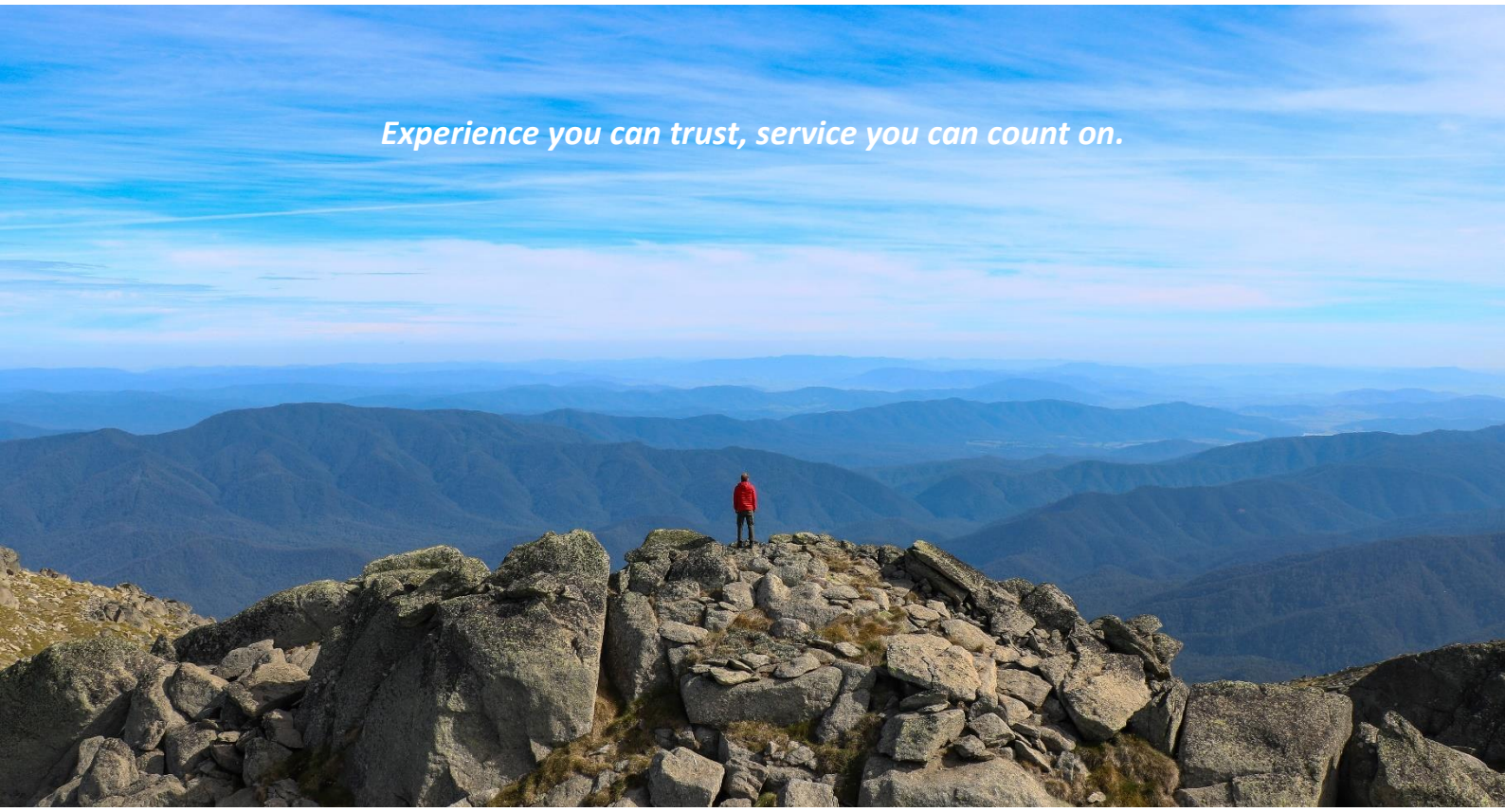

Remedial Action Plan (RAP)

40-42 Mamre Road, St Marys NSW 2760

Prepared For:	V Homes Developments Pty Ltd
Reference:	21-1178
Date:	03 June 2021

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Document History:		
Document No	**Revision No.**	**Issue Date**
21-117	A	03.06.2021

Report Author:	Technical Reviewer
	
Con Kariotoglou Managing Director *BSc, Cert IV WHS, AFMIML, MEIANZ, MALGA* *SafeWork NSW Approved Asbestos Assessor, License No. LAA001006*	Con Kariotoglou Managing Director *BSc, Cert IV WHS, AFMIML, MEIANZ, MALGA* *SafeWork NSW Approved Asbestos Assessor, License No. LAA001006*

This report is to be read in its entirety and should not be review in individual section to provide any level of information independently. Each section of the report relates to the rest of the document and as such is to be read in conjunction, including its appendices and attachments.

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EXECUTIVE SUMMARY

ECON Environmental Pty Ltd was engaged by V Home Developments Pty Ltd to prepare a Remedial Action Plan (RAP) for the remediation of contaminated soils within the subject site located at 40-42 Mamre Road, St Marys NSW 2760, ref: 21-1155, dated 7 May 2021, *in accordance to the recommendations set out in the Detailed Site Investigation, prepared by ECON Environmental, Ref: 21-1165, dated 31 May 2021.*

The total combined area of the subject site (40 & 42 Mamre Roads) is approximately 2,151m^2, with 40 Mamre Road being approximately 1,076m^2, and 42 Mamre Road being approximately 1,075m^2. A detailed site investigation was carried out on Wednesday 19 May 2021 by ECON Environmental's representative Con Kariotoglou, which involved a visual assessment of the entire subject site and surrounding areas as well as the acquisition of representative soil samples.

The following report was prepared specifically for the proposed works and are the principal documents used in the preparation of this RAP:

- ECON Environmental Pty Ltd, Preliminary Site Investigation, 40-42 Mamre Road, St Marys NSW 2760, Ref: 21-1155, Dated 07 May 2021.
- ECON Environmental Pty Ltd, Detailed Site Investigation, 40-42 Mamre Road, St Marys NSW 2760, Ref: 21-1165, Dated 31 May 2021.

The removal of TRH, B(a)P TEQ and B(a)P contaminated soils to a licensed landfill (off-site disposal) is the preferred remediation strategy for **Hotspots BH6.** Assuming appropriate permits have been granted, the remediation of the site is to take place in the following stages:

Hotspot BH6:

- excavate the area 3m x 3m x 0.5m depth – est. volume **4.5m^3 (7.2 tonnes)**
- excavated soil surfaces should be visibly clean residual soil material
- unless tested and proven otherwise, the contaminated material from Hotspot BH2 location will be disposed of offsite at a licensed facility as **Restricted Solid Waste.**
- if the material is transported interstate or within NSW to an appropriate licenced facility it must be tracked and monitored using an NSW EPA approved tracking waste system.

The floor and walls of the identified Hotspots will be validated to ensure the successful removal of contaminated soil material. Chasing up of contaminants may be required during this stage of works if levels are found over site criteria. The validation goals are to have no contaminated soils remaining in the area of concern. A Remediation Validation report must be provided by a suitably qualified and experienced environmental consultant, or equivalent person, for the proposed development. Validation will involve a validation soil sampling and laboratory analysis regime as per follows:

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- At least one (1) sample for the contaminates of concern from of the each four (4) walls of the excavated hotspot pit, additional discretionary samples if necessary,
- At least one (1) samples for the contaminants of concern from each of the base/floor of the excavated hotspot pit areas, additional discretionary samples if necessary,
- Each validation sample retrieved will be analysed for the contaminate of concern: **TRH, B(a)P TEQ and B(a)P.**

Any other fill materials to be excavated will be temporarily stockpiled to ensure appropriate sampling of the soil requiring off-site disposal. The stockpiles will be classified according to the NSW DECC "*Waste Classification Guidelines, Part 1: Classifying Waste"* and disposed of to a licensed landfill/facility. If the material has been classified prior to excavation (in-situ), it could be immediately loaded on trucks and removed off-site to the most appropriate licensed facility.

The **Remediation and Validation Report (RemVal)** must be prepared in accordance with the NSW EPA (2020) Guidelines: Consultants reporting on Contaminated Land, to present the remediation works undertaken and confirm that the objectives of the remediation works have been attained.

It is considered that the site will be suitable for the intended continual residential land use subject to the implementation of remediation and validation works in accordance with this RAP.

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1. INTRODUCTION

1.1 Background

ECON Environmental Pty Ltd was engaged by V Home Developments Pty Ltd to prepare a Remedial Action Plan (RAP) for the remediation of contaminated soils within the subject site located at 40-42 Mamre Road, St Marys NSW 2760, ref: 21-1155, dated 7 May 2021, *in accordance to the recommendations set out in the Detailed Site Investigation, prepared by ECON Environmental, Ref: 21-1165, dated 31 May 2021.*

The total combined area of the subject site (40 & 42 Mamre Roads) is approximately 2,151m^2, with 40 Mamre Road being approximately 1,076m^2, and 42 Mamre Road being approximately 1,075m^2. A detailed site investigation was carried out on Wednesday 19 May 2021 by ECON Environmental's representative Con Kariotoglou, which involved a visual assessment of the entire subject site and surrounding areas as well as the acquisition of representative soil samples.

This RAP outlines procedures for the remediation of the site to a condition suitable for the proposed land use. The RAP also provides guidance on how the remedial strategy is to be implemented during construction and relevant occupational and environmental controls to be adopted for the proposed land use and potential future development of the site. The principal objective of this plan is to outline the management techniques and safeguards that should be implemented to ensure the remediation and development are completed in an acceptable manner, preventing any adverse exposure on site contractors and the surrounding environment during future development and land use of the site.

1.2 Objectives

The objectives of the Remedial Action Plan are to:

- Set remediation goals, which will be adopted to ensure the remediated site will be suitable for the proposed land use and will pose no unacceptable risk to the human health or the environment,
- Document the procedures and plans to be implemented to reduce the risk of significant harm to acceptable levels within the site,
- Establish the environmental safeguards required in completing the remediation in an environmentally acceptable manner within the site and,
- Identify necessary approvals and licenses required by regulatory authorities if required.

1.3 Scope of Works

The Scope of Works included the following:

- A review of previous investigations and summary of the site's contamination status for the entire investigative site,

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- Identify the areas of environmental concern to determine the lateral and vertical extent of the contamination within nominated hotspot areas,
- Detail the preferred remediation strategy, and an outline of the methodology for the implementation of the selected strategy within the site,
- Describe a brief outline of environmental pollution controls, community health and safety, and occupational health and safety measures that should be implemented during remedial works within the site, and
- An outline of regulatory approvals and licenses which may be required to adopt the preferred remedial strategy for the site.

1.4 Legislative Requirements

The legislative framework for the report is based on guidelines that have been set out by the NSW Environmental Protection Agency (EPA) in the form of the following Acts/Regulations:

- Protection of the Environment Operations Act (1997)
- Protection of the Environment Operations Regulation (2008)
- Contaminated Land Management Act (1998)

In addition, the following guidelines and technical documents have been reviewed and applied where applicable:

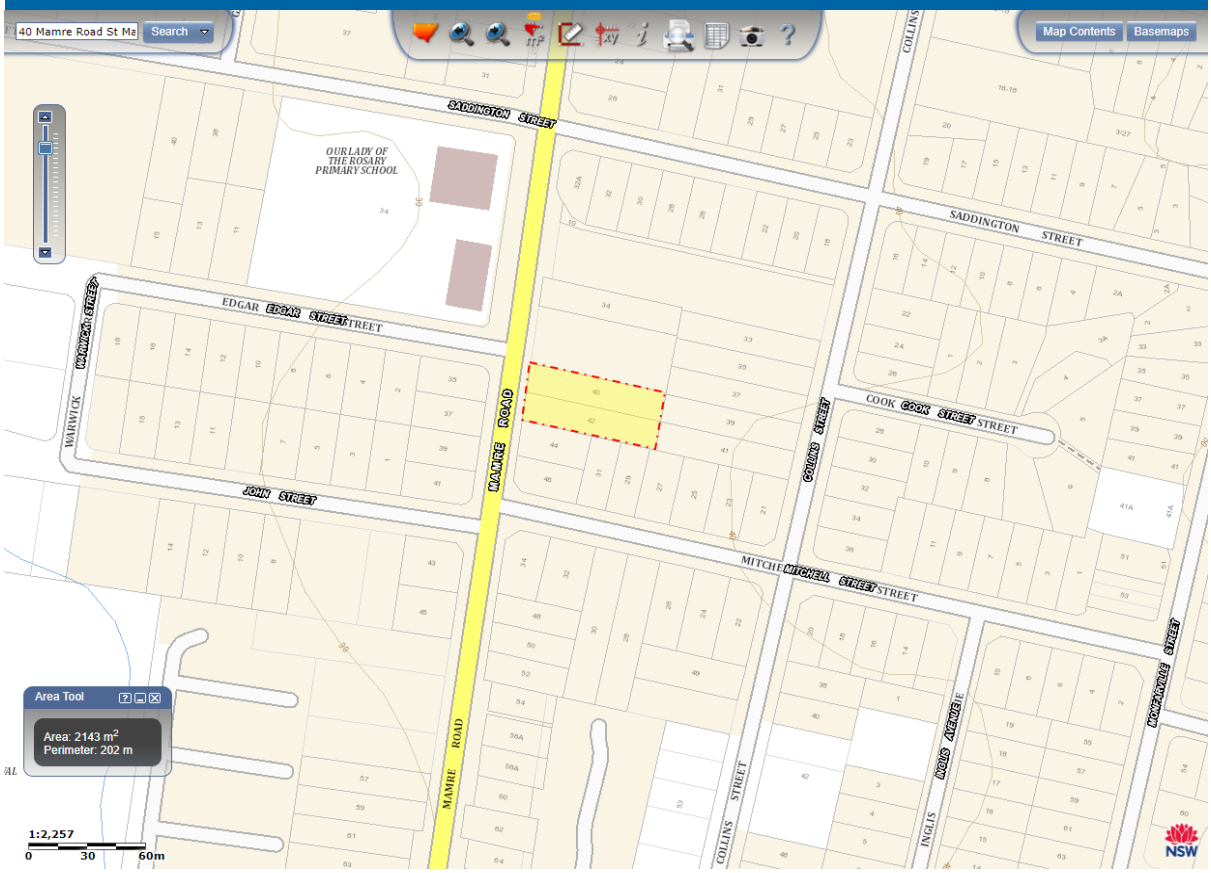
- Contaminated Land Management - Guidelines for the NSW Site Auditor Scheme (3 Edition, 2017).
- State Environmental Planning Policy No.55 (SEPP55) – Remediation of Land (2018)
- NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (2020).
- NSW EPA Sampling Design Guidelines (1995).
- NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (2014).
- Guidelines on the Investigation Levels for Soil and Groundwater, National Environmental Protection Measure 1999, 2013 Amendment (NEPC, 2013).
- Guidelines for the Assessment, Remediation & Management of Asbestos - Contaminated Sites (DOH, 2009).
- SafeWork NSW Code of Practice: How to Safely Remove Asbestos – August 2019
- SafeWork NSW Code of Practice; How to Manage and Control Asbestos in the Workplace – August 2019
- Guidelines for the Assessment, Remediation & Management of Asbestos - Contaminated Sites (WA DOH, 2009).

2. SITE IDENTIFICATION

The study sites are 40-42 Mamre Road, St Marys NSW 2760 (Figure 1). Both sites can be identified as rectangular shaped allotments surrounded by low density residential properties on all boundaries. Figure 2 shows an aerial photograph of the site and the surrounding land.

Table 1: Site Identification	
Street Address	40-42 Mamre Road, St Marys NSW 2760
Lot and DP Number	Lot 1 in DP 219187 – 40 Mamre Road Lot 1 in DP 111896 – 42 Mamre Road
Approx. Total Site Area	1,076m^2 - 40 Mamre Road 1,075m^2 - 42 Mamre Road 2,151m^2 - total combine
Zoning	R3 – Medium Density Residential SP2 - Infrastructure
Local Government Area	Penrith City Council
LGA Legislation	Penrith Local Environmental Plan 2010

Figure 1: Site location map – source www.maps.six.nsw.gov.au



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3. REQUIREMENT REASONING

The objective of the Remedial Action Plan is to set remediation goals, which will be adopted to ensure the remediated site will be suitable for the proposed land use and will pose no unacceptable risk to the human health or the environment.

Figure 2: Aerial photograph of the subject site and surrounds – *source www.maps.six.nsw.gov.au*

3.1 Proposed Development or Intended Land Use

The development approval includes a proposed multi housing residential development, as shown in the proposed development plans in Appendix A – Proposed Development Plans.

3.2 Site Inspections

On Wednesday 19 May 2021, a site investigation was conducted by ECON Environmental's representative Con Kariotoglou. Field work was carried out in accordance with the methodology described in AS4482.1 – 2005 and the NEPM (2013). At the time of inspection, the following observations were noted:

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At the time of inspection, the following observations were noted:

40 Mamre Road, St Marys:

- The site consisted of a single-storey fibre-cement panelled residential house with terracotta roof tiles and a concrete paved area at the rear of the property,
- A concrete driveway runs from the front of the property to the rear garage,
- The rear garage consists of fibre-cement walls and roof and is in poor condition,
- Low lying grasses and vegetation were evident covering the front and back yards,
- The property was occupied at the time of the inspection,
- No visible signs of oil stains or olfactory signs of odours were detected during the inspection within the subject site.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear garage within the property,
- No visible signs of ACM were noted on surface soils within the boundaries of the property,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.
- No evidence of any potential human and environmental areas of concern were evident during the inspection within the subject site.

42 Mamre Road, St Marys:

- The site consisted of a single-storey brick and fibre-cement panelled residential house with terracotta roof tiles, the house was in poor condition.
- The property showed no signs of hoarding within the site that was observed during the initial Preliminary Site Investigation by ECON Environmental on Monday 3 May 2021 *(refer to ECON Environmental Preliminary Site Investigation Ref 21-1155, dated 7 May 2021).*
- Low lying grasses and vegetation were evident covering the front and back yards, where soils were exposed where areas of hoarding were removed from the rear of the premises.
- A concrete driveway runs from the front of the property to the rear of the house,
- The property was occupied at the time of the inspection,
- No visible signs of oil stains were detected during the inspection which were previously reported beneath the cars and car parts within the rear portion of the property within the previous ECON Environmental Preliminary Site Investigation, Monday 3 May 2021.
- No olfactory signs of odours were detected during the inspection within the property.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear of the property on surface soils,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.
- Evidence of potential human and environmental areas of concern were evident during the inspection within the entire subject site.

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3.3 Surrounding Land Use

The subject site is located within a low and medium density residential setting and bordered by:

- Low density residential properties directly north, south, east and west of the subject site.
- Our Lady of The Rosary Primary School, 30m northwest of the subject site,
- Wilson Oval, 220m south west of the subject site,
- Byrnes Creek, 245m southwest of the subject site,

3.4 Topography

According to https://www.environment.nsw.gov.au/eSpade2Webapp the topography of the site includes flat to gently sloping alluvial plain with occasional terraces or levees providing low relief. Slopes <10m.

3.5 Geology and Soils

The Geological Map of Gosford-Lake Macquarie (Geological Series Sheet 9131 & part sheet 9231, Scale 1:100,000), published by the Department of Mineral Resources indicated the site is located within an area underlain by Quaternary alluvium derived from Wianamatta Group shales and Hawkesbury Sandstone.

3.6 Surface Water Hydrology

No surface water or distinct overland flow paths were noted during the investigation. The entire site was covered by grass and/or paved hardstand areas. Stormwater is expected to infiltrate into soils or sheet west down into Mamre Road stormwater system.

3.7 Soil Sample Methodology

According to the NSW EPA Contaminated Sites Sampling Guidelines (Sept. 1995), for this sized area site (2,151m^2), a total of seven (7) soil samples plus one (1) QA/QC sample is required to be collected. The soil samples were collected on Wednesday 19 May 2021 via boreholes. A total of seven (7) boreholes (BH1-BH7) were advanced across the entire subject site (Figure 3) and were collected from within the near surface fill material (0-0.3m BGL). Samples were collected from using a hand auger with a 150mm diameter drill. No groundwater was encountered within any of the boreholes drilled onsite.

During the collection of soil samples, any features such as seepage, discoloration, staining, odours, or other physical indicators of contamination were noted. All site work was undertaken by Con Kariotoglou, Environmental Consultant of ECON Environmental. Soil Samples were transferred directly from the boreholes into laboratory supplied 250 mL sample jars sealed with Teflon lids. Asbestos

samples were collected in asbestos sample bags and zip locked. The samples were stored in a chilled esky and transferred to ALS Environmental Division under stringent chain of custody (COC) procedures.

The decontamination of non-dedicated sampling equipment was achieved by washing with phosphate-free detergent and tap water, followed by a final rinse with distilled water. Decontamination was conducted after the collection of samples at each sample location. A clean pair of disposable gloves was used when handling each sample. The hand augers were decontaminated between sampling locations by physically removing soil material between boreholes, washing the augers with Decon 90 and rinsing them with water.

Sampling of asbestos was undertaken as follows:

- A minimum 10L sample from each sample location was recovered
- Each sample (minimum of 10 L) was screened through a 7mm sieve and the material retained on the sieve examined for any bonded ACM and / or suspect material and forwarded to the laboratory for analysis if any suspected ACM is encountered
- If visible FA material is present or suspected, the soil was wetted to minimise the release of fibres
- Identified bonded ACM and FA was weighed for each sample, and
- One wetted 500ml sample from each sampling location was submitted to a NATA accredited laboratory for analysis for AF. Soil asbestos analysis should comply with Australian Standard Method for the Qualitative Identification of asbestos in bulk samples (AS4964–2004).

The samples were stored in a chilled esky and transferred to ALS Environmental Division under stringent chain of custody (COC) procedures. The decontamination of non-dedicated sampling equipment was achieved by washing with phosphate-free detergent and tap water, followed by a final rinse with distilled water. Decontamination was conducted after the collection of samples at each sample location. A clean pair of disposable gloves was used when handling each sample. The hand augers were decontaminated between sampling locations by physically removing soil material between boreholes, washing the augers with Decon 90 and rinsing them with water.

Figure 3: Site sampling borehole locations

3.8 Soil Laboratory Results

The summary of results are as follows:

- Heavy Metals: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.
- TRH: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria, except for samples:
  - **BH6 (0.2-0.3m) F3(C_{16}-C_{34}) 330mg/kg**
- BTEX: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.
- PAH: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria, except for samples:
  - **BH6 (0.2-0.3m) B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg**
- PCB: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.
- OC/OP Pesticides: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.
- Phenols: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.
- Asbestos: All soil samples were reported by the laboratory to have concentrations below the adopted site assessment criteria.

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3.9 Refined Conceptual Site Model

The refined Conceptual Site Model (CSM) is presented in the table below:

Table 2: Refined Conceptual Site Model (CSM)					
Potential Source	Potential Receptor	Potential Exposure Pathway	Complete Linkage	Risk	Justification
BH6 (0.2-0.3m) F3(C_{16}-C_{34}) 330mg/kg	Site future users, general public & surrounding residents	Dermal & Ingestion	No, as long as the site is securely locked, and no excavation works that would disturb contaminated soils.	Low	Impacted soils are with underlying soils 0.2-0.3m BGL
BH6 (0.2-0.3m) B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg	Site future users, general public & surrounding residents	Inhalation	No, as long as the site is securely locked, and no excavation works that would disturb contaminated soils.	Low	Impacted soils are with underlying soils 0.2-0.3m BGL
Existing Building Structures on site containing hazardous materials (e.g. Asbestos)	Site future users, general public & surrounding residents	Inhalation	No, as long as the site is securely locked, and no demolition works that would disturb building structures.	Low to Medium	Impacted building structures with asbestos are in good condition with no damage or showing deterioration.

3.10 Human Receptors and Sensitive Environments

On-site Human Receptors & Sensitive Environments:

- Construction workers during the construction process
- Future users and/or occupants of the site

Off-site Human Receptors & Sensitive Environments:

- Occupants of the low and medium density residential properties directly surrounding the subject site,
- Staff and students at Our Lady of The Rosary Primary School, 30m northwest of the subject site,
- Public users of Wilson Oval, 220m south west of the subject site,
- Natural ecosystems within Byrnes Creek, 245m southwest of the subject site.

3.11 Potential for Migration and Exposure of Contaminants

Site history information and onsite inspection observations indicated that due to the conditions of the site, there is a **LOW** potential for contaminants to provide exposure risks to humans within the site.

However, if future proposed developments of the subject site include the excavation of the underlying soils with the subject site, then there is a **MEDIUM TO HIGH** potential for contaminants present within surface and underlying soils to have the ability to migrate vertically up into the atmosphere, or down through the water column into the groundwater or migrate horizontally to adjacent properties or washed downgradient with stormwater runoff into adjacent properties or into Mamre Road drainage system to the west.

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4. SUMMARY OF PREVIOUS INVESTIGATIONS

The following report was prepared specifically for the proposed works and are the principal documents used in the preparation of this RAP:

- ECON Environmental Pty Ltd, Preliminary Site Investigation, 40-42 Mamre Road, St Marys NSW 2760, Ref: 21-1155, Dated 07 May 2021.
- ECON Environmental Pty Ltd, Detailed Site Investigation, 40-42 Mamre Road, St Marys NSW 2760, Ref: 21-1165, Dated 31 May 2021.

4.1 ECON Environmental – Preliminary Site Investigation (May 2021)

ECON Environmental Pty Ltd was engaged by V Homes Developments Pty Ltd to undertake a Preliminary Site Investigation on the nominated subject sites located at 40-42 Mamre Road, St Marys NSW 2760.

The objective of the investigation is to assess the potential for site contamination, based on historical and current land use practices as well as a site inspection of the subject sites, and to evaluate its suitability for its intended land use and proposed multi house residential development.

The total combined area of the subject site (40 & 42 Mamre Roads) is approximately 2,151m2, with 40 Mamre Road being approximately 1,076m^2, and 42 Mamre Road being approximately 1,075m^2. A site inspection was carried out on Monday 3rd May 2021 by ECON Environmental's representative Con Kariotoglou, which involved a visual assessment of the entire sites of both properties and surrounding areas. Details of the findings are presented within the body of this report, as well as an assessment of significance with regards to the findings of the investigation.

Based on the current data and evidence collected during the site inspection on Monday 3rd May 2021, the following findings of this Preliminary Site Investigation within both properties, are as follows:

40 Mamre Road, St Marys:

- The site consisted of a single-storey fibre-cement panelled residential house with terracotta roof tiles and a concrete paved area at the rear of the property,
- A concrete driveway runs from the front of the property to the rear garage,
- The rear garage consists of fibre-cement walls and roof and is in poor condition,
- Low lying grasses and vegetation were evident covering the front and back yards,
- The property was occupied at the time of the inspection,
- No visible signs of oil stains or olfactory signs of odours were detected during the inspection within the subject site.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear garage within the property,
- No visible signs of ACM were noted on surface soils within the boundaries of the property,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.

- No evidence of any potential human and environmental areas of concern were evident during the inspection within the subject site.

42 Mamre Road, St Marys:

- The site consisted of a single-storey brick and fibre-cement panelled residential house with terracotta roof tiles, the house was in poor condition.
- The property showed signs of hoarding with the following items detected within the property: several cars, car parts, engines parts, tyres, trailers, corrugated tin roof sheeting, fridges, timber and steel furniture, timber pallets, stockpiles of construction materials including bricks, timbers and steel, paint cans, household rubbish and asbestos containing materials (fragments and sheets).
- Low lying grasses and vegetation were evident covering the front and back yards,
- A concrete driveway runs from the front of the property to the rear of the house,
- The property was occupied at the time of the inspection,
- Visible signs of oil stains were detected during the inspection beneath the cars and car parts within the rear portion of the property.
- No olfactory signs of odours were detected during the inspection within the property.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear of the property on surface soils,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.
- Evidence of potential human and environmental areas of concern were evident during the inspection within the entire subject site.

Based on historical data of previous business activities within and adjacent to the subject site (2005-2020), the underlying soils **DOES** have the potential to be comprised of hazardous materials.

Currently human exposure risk to the potential contaminants identified is currently **MEDIUM** as:

- The sites are not locked or fenced off to prevent public access,
- There is visible evidence to suggest that the sites have underlying soils which may be contaminated. Therefore, there is a potential exposure risk to humans and the environment from underlying contaminating soils.

Site history information and onsite inspection observations within the proposed residential development footprint area of the subject site indicate that there is a **MEDIUM-HIGH** potential for contaminants to provide exposure risks to humans and the environment, due to the following:

- The subject sites have not been significantly altered since 1965.
- Historically potentially contaminating activities have been identified within both the subject sites. Historical evidence of garages and/or service station has been identified as being located within the subject sites and therefore likely to cause polluting activities within the subject site.
- Visible signs of environmental areas of concern during site inspection were identified within the 42 Mamre Road property.

- If the proposed development includes the demolition of existing building structures and excavation of underlying soils within the development footprint area, then there is a **HIGH** potential for contaminants present within the subject site to have the ability to migrate vertically up into the atmosphere (asbestos fibres dispersed) or washed downgradient with stormwater runoff into adjacent properties or into the Mamre Road drainage system (chemicals and asbestos).

Subject to the above, it is considered that the subject site can be made suitable for its future proposed development and intended land use, subject to the following recommendations:

- A **Detailed Site Investigation** is to be undertaken within the subject site (40 & 42 Mamre Road, St Marys) subject to historical data of business activities and current inspection observations within the subject site.
- If contamination is identified during the Detailed Site investigation, then a **Remedial Action Plan (RAP)** is to be prepared detailing appropriate remediation and validation procedures to render the subject site suitable for its future proposed development and intended land use.
- A **Hazardous Material Assessment** is to be undertaken within the subject site (40 & 42 Mamre Road, St Marys), to locate and register all hazardous building structure materials*, if greater than 10 square metres*, and recommend appropriate removal works, prior to the demolition of existing building structures within the subject site.
- An **Asbestos Clearance Certificate** is to be provided by SafeWork NSW Licenced Approved Asbestos Assessor (LAA) prior to building demolition, to confirm that all hazardous materials within the subject sites (40 & 42 Mamre Road, St Marys) have been appropriately removed.
- Any proposed excavations of underlying soils for the proposed development will require a **Waste Classification** assessment prior to any excavation and disposal of soil material offsite to a NSW EPA licenced facility, in accordance with the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (2014).

4.2 ECON Environmental – Detailed Site Investigation (May 2021)

ECON Environmental Pty Ltd was engaged by V Home Developments Pty Ltd to undertake a Detailed Site Investigation on the subject site located at 40-42 Mamre Road, St Marys NSW 2760, as per the conclusions and recommendations of the ECON Environmental Preliminary Site Investigation, 40-42 Mamre Road, St Marys NSW 2760, ref: 21-1155, dated 7 May 2021.

The objective of the investigation is to assess the subject site for contamination, based on the detailed investigation undertaken for the site and acquisition of soil samples from within the site to evaluate its suitability for its intended land use and proposed development.

The total combined area of the subject site (40 & 42 Mamre Roads) is approximately 2,151m2, with 40 Mamre Road being approximately 1,076m^2, and 42 Mamre Road being approximately 1,075m^2. A site investigation was carried out on Wednesday 19 May 2021 by ECON Environmental's representative Con Kariotoglou, which involved a visual assessment of the entire subject site and surrounding areas as well as the acquisition of representative soil samples, and the inspection of all

existing building structures on site. Details of the findings are presented within the body of this report, as well as an assessment of significance with regards to the findings of the investigation.

At the time of inspection, on Wednesday 19 May 2021, the following observations were noted:

40 Mamre Road, St Marys:

- The site consisted of a single-storey fibre-cement panelled residential house with terracotta roof tiles and a concrete paved area at the rear of the property,
- A concrete driveway runs from the front of the property to the rear garage,
- The rear garage consists of fibre-cement walls and roof and is in poor condition,
- Low lying grasses and vegetation were evident covering the front and back yards,
- The property was occupied at the time of the inspection,
- No visible signs of oil stains or olfactory signs of odours were detected during the inspection within the subject site.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear garage within the property,
- No visible signs of ACM were noted on surface soils within the boundaries of the property,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.
- No evidence of any potential human and environmental areas of concern were evident during the inspection within the subject site.

42 Mamre Road, St Marys:

- The site consisted of a single-storey brick and fibre-cement panelled residential house with terracotta roof tiles, the house was in poor condition.
- The property showed no signs of hoarding within the site that was observed during the initial Preliminary Site Investigation by ECON Environmental on Monday 3 May 2021 *(refer to ECON Environmental Preliminary Site Investigation Ref 21-1155, dated 7 May 2021).*
- Low lying grasses and vegetation were evident covering the front and back yards, where soils were exposed where areas of hoarding were removed from the rear of the premises.
- A concrete driveway runs from the front of the property to the rear of the house,
- The property was occupied at the time of the inspection,
- No visible signs of oil stains were detected during the inspection which were previously reported beneath the cars and car parts within the rear portion of the property within the previous ECON Environmental Preliminary Site Investigation, Monday 3 May 2021.
- No olfactory signs of odours were detected during the inspection within the property.
- Visible signs of asbestos containing materials (ACM) were noted on building structures within the main residence and within the rear of the property on surface soils,
- No evidence of underground or above ground chemical storage tanks were evident within the subject site.
- Evidence of potential human and environmental areas of concern were evident during the inspection within the entire subject site.

According to the NSW EPA Contaminated Sites Sampling Guidelines (Sept. 1995), for this sized area site (2,151m^2), a total of seven (7) soil samples plus one (1) QA/QC sample is required to be collected. The soil samples were collected on Wednesday 19 May 2021 via boreholes. A total of seven (7) boreholes (BH1-BH7) were advanced across the entire subject site (Figure 3) and were collected from within the near surface fill material (0-0.3m BGL). Samples were collected from using a hand auger with a 150mm diameter drill. No groundwater was encountered within any of the boreholes drilled onsite.

During the collection of soil samples, any features such as seepage, discoloration, staining, odours, or other physical indicators of contamination were noted. All site work was undertaken by Con Kariotoglou, Environmental Consultant of ECON Environmental.

All soil samples collected on Wednesday 19 May 2021 were reported by the laboratory to have concentrations BELOW the adopted site assessment criteria for HIL A, land use as per the NEPM, 2013, except for the following sample:

- **BH6 (0.2-0.3m) TRH F3(C_{16}-C_{34}) 330mg/kg**
- **BH6 (0.2-0.3m) B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg**

Human exposure to the potential contaminants identified is currently considered as **LOW** as:

- The subject sites are privately owned,
- The site is not publicly accessible,
- The soil sample (BH6) collected on Wednesday 19 May 2021 that was reported by the laboratory to have concentrations ABOVE the adopted site assessment criteria for HIL A, land use as per the NEPM, 2013, was 0.2-0.3m below ground level (BGL), therefore potential exposure risks to humans and the environment were reduced.

Site history information and onsite inspection observations indicated that due to the conditions of the site, there is a **LOW** potential for contaminants to provide exposure risks to humans within the site.

However, if future proposed developments of the subject site include the excavation of the underlying soils with the subject site, then there is a **MEDIUM TO HIGH** potential for contaminants present within surface and underlying soils to have the ability to migrate vertically up into the atmosphere, or down through the water column into the groundwater or migrate horizontally to adjacent properties or washed downgradient with stormwater runoff into adjacent properties or into Mamre Road drainage system to the west.

Subject to the above, it is considered that the subject site can be made suitable for its future intended proposed development and land use, subject to the following recommendations:

- A **Remedial Action Plan (RAP)** is to be prepared by a suitably qualified and experienced professional detailing appropriate **TRH F3(C_{16}-C_{34}), B(a)P TEQ and B(a)P Remediation and Validation** procedures with the vicinity of borehole locations **BH6 (0.2-0.3m)** to render the subject site suitable for its intended future proposed development and land use.
- The removal of all **Hazardous Containing Materials** from building structures within both properties (40 & 42 Mamre Road, St Marys) prior to demolition of building structures

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according to the Hazardous Material Assessment and Hazardous Registry – Appendix E – Hazardous Materials Assessment.

- An **Asbestos Clearance Certificate** is to be provided by SafeWork NSW Licenced Approved Asbestos Assessor (LAA) prior to building demolition, to confirm that all hazardous materials within the subject sites (40 & 42 Mamre Road, St Marys) have been appropriately removed.
- If any proposed plans for the subject site include excavations and disposal of those underlying soils to a NSW EPA licenced facility, then a **Waste Classification** report of soils is to be prepared in accordance with the NSW EPA Waste Classification Guidelines: Part 1 Classifying Waste (2014).

5. DATA QUALITY OBJECTIVES

Data quality objectives were established for the site characterisation works, following the decision-making procedures steps outlined in NEPC (2013):

1. Define the problem
2. Identify the decision
3. Identify inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify limits on decision errors, and
7. Optimise the design for obtaining data.

5.1 STEP 1 – Define the Problem

The ECON Environmental Detailed Site Investigation (May 2021) indicated that there is TRH & PAH contamination within borehole **BH6, namely:**

- **BH6 (0.2-0.3m) TRH F3(C_{16}-C_{34}) 330mg/kg**
- **BH6 (0.2-0.3m) B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg**

5.1.1 Objectives

The objectives are to:

- Appoint a Contractor to excavated and dispose of the TRH & PAH contaminated soils from within borehole BH6 (0.2-0.3m),
- To provide a Remediation Validation report for the remediation works undertaken within boreholes BH6.

5.2 STEP 2 - Identify the Decision

Based on the decision-making process for assessing urban redevelopment sites, the following decisions must be made:

1. Are there any unacceptable health risks to future onsite receptors?
2. Are there any unacceptable ecological risks posed by the site?
3. Are there any aesthetic issues at the site?
4. Is there any evidence of, or potential for, migration of contaminants from the site?
5. Is a site management strategy required?

5.3 STEP 3 - Identify Inputs to the Decision

The following information is required for input into the decisions identified in Step 2:

- Findings and conclusions from previous assessments carried out on site,
- Laboratory analytical results from soil analysis previously carried out,
- Field observations made on site during additional assessment or characterisation,
- Collection and laboratory analysis of soil samples from locations specified in this RAP,
- Laboratory analysis in accordance with USEPA/APHA methods, and
- Comparison and interpretation of laboratory results against the adopted soil investigation and screening levels as specified in this RAP.

5.3.1 Contaminants of Concern

The contaminants of concern identified in soils during previous investigations are listed in the table below:

Table 3: Summary Areas and Contaminants of Concern

Areas of Environmental Concern	Contaminating Activities	Contaminants of Concern
Borehole BH6	TRH contamination 330mg/kg	TRH F3(C16-C34)
Borehole BH6	B(a)P TEQ contamination (9.0mg/kg)	B(a)P TEQ
Borehole BH6	B(a)P contamination (6.0mg/kg)	B(a)P

5.4 STEP 4 - Define the Study Boundaries

The spatial and temporal aspects of the investigative area that the data must represent to support the decisions identified in Step 2 are as follows:

- The lateral extent of the assessment is limited the boundaries of entire site, and
- The vertical extent of the assessment is the depth of the excavations of the BH5 hotspot remediation (0.5m BGL).

5.5 STEP 5 - Develop a Decision Rule

Soil analytical data were assessed against National Environmental Protection Measure (NEPM) criteria as referenced in Section 8. Statistical analysis of the data will be undertaken if necessary. The following statistical criteria shall be adopted:

1. The upper 95% confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) must be below the adopted criterion,
2. No single analyte shall exceed 250% of the adopted criterion, and
3. The standard deviation of the results must be below 50 % of the criterion.

The acceptable limits for laboratory QA/QC parameters are shown in the table below and are based upon the laboratory reported acceptable limits and those stated within the NEPM 2013 Schedule B3 Guideline & AS 4482.1-2005.

Table 4: QA/QC Parameters

Type of QC Sample	Control Limit
FIELD	
Rinsate Blanks	Analytes <LOR
Intra-Laboratory Duplicates	RPD's < 30 - 50%
Inter-Laboratory Duplicates	RPD's < 30 - 50%
Trip Blanks	Volatiles <LOR
Trip Spike Recovery	>70%
LABORATORY	
Method Blanks	< Laboratory LOR
Matrix Spike	Recovery targets: • Metals: 70% to 130% • Organics: 60% to 140%
Laboratory Duplicate	RPD's <30%
Laboratory Control Samples	Recovery targets: 70% to 130%
Surrogate Spike	Recovery targets: 60% to 140%

The following conditions should be adopted:

- If the control limits are exceeded, then an assessment of the significance of the results should be carried out,
- If major non-conformances from the laboratory or field data are identified, then further sampling and laboratory analysis may be required to provide an adequate sample set for data reliance,
- If the results of the DQI assessment indicate that the data set is reliable, then the data set will be deemed to be acceptable for the purposes of the validation works, and
- If the measured concentrations of soil, groundwater and soil vapour samples analysed meet their respective validation criteria, then no additional remediation is required.

The following conditions should be adopted:

- If the control limits are exceeded, then an assessment of the significance of the results should be carried out,

- If the results of the DQI assessment indicate that the data set is reliable, then the data set will be deemed to be acceptable for the purposes of the additional investigation and validation works, and
- If the measured concentrations of soil samples analysed meet their respective validation criteria, then no additional assessment is required is required.

5.6 STEP 6 - Specify Limits of Decision Errors

There are two types of decision errors:

- **Sampling errors,** which occur when the samples collected are not representative of the conditions within the investigative area, and
- **Measurement errors,** which occur during sampling collection, handling, preparation, analysis and data reduction. Ensure all samples are compliant with guidelines and comply with holding times. Soil samples are to be assessed by a NATA accredited laboratory.

These errors may lead to following (null hypothesis):

- Deciding that the site is not suitable for the proposed development when it actually is (Type I error), and
- Deciding that the site is suitable for the proposed development when it is actually not (Type II error).

A 5% significance level has been selected for Type I errors on the basis that 95% of the data set will satisfy the DQIs. Therefore, the acceptable limit of the decision errors is based on a 5% probability of the hypothesis being incorrect.

An assessment will be made as to the likelihood of a decision error being made based on:

- The acceptable limits for inter/intra laboratory duplicate sample comparisons as specified in Step 5 of the DQOs, and
- The acceptable limits for laboratory QA/QC parameters are based upon the laboratory reported acceptable limits and those stated within the NEPM Guidelines.

If the concentration of a particular contaminant of concern exceeds its assessment criteria, then a further assessment is required to address the significance of the result.

Statistical analysis based on 95% UCL may be used to assess the significance of the data provided the following conditions are met:

- the arithmetic mean of the data set must be less than its respective threshold level; that is, it is acceptable for individual results to exceed its respective threshold level, but the cumulative mean of the data set of soil sample results must not exceed the threshold level,
- the standard deviation of the data set is less than 50% of the relevant threshold level, and

- no individual sample result should be greater than 250% of the relevant threshold level.

5.7 STEP 7 - Optimize Design for Obtaining Data

The optimum design for obtaining data in order to achieve the Data Quality Objectives is as follows:

- Review of previous reports prepared by ECON Environmental,
- Adhering to the specifications of this RAP, and other requirements that the Council may have,
- Only NATA-accredited environmental testing laboratories will be commissioned to analyse soil samples and will implement a quality control plan conforming to the NEPM (Assessment of Site Contamination) Measure Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils,
- An assessment of the Data Quality Indicators to determine if the field procedures and laboratory analytical results are reliable, and
- Field sampling works will be carried out by an experienced and qualified Environmental Scientist in accordance with Envirotech protocols, based on National Environmental Protection (Assessment of Site Contamination) Amendment Measure 2013 Schedules B1, B2, B4, B6 & B9 and other NSW EPA endorsed guidelines.

6. VALIDATION CRITERIA

6.1 General

Concentrations of contaminants in soil samples were compared against the National Environmental Protection Council (2013) site assessment criteria presented below and summarised in Table 6:

- Health Investigation Levels (HIL) for Soil Contaminants – NEPM HIL Residential A,
- CCME: Soil Quality Guidelines for the Protection of Environmental and Human Health Agricultural, Residential/Parkland, Commercial and Industrial,
- Assessment levels for Soil, Sediment and Water – Department of Environment and Conservation 2010, and
- Interim Ecological Soil Screening Level – United States Environmental Protection Agency 2005.

It is acknowledged that the guideline values adopted are generally intended for application as investigation and screening levels and are based on a conservative approach. However, the guidelines do not necessarily preclude their use in determining the suitability of a site for its proposed land use in the absence of remediation guideline values. Therefore, should the validation samples be at concentrations below their respective adopted criterion, they are considered to render the site suitable for the proposed use.

It should be noted that should validation samples fail their respective validation criteria, a justifiable decision should be made to determine whether a quantitative risk assessment would be warranted, based on the likelihood that it would result in a beneficial outcome in avoiding further unnecessary remediation costs.

Full details of the validation criteria for each contaminant of concern in soils, groundwater and soil vapour are presented in below.

6.2 Soils

6.2.1 Health Investigation Levels (HILs)

The NEPM presents Tier 1 Health Investigation Levels (HILs) for a broad range of chemicals such as metals, inorganics, PAHs, phenols, pesticides and other organics. The HILs are applicable to generic land uses such as residential, commercial/industrial or public open space and all soil types, generally within the first 3 metres of soil below ground level. The HILs have been applied to assess human health risks via all relevant pathways of exposure.

Based on the proposed development, soil investigation results within the building footprint/site will be assessed against the following criteria:

- ***HIL 'A' -*** *Residential use with gardens/accessible soils, including children's day-care centres, preschools and primary schools,*

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6.2.2 Export of Waste

To assess the waste classification of materials to be disposed of off-site, the NSW EPA refers to the NSW EPA (2014) "Waste Classification Guidelines, Part 1: Classifying Waste".

6.2.3 Duty to Report

The CLM Act uses the key concept of 'foreseeable' to determine the likelihood of the presence of contamination or potential routes for its migration. Foreseeability depends on a number of considerations, including:

- the physical and chemical properties of the contaminants,
- the quantity of the contaminants,
- the location of the site,
- the geological and hydrogeological conditions (soil stratigraphy, depth to groundwater, and direction and rate of groundwater or surface water flow),
- the potential fate and transport mechanisms.

To determine the foreseeable movement of, in this instance, asbestos contaminants through various media, such as soil, surface water or air, enough samples need to be collected to allow verification of the extent of contamination in the relevant media and the results compared with the appropriate references in these guidelines. Where relevant media have not been sampled the potential movement of contaminants at levels above the notification trigger values should be assumed. An exception to this is when negligible amounts of contaminants that are unlikely to affect human health and the environment have been released into the environment.

In accordance with Section 2.3.4 of the EPA (2015) Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, notification is required when foreseeable:

- friable asbestos is present in or on soil on the land, and
- the level of asbestos (% weight for weight) in an individual soil sample is equal to or above the health screening level of friable asbestos in soil (0.001%) specified in Section 4.8, Schedule B1 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC 2013); and
- a person has been, or foreseeably will be, exposed to elevated levels of asbestos fibres by breathing them into their lungs.

In accordance with Section 2.3.5 of the EPA (2015) Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, notification is required when:

- the contaminant has entered or will foreseeably enter groundwater or surface water, and

- the concentration of the contaminant in the groundwater or surface water is, or will foreseeably be, above the groundwater investigation level for that contaminant as specified in Section 6, Schedule B1 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC 2013), and
- the concentration of the contaminant in the groundwater or surface water will foreseeably continue to remain above the specified concentration.

Furthermore, the guideline specifies situations not intended to be captured by the duty to report such as:

- sites without off-site contamination where
    - on-site contamination is not likely to migrate to a neighbouring property, and
    - any on-site contamination has been assessed and the site found to be suitable for the proposed use in accordance with the requirements under the Environmental Planning and Assessment Act 1979
- sites with contaminants that are at levels above the triggers but are equal to, or below, the ambient background concentration,
- sites with non-friable asbestos materials (fibro) in or on soils, or naturally occurring asbestos.

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7. REMEDIATION OPTIONS

7.1 Overview

With regards to site remediation, the Environment Protection Authority (EPA) endorses the Policy of the 1992 Australian and New Zealand Environment and Conservation Council (ANZECC) and National Health and Medical Research Council (NHMRC) Guidelines for the Assessment and Management of Contaminated Sites. Furthermore, the threshold concentrations presented in the NSW EPA Third Edition 2017 Guidelines for the NSW Site Auditor Scheme and the National Environment Protection (Assessment of Site Contamination) Measure 2013 (NEPM) are considered as appropriate soil and groundwater clean-up criteria.

For groundwater, the ANZECC 2000 Guidelines for Fresh and Marine Water Quality have been generally accepted by the NSW EPA as appropriate investigation levels along with criteria outlined in the National Environment Protection (Assessment of Site Contamination) Measure 2013. The NSW EPA Service Station Guidelines also provide reference guidelines. In addition, the NSW EPA 2014 Waste Classification Guidelines Part 1: Classifying Waste have been used as the basis of technical review for the waste disposal options most applicable to the site.

A risk management approach has provided the basic principle of the remediation technologies/methods selected for the Site. This approach is consistent with the strategy outlined in the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC, 1992) and the National Environment Protection (Assessment of Site Contamination) Measure 2013, which are endorsed by NSW EPA.

A contaminated site, as defined by the NEPM 2013 and the ANZECC 1992, is a site at which hazardous substances occur at concentrations above background levels, and where assessment indicates it poses, or is likely to pose, an immediate or long-term hazard to human health or the environment.

Wherever human health is at risk, either on or off-site, or the off-site environment is at risk, a contaminated site should be remediated to the extent necessary in order to minimise such risks in both the short and long terms.

Environmental and Human Health Risk is based on exposure to potential hazards and is defined as:

Risk = Hazard x Exposure

The elimination of the risk can be achieved by the removal of the hazard and/or the exposure pathway. Remediation is defined as any measure that removes the risk to an acceptable level by negating the hazard or exposure pathway. Therefore, remediation can involve removal of the hazard (i.e. no risk remains) or alternatively, management of the risk by removal of the exposure pathway even if the hazard remains. Exposure pathways to contaminated material can be managed by undertaking a physical action (e.g. erection of a fence, installation of cap, etc.) and/or a management plan, which prevents exposure to contaminants (e.g. use of planning controls, management of site activities etc.).

7.2 Typical Remedial Options Available

Several remedial options were reviewed. The suitability of the remedial options was examined with respect to the requirements of the proposed development, whilst taking into account the provisions of a number of relevant guideline documents, including:

- ANZECC/NHMRC document Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Lands 1992 (ANZECC 1992). Department of Environment and Conservation (now DECCW), Contaminated Site: Guidelines for the NSW Site Auditor Scheme (3rd Edition) 2017,
- ANZECC, Guidelines for the Assessment of On-site Containment of Contaminated Soil' (ANZECC 1999),
- NSW EPA Best Practice Note: landfarming (NSW EPA, 2014).

Typical remedial options that may achieve the remedial objectives are identified as:

- Removal of contaminated material to landfill,
- Encapsulation of the contaminated soils by a physical barrier system, or
- On-site treatment and re-use of contaminated material.

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8. SELECTION OF PREFERRED REMEDIATION STRATEGY

8.1 Evaluation of Remediation Options

A summary of the hierarchical policy for site remediation options (Guidelines for the NSW Site Auditors Scheme NSW DEC 2017) is as follows:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level,
2. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site,
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill,
4. Bioremediation which uses naturally occurring micro-organisms, such as bacteria and fungi, to eliminate, attenuate or transform polluting or contaminating substances in soils, and
5. Consolidation and isolation of the soil on site by containment within a properly designed barrier.

An evaluation of remedial options was considered as follows:

- **Do nothing** – Whereby no remediation is undertaken, and impacted soil remains on site. Given the sensitive nature of the proposed development, including residential and commercial uses, this option is not considered suitable.
- **On-site containment** – Given that this option will result in the site recorded on the Register of Contaminated Sites under section 21(A) of the Environmental Protection Act 1997, it is the least preferred option in the hierarchy of remediation options as outlined above.
- **On-site treatment and re-use of contaminated land** – This strategy is feasible for some contaminants such as bacterial contamination. Bacterially contaminated soil is excavated and then spread thin over plastic exposed to the sun for seven days. This can be carried out by the caretaker/owner of the site. This is an advantageous strategy as the soil, once exposed to the sun, is reusable onsite.
- **Excavation to offsite** – This remedial strategy involves the complete removal of impacted soil from the site for disposal at an appropriately licensed waste management facility. The advantage of this strategy is that it removes the contaminants and their associated problems from the site. The disadvantage is that it is typically more costly than on-site containment and off-site transport of contaminated soil increases the risk of exposure within the surrounding community.
- **Bioremediation** – This remedial strategy involves 'landfarming' wherein engineered bioremediation systems which generally use tilling or ploughing of impacted soils to reduce contaminant levels biologically. Another well-practiced system of bioremediation uses forced air that actively aerates the contaminated mass to encourage bioremediation.

8.2 Preferred Remediation Options

Based on an assessment of the options and considering the proposed land-uses and development, the remediation option which should be adopted for the site is ***Excavation of contaminated soil offsite.***

Excavation Offsite: The excavation to offsite is considered to be the most appropriate remedial strategy for specific areas within the site where Lead contamination is at greatest concentrations. The sensitive nature of the potential inhabitants for the proposed are key to this remediation recommendation. Off-site disposal of contaminated soil is considered a suitable option for managing human health and environmental impacts from the contaminated materials. Off-site disposal harnesses the excavation of soil, classification of spoil, and disposal to a facility which can legally receive it.

The EPA permits disposal of contaminated material subject to an approved landfill. The NSW EPA Waste Classification Guidelines (2014) document sets out the methodology for assessing and classifying wastes to be disposed to landfill. Essentially, wastes are classified into General Solid (Non-putrescible), General Solid (Putrescible), General Solid – Special Waste Asbestos, General Solid – Restricted Waste and Hazardous Waste.

The selection of an appropriate landfill will normally depend largely upon the results of classification of the wastes. It is sometimes necessary for heavily contaminated soils to be pre-treated prior to disposal, to reduce the concentrations or minimise the mobility of the contaminants. Special criteria are sometimes applicable to certain categories of waste. Contaminants covered by Chemical Control Orders have restrictions placed on their handling and disposal.

Note: The preferred remediation option will be undertaken by an appropriate licenced and experienced contractor.

8.3 Contingency Plan

The stated primary remedial objectives stated include excavations within the BH6 hotspot location within the site, as stated. If further contaminants are identified, then chasing out the contaminants apply and the implementation of the unexpected finds protocol in Section 11.

8.4 Excavation Contingency Plan

The conditions that may be encountered when excavating is uncertain. As unknown and variable subsurface conditions impose a degree of uncertainty for the project a set of anticipated conditions has been assumed in developing the excavation plan. However, because field conditions vary, flexibility has been built into the excavation plan to adapt to differing conditions. The table below summarises conditions that can be reasonably expected and the resulting problems they may cause and how these problems may be resolved within the context of the excavation program.

Table 5: Excavation Contingency Planning

Anticipated Problem	Corrective Action by Contractor
Chemical spill / exposure	Stop work, refer to Occupational Health, Safety and Rehabilitation Plan and immediately contact ECON Environmental
Excessive rain	Maintain access roads, cover high-traffic areas with gravel; or cover working areas/stockpiles with plastic during off-shifts; or shut down operations until runoff is more manageable. Inspect & maintain sediment control pond & filter fences.
Unmanageable mud in excavation zone	Improve drainage collection system; add geotextile/gravel in problem areas; or strip off mud/slurry materials; or excavate from the top of the fill.
Excessive drainage	Minimise active/contaminated work area; or improve diversion clean run-on; or maintain sufficient on-site wastewater storage capacity; or mobilise additional storage and/or treatment systems as needed.
Excessive dust	Use water sprays or biodegradable dust sprays or cease dust-generating activity until better dust control can be achieved or apply interim capping systems.
Sediment pond water for discharge – analytical results exceed site response levels	Perform in-situ treatment, e.g. flocculant dosing, until response levels are met. Alternatively arrange off-site disposal by a licensed Contractor.
Excessively wet materials	Stockpile and dewater on-site; or add absorbents.
Equipment failures	Maintain spare equipment or parts; or maintain alternate rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	Remove source, use absorbent booms to remove oil and make any repairs as required.
Silt fence fails	Stop work and repair fence to specifications.
Excessive noise	Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment.
Unexpected Problem	**Corrective Action by Contractor**
Asbestos cement sheeting, lagging, pipping etc.	Stop excavations if there is the potential for people to inhale airborne asbestos fibres. Contact ECON Environmental immediately to assess whether the material is asbestos. Cover the area with plastic and suppress dust by wetting down if needed. Place a warning sign at the entrance to the site where asbestos removal or site remediation is taking place.
Discovery of USTs	Stop excavations, contact ECON Environmental immediately.
Excessive odours	Monitor for volatiles using PID and upgrade PPE if necessary. Use odour and volatile suppressing agents to eliminate or reduce odours as required and/or cover odorous material if practicable.
Unearthing drummed material	Isolate and contact Superintendent. Arrange temporary storage in a secure part of the remediation site (to be nominated).

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In addition to the above listed contingencies, the following steps may need to be undertaken should non-spadeable sludges or buried drums be discovered during the remediation works:

- upgrade of personal protective equipment (PPE), for workers within the active work zone, in accordance with the site Occupational Health, Safety and Rehabilitation Plan,
- segregation and bunding of discovered material,
- use of odour suppressants (where appropriate),
- cover the discovered material with plastic sheeting,
- appropriate sampling and analysis to assess potential contaminants, and
- appropriate off-site disposal of the materials following receipt of analytical results and any associated regulatory approvals required.

8.5 Unexpected Finds Protocol

The possibility exists for residual hazards to be present at the site. Environmental sampling is based on chemical analytes identified as a potential concern during a documented process of reviewing historical site activities. However, ground conditions between sampling points may vary and further hazards may arise from unexpected sources and / or in unexpected locations.

The nature of any residual hazards which may be present at the site are generally detectable through visual or olfactory means, for example:

- Fragments of asbestos-containing materials (visible),
- Construction / Demolition Waste (visible),
- Hydrocarbon impacted materials (visible / odourous), and
- Ash and / or slag contaminated soils / fill materials (visible).

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances be identified (or any other unexpected potentially hazardous substance), the procedure summarised in Section 11 is to be followed.

An enlarged version of the unexpected finds protocol, suitable for use on site, should be posted in the Site Office and referred to during the Site-Specific Induction by the Principal Contractor.

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the following minimum requirements in-situ:

- In-situ Sampling
  - <25m^3 = 3 samples
  - <50m^3 = 3 samples
  - 75m^3= 4 samples
  - 100m^3 = 5 samples
  - 125m^3 = 7 samples
  - 150m^3 = 8 samples
  - 175m^3 = 9 samples
  - 200m^3 = 10 samples
  - >200m^3 = 1 samples per 25m^3

Lower sampling rates may be derived for soil quantities greater than 200m^3 by applying statistical analysis, such as 95% UCL.

- Stockpile Sampling
  - Samples should be analysed for the chemicals of concern.
  - <=75m^3 = 3 samples
  - >75m^3 to <=100m^3 = 4 samples
  - >100m^3 to <=125m^3 = 5 samples
  - >125m^3- to <=150m^3 = 6 samples
  - >150m^3 to <=175m^3 = 7 samples
  - >175m^3 to <=200m^3 = 8 samples
  - >200m^3 = 1 sample every 25m^3

All additional works should be documented by the use of field notes, site photographs, site plans and reporting.

The Site Owner will be notified of any unexpected finds together with a proposed amendment to the existing RAP document.

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9. IMPLEMENTATION OF PREFERRED REMEDIATION STRATEGY

9.1 Roles and Responsibilities

Principal and Principals Representative

- The Principal's representative, is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls.

Principal Contractor and Site Manager

- The Principal Contractor (referred to herein as the Contractor) is anticipated to be the party responsible for the day-to-day implementation of this RAP and shall fulfil the responsibilities of the Principal Contractor as defined by SafeWork NSW.
- If hazardous materials (Asbestos) are identified, SafeWork NSW licensed contractors are to be commissioned to safely remove them from site and dispose of them at a suitably licensed waste disposal facility (tickets retained for proof).
- Furthermore, Principle Representative, Principal Contractor and Site Manager will be responsible for implementing the Remedial Environmental Monitoring Plan (REMP) including:
    - Notification of adjoining residents and local planning authority (involved in remedial works) prior to commencement of remedial works,
    - Define hours of operation (complying with council requirements),
    - Define roles and responsibilities for relevant parties to provide contact details,
    - Traffic control measures,
    - Handling of contaminated material,
    - Odour control measures,
    - Stockpiling of excavated soils on site, and
    - Complaints and how they will be handled.

9.2 TRH & B(a)P TEQ & B(a)P Remediation Process – Excavation Offsite

Suitably experienced and licensed contractors is to be commissioned to safely remove TRH, B(a)P TEQ and B(a)P contaminated soils and dispose of them at a suitably NSW EPA licensed waste disposal facility (tickets retained for proof).

The following soil samples tested were reported by the laboratory to have concentrations **ABOVE** the adopted site assessment criteria for HIL A, as per the NEPM, 2013.

- **BH6 (0.2-0.3m) TRH F3(C_{16}-C_{34}) 330mg/kg**
- **BH6 (0.2-0.3m) B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg**

Therefore, the BH6 sampling location is deemed to be contaminated Hotspots. Hence the following remediation processes are to be applied:

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Hotspot BH6:

- excavate the area 3m x 3m x 0.5m depth – est. volume **4.5m^3 (7.2 tonnes)**
- excavated soil surfaces should be visibly clean residual soil material
- unless tested and proven otherwise, the contaminated material from Hotspot BH5 location will be disposed of offsite at a licensed facility as **Restricted Solid Waste**.
- if the material is transported interstate or within NSW to an appropriate licenced facility it must be tracked and monitored using an NSW EPA approved tracking waste system.

Note: additional excavations/chasing out of contaminants may be required should further visible and odorous contaminants are identified within each of the hotspot areas.

Figure 4: Site Hotspot borehole BH6 location

Table 6: Hotspot BH6 excavations				
Borehole Sample	Hotspot Dimensions	Approximate Volume (m^3)	Latitude	Longitude
BH6	3m x 3m x 0.5m	4.5	-33.774624293	150.773577212

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9.3 Work Health and Safety (WHS)

- All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act
- Removal of waste materials from the site shall only be carried out by suitably licensed contractors holding consent and/ or approvals to dispose of the waste materials per the assigned waste classification, and
- Asbestos containing soils are to be safely disposed at a facility licensed to receive such waste with receipts retained for proof of safe and appropriate disposal.

9.4 Waste Classification

In New South Wales, it is an offence to transport waste to a place that cannot lawfully receive it or use a site to receive waste that cannot lawfully be used as a waste facility. To ensure that waste generators (or their representatives) do not trigger such offences:

- in relation to disposal, excavated soil material must ensure the waste is classified in accordance with the Waste Classification Guidelines – Part 1: Classifying Waste (EPA 2014), and the waste is taken to a facility that is lawfully able to receive that waste.

The Waste Guidelines set out six important steps for classifying waste and are undertaken to ensure the consultant or waste generator (or their representative):

- has assessed the waste against the relevant step(s) of the Waste Guidelines,
- has provided adequate justification for the determined classification of the waste.

Where a waste has undergone chemical assessment to determine its classification, the consultant or waste generator (or their representative) needs to provide adequate justification for:

- sampling density,
- sampling pattern and method used,
- selection of contaminants of potential concern for laboratory analysis,
- leachate analysis using the toxicity characteristics leaching procedure,
- the determined classification of the waste based on chemical assessment.

Any soil to be removed from the site shall be classified in accordance with the NSW EPA (2014) "Waste Classification Guidelines, Part 1: Classifying Waste" before it can be disposed of off-site.

Unless tested and proven otherwise, the contaminated material from the following Hotspots locations will be disposed of offsite at a licensed facility as the following classifications:

- **BH6 (0.2-0.3m) TRH F3(C_{16}-C_{34}) and B(a)P TEQ 9.0mg/kg, B(a)P 6.0mg/kg – Restricted Solid Waste**

The contaminated soils are to be excavated and disposed of offsite to an EPA approved licenced landfill facility.

Remaining soil materials within the site, *if to be excavated* – a waste classification required.

9.5 Waste Disposal

Waste generated from the site must be taken to a facility lawfully able to receive that waste. The consultant or waste generator (or their representative) must demonstrate the following:

- If the waste is taken to a facility licensed by the EPA for waste disposal, the facility's environment protection licence (EPL) must show it can lawfully receive that waste. A waste facility licensed by the EPA does not necessarily mean it can lawfully receive a class of waste for disposal,
- If the waste is taken for processing to a facility licensed by the EPA, that waste must meet the 'limit conditions' for that waste in the EPL, and
- If the waste facility is not licensed by the EPA, the facility must have consent from the appropriate regulatory authority to receive that waste for its waste activities.

The consultant or waste generator (or their representative) must provide the following:

- the estimated volume of waste taken off site,
- receipts verifying the facility has received that volume and class of waste from the waste generator (or its representative). This may include a valid consignment authorisation, and
- reconciliation documents demonstrating the total volume of waste taken off site is consistent with the total volume of waste generated from the site.

9.6 Validation Goals / Implementation

The validation goals are to have no contaminated soils remaining in the area of concern.

A Remediation Validation report must be provided by a suitably qualified and experienced environmental consultant, or equivalent person, for the proposed development.

Validation will involve a validation soil sampling and laboratory analysis regime as per follows:

- **Hotspot BH6**
    - At least one (1) sample for the contaminates of concern from of the each four (4) walls of the excavated hotspot pit, additional discretionary samples if necessary,
    - At least one (1) samples for the contaminants of concern from each of the base/floor of the excavated hotspot pit areas, additional discretionary samples if necessary,
    - Each validation sample retrieved will be analysed for the contaminate of concern: **TRH, B(a)P TEQ and B(a)P.**

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Additionally, all remediation and validation work, imported fill material certification, waste classification and disposal documentation must be documented in the Remediation and Validation Report prepared for the site.

The **Remediation and Validation Report** must be prepared in accordance with the NSW EPA (2020) Guidelines: Consultants reporting on Contaminated Land, to present the remediation works undertaken and confirm that the objectives of the remediation works have been attained.

9.7 Validation of Imported Clean Fill Material

The imported clean fill must be accompanied by a certificate and supporting information confirming it is deemed suitable for the proposed use at the site. Imported material would be:

- Virgin excavated natural material (VENM) as per Environment Operations Act 1997,
- Excavated natural material (ENM) Order 2014,
- Compost under Resource Recovery Order 2016,
- Manure under Resource Recovery Order 2014,
- Pasteurised garden organics under Resource Recovery Order 2016,
- Recovered aggregate under Resource Recovery Order 2014.

Based on the proposed development and land use, the importation of clean fill may be required to backfill the excavations where fill soils have been removed and where levels are required to be raised, if required. The imported fill must be certified VENM material OR other material that is certified and suitable to be used on the site and be tested in accordance with the requirements of the NSW EPA 2014 Waste Classification Guidelines Part 1: Classifying Waste (including testing for asbestos) at a rate of 1 sample per 250 m^3. It will also be visually assessed for fibro sheeting and samples analysed for asbestos if detected. *A minimum of 5 samples for imported fill will be conducted.*

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10. ENVIRONMENTAL MANAGEMENT PLAN

10.1 Introduction

A major component of the remedial works shall involve the installation and maintenance of an Environmental Management Plan (EMP). The EMP will provide details of the environmental protection and pollution control measures to be implemented during the operational phase of the remedial works. The pollution control measures have the objective of removing/minimizing any adverse impact on the surrounding environment.

In the following sections, outlines have been presented of the various pollution control measures that would be implemented during most elements of the remedial works. These form the basis of the Environmental Management Plan that should be read in conjunction with this document.

10.2 Site Fencing

Reasonable measures need to be taken to ensure the site boundary remains secure during all remedial site works. Secure temporary fencing is required to be in place for the duration of site works with gates secured and locked outside of site operating hours to prevent unauthorized access.

10.3 Erosion Sediment Control Plan

An erosion and sediment control plan will be prepared for the site. Erosion and run-off control measures will be implemented during all elements of remedial works. Typically, these measures will be designed to prevent the transport of pollutants (including sediments) out of the remediation area (including the designated stockpile areas) via surface run-off. Such measures typically include:

- Minimizing disturbed areas,
- Sediment control fencing,
- Stabilized site access points,
- Strict excavation times tables, and
- Prompt rehabilitation of disturbed areas.

10.4 Noise Control Plan

The Principal Contractor and Site Manager will be responsible for keeping noise levels to a minimum and not exceed limits outlined in AS 2436-1981. Noise levels must comply with Council and NSW EPA requirements. It is expected that equipment and machinery used onsite will not generate noise levels above this requirement.

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10.5 Dust Control Plan

Dust generation should be kept to an absolute minimum. Dust control measures will be implemented to ensure that dust generated from the site is controlled within acceptable levels. These control measures will be developed considering the site conditions in each remediation area, and are likely to include (but not necessarily be limited) to the following:

- All vehicles leaving the site will be hosed down to remove any potentially contaminated dust,
- A water cart or equivalent will be utilized on-site to keep vehicle paths and areas of site work damp to minimise dust generation,
- Access to water sprays shall be available to water down excavation / loading areas, and
- Plastic sheeting shall be available to cover excavation faces and stockpiles.

10.6 Odour Control Plan

All potential odours generated during remedial action is taking place must be monitored and comply with local Council and NSW EPA requirements. Due to the type of contamination present onsite, odours are not expected to be encountered.

10.7 Health and Safety

A Work Health and Safety (WHS) plan is an essential part of all remediation projects, to ensure the health and safety of all personnel working on or visiting the site. All remediation work would be undertaken in accordance with the provisions set out by the Work Health and Safety Act (2011) and associated Regulations 2017, and any other regulations or directions set out by regulatory authorities. Prior to commencing any remediation works, a specific WHS Plan would be prepared by the Remediation Contractor covering the following minimum aspects:

- Method statements,
- Identification of the remediation area and exclusion zones,
- Induction of personnel,
- Personal protective equipment (PPE),
- Hazard identification / locations,
- Identification of contaminants of concern and their physical and toxicological properties,
- Description of exposure pathways and personal protection requirements,
- Location of all underground/aboveground services,
- Details of specific work practice procedures to be followed within the designated contaminated areas,
- Monitoring protocols to identify a potentially hazardous practice,
- Emergency information, and
- Incident reporting.

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10.8 Onsite Stockpiling

Onsite stockpiles, as a result of excavations works should be managed to minimise the risk of dust generation, erosion and leaching. The measures required to achieve this will depend on the materials in the stockpile and the length of time the stockpile is to remain on site, but should include:

- Restrict the height of stockpiles to reduce dust generation,
- Construct erosion, sediment and runoff control measures,
- Cover stockpiles of contaminated soils with GeoFabric to be left on site temporarily,
- Temporarily fence off the stockpile with sit bags around perimeter of the stockpile to ensure cross contamination does not occur,
- Keep temporary stockpiles moist, by using water spray where required,
- Once the stockpiles have been removed from site, 100mm of the underlying stockpile footprint area is to be scraped and removed from site along with the stockpile, and
- Underlying stockpile footprint areas will require floor validation sampling (minimum three (3) samples per stockpile footprint area) for asbestos analysis to ensure all asbestos contamination has been removed from the stockpile area.

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11. UNEXPECTED FINDS PROTOCOL

All unexpected finds must be documented in the Remediation and Validation Report upon the completion of the remediation works.

11.1 Management

Where earthworks are required there is potential to expose unexpected forms of contamination within the surface and subsurface. In such instances, action is required to mitigate potential contaminated soil/material encountered during excavation or construction activities. If potentially contaminated material is encountered the Unexpected Finds Protocol is to be followed. Works in the vicinity will be stopped or modified and will not recommence until the material has been analysed and management measures developed.

11.2 Training

Personnel involved in earthworks on site are to be inducted on the identification of potential unexpected finds and asbestos awareness. The induction can be undertaken at the time of general site induction and refreshed periodically at toolbox meetings. Induction to provide awareness of all types of possible unexpected finds is not practicable. In general, a precautionary approach can be employed and the unexpected finds procedure outlined in the following sections should be implemented.

11.3 Procedure

Personnel involved in earthworks on site are to be inducted on the identification of potential unexpected finds and asbestos awareness. The induction can be undertaken at the time of general site induction and refreshed periodically at toolbox meetings. Induction to provide awareness of all types of possible unexpected finds is not practicable. In general, a precautionary approach can be employed, and the unexpected finds procedure outlined in the following sections should be implemented.

Should an unexpected actual or suspected contamination be encountered during the development works, the following procedure applies:

- Stop work in the potentially hazardous area as soon as it is safe to do so and move to the upwind side of the area, or away from the area,
- Assess the potential immediate risk to human health posed by the unexpected find and assess if evacuation or emergency services need to be contacted,
- Delineate an exclusion zone around the affected area using fencing and/or appropriate barriers and signage. Additional control measures may be required for odours and/or volatile compounds: odours suppression and no smoking signage,

- Contact the appointed environmental consultant for advice and request a site visit to undertake an assessment of the unexpected find. The Site Supervisor should be informed of the find once a preliminary assessment is made,
- The environmental consultant will assess the unexpected find and provide advice regarding:
    - Preliminary assessment of the contamination and need for immediate management controls,
    - What further assessment and/or remediation works are required and how such works are to be undertaken in accordance with contaminated site regulations and guidelines,
    - Preparation of an addendum to the remediation action plan (if necessary) or provide clean up advice,
    - Remediation works required (where applicable),
    - Validation works required following remediation works (if applicable).
- Works are not to recommence in the affected area until appropriate advice has been obtained from the environmental consultant and the environmental consultant has provided relevant information to the Site Supervisor, particularly for considering change to the Site Safety Plan,
- If it is deemed safe to do so by the Site Supervisor, works may resume in the affected area.

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12. CONCLUSION

The site can be made suitable for the intended land-use through remedial action as part of the redevelopment works in accordance with State Environmental Planning Policy No.55 Managing Land Contamination: Planning Guidelines SEPP 55 Category 2 remediation works.

In conclusion, the RAP:

- Has been developed in a manner consistent with current industry practice,
- Has selected a preferred remediation strategy based on the site-specific issues and currently available technologies that will allow the site to be made suitable for the intended land use,
- Has selected a validation sampling process to ensure all contaminants of concern have been appropriately excavated and disposed of from the site,
- Has presented an outline of the Environmental Management Plan (EMP) and associated contingency plans to ensure the environment is appropriately protected during the proposed works,
- Has presented an information and consultation program to ensure the stakeholders are informed of the works as they proceed, and
- Has outlined the means of validation of the completed works and ongoing management.

Subject to the above, it is considered that the site can be remediated, and the site made suitable for the land use, pending on the findings of the following Remedial Works and Validation of the site.

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13. LIMITATION STATEMENT

The information contained within this report have been prepared exclusively for the client. ECON Environmental has carried out the investigation with a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia. No other warranty, expressed or implied, is made or intended. This report is to be read in its entirety including attachments and appendixes and should not read in individual sections.

A third party should not rely upon the information prior to making an assessment that the scope of work conducted meets their specific needs. ECON Environmental cannot be held liable for third party reliance on this document.

The sub-surface environment can vary greatly across an individual site. The conclusions presented in this report are based on limited investigation of conditions at specific sampling locations chosen to be as representative as possible under the given circumstances. However, it is possible that this investigation may not have encountered all areas of contamination at the site due to the limited sampling and testing program undertaken.

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

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