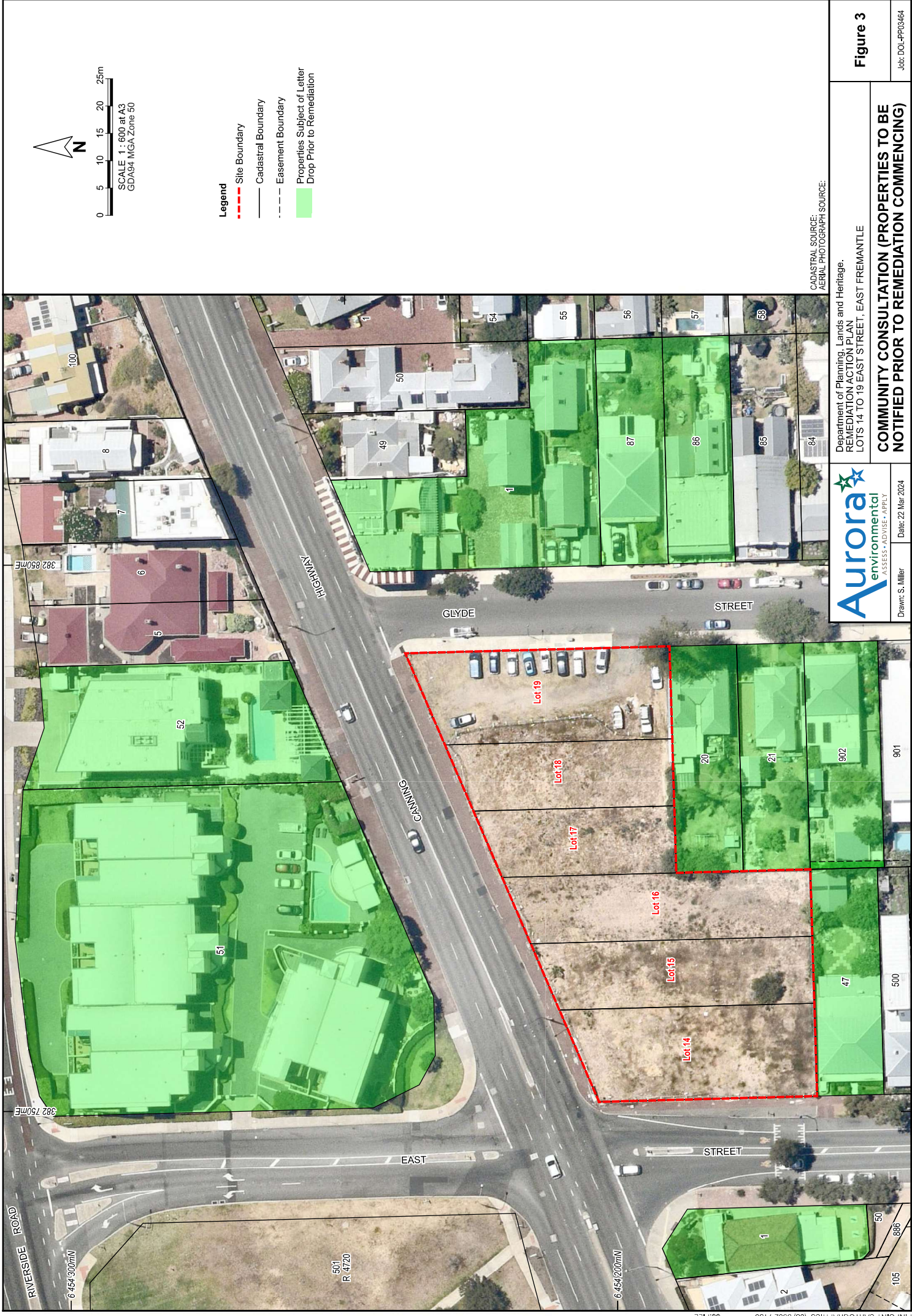
National Environment Protection Council (2021) National Environment Protection (Ambient Air Quality) Measure, 1998 as amended 2021.

WorkSafe (2005) How to safely remove asbestos: Code of Practice.

FIGURES







0 5 10 15 20 25m
SCALE 1: 600 at A3
GDA94 MGA Zone 50

Legend

- Site Boundary
- Cadastral Boundary
- Easement Boundary
- Properties Subject of Letter Drop Prior to Remediation

CADASTRAL SOURCE:
AERIAL PHOTOGRAPH SOURCE:



ASSESS • ADVISE • APPLY

Drawn: S. Miller

Date: 22 Mar 2024

Department of Planning, Lands and Heritage.

REMEDIATION ACTION PLAN

LOTS 14 TO 19 EAST STREET, EAST FREMANTLE

Figure 3

COMMUNITY CONSULTATION (PROPERTIES TO BE NOTIFIED PRIOR TO REMEDIATION COMMENCING)

Job: DOL-PP03/64

APPENDIX 1

Site-specific Dust Risk Assessment

Site Specific Dust Risk Assessment

Prepared in accordance with Department of Environment and Conservation (DEC) (now DWER) 'A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities' (2011).

Part A: Nature of Site				
Item	Score Options			Allocated Score
1. Nuisance potential of soil, when disturbed	Very low = 1	Low = 2	Medium = 4	High = 6
2. Topography and protection provided by undisturbed vegetation	Sheltered and screened = 1	Medium screening = 6	Little screening = 12	Exposed and wind prone = 18
3. Area of site disturbed by the works	Less than 1ha = 1	Between 1 and 5ha = 3	Between 5 and 10ha = 6	More than 10ha = 9
4. Type of work being done	Roads or shallow trenches = 1	Roads, drains and medium depth sewers = 3	Roads, drains, sewers and partial earthworks = 6	Bulk earthworks and deep trenches = 9
Total Score for Part A				18
Part B: Proximity of Site to Other Land Uses				
Item	Score Options			Allocated Score
1. Distance of other land uses from site	More than 1km = 1	Between 1km and 500m = 6	Between 100m and 500m = 12	Less than 100m = 18
2. Effect of prevailing wind direction (at time of construction) on other land uses*	Not affected = 1	Isolated land uses affected by one wind direction = 6	Dense landuse affected by one wind direction = 9	Dense / sensitive landuse highly affected by prevailing winds = 12
Total Score for Part B				30
Site Classification Score (A x B)				540
Site Classification				3 (Medium Risk)
*See wind roses prepared by the Bureau of Meteorology overleaf which indicate the annual dominant prevailing wind direction for the closest weather station to the site (Perth Airport, approximately 22 km north-east of the site [ID 009021]) in August (i.e., proposed timing of remedial works) is as follows: 9am to the south-west and 3 pm to the east/ north. Score of 12 assigned as residences adjacent to the south-west of the site may be impacted by prevailing winds in the morning, and residences/ commercial premises adjacent to the north/ east of the site are likely to be impacted by prevailing winds in the afternoon.				

Site Specific Dust Risk Assessment

