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Report Type:
Supplementary Contamination Assessment

Project Address:
**Portion of Lot 1 in DP837179 (Lot 10 in DP1232584)
Meadowbank Education and Employment Precinct Schools
Project, 2 Rhodes Street, Meadowbank, NSW**

Client Name:
Ward Civil Pty Ltd

10 October 2019
Report No: **9280-ER-1-1 REV1**

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DOCUMENT CONTROL

Revision	Date	Author	Reviewer
Rev 0	2 July 2019	Sam Scully	Aidan Rooney
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EXECUTIVE SUMMARY

Alliance Geotechnical Pty Ltd (AG) was engaged by Ward Civil, to undertake a Supplementary Contamination Assessment for Meadowbank Education and Employment Precinct Schools Project at 2 Rhodes Street, Meadowbank, NSW (refer **Figure 1** with the 'site' boundaries outlined in **Figure 2**).

This report has been prepared by AG on behalf of the NSW Department of Education (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9343) for the Meadowbank Education and Employment Precinct Schools Project (hereafter referred to as MEEPSP) at 2 Rhodes Street, Meadowbank (the site).

MEEPSP will cater for 1,000 primary school students and 1,620 high school students. The proposal seeks consent for:

- A multi-level, multi-purpose, integrated school building with a primary school wing and high school wing. The school building is connected by a centralised library that is embedded into the landscape. The school building contains:
 - Collaborative general and specialist learning hubs, with a combination of enclosed and open spaces;
 - Adaptable classroom home bases;
 - Four level central library, with primary school library located on ground floor and high school library on levels 1 to 3.
 - Laboratories and workshops;
 - Staff workplaces;
 - Canteens;
 - Indoor gymnasium;
 - Multipurpose communal hall;
 - Outdoor learning, play and recreational areas (both covered and uncovered).
- Associated site landscaping and public domain improvements;
- An on-site car park for 60 parking spaces; and
- Construction of ancillary infrastructure and utilities as required.

The objectives of this investigation were to:

- Assess data gaps and delineate the identified contamination presented in the Stage 2 Detailed Site Investigation (DSI) completed by AG in 2018 (AG, 2018b) and the remedial action plan (RAP) completed by AG in 2018 (AG, 2018c);
- Assess the potential nature and extent of identified contaminants of potential concern on the site, with reference to the areas of environmental concern reported by AG in (AG, 2018b & AG, 2018c);
- Provide advice on whether the site would be suitable (in the context of land contamination) for the proposed land use setting;
- Provide recommendations for further investigation, management and/or remediation (if warranted).

The scope of works undertaken to address the investigation objectives, included:

- A desktop review of relevant information relating to the site;
- A site walkover to understand current site conditions;
- Conduct an intrusive site investigation using both excavator and utility-mounted drill rig to assess subsurface ground conditions and to facilitate the collection of representative soil samples;
- Laboratory analysis to compliment the in-situ testing completed during the field investigation; and
- Data assessment and report preparation.

Conclusions and Recommendations

Based on AG's assessment of the desktop review information, fieldwork data and laboratory analytical data, in the context of the proposed redevelopment scenario, AG makes the following conclusions:

Data Gap Assessment (previously inaccessible areas)

- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable direct contact human health exposure risk;
- fibrous asbestos and asbestos fines detected in the soils assessed, may present an unacceptable human health exposure risk, at sampling points **TP53** and **TP57**;
- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable inhalation / vapour intrusion human health exposure risk; and
- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present a petroleum hydrocarbon management limit risk.

Chemical Delineation Assessment

- the extent of previously identified lead contamination at sampling points **BH02**, **BH22** and **BH24**, is considered to have been adequately delineated; and
- the extent of previously identified benzo(a)pyrene contamination at sampling points **BH04**, **BH16** and **BH23**, is considered to have been adequately delineated.

Asbestos Delineation Assessment

- the extent of previously identified asbestos contamination at sampling points **SS02**, **SS03**, **BH30**, **BH40**, **BH41** and **TP53** is considered to have been adequately delineated;
- the extent of previously identified asbestos contamination at sampling point **BH07**, has not been adequately delineated; and
- Non-friable ACM identified at sampling point **TP04B** may present an unacceptable human health exposure risk and has not been adequately delineated.

Indicative Waste Classification

- General Solid Waste (Special Waste).

Based on these conclusions, AG makes the following recommendations:

- a further supplementary contamination assessment could be undertaken to further understand the nature and extent of asbestos contamination identified at sampling points **TP04B, TP07A** and **TP57**; or
- alternatively, AG (2018c) could be updated to include the recently identified contamination risks onsite and outline the appropriate remedial measures to adequately remove the contamination pathway and associated human health exposure risks. It is recommended that any update to AG (2018c) be undertaken by an appropriately experienced environmental consultant.

This report, including its conclusions and recommendations, must be read in conjunction with the limitations presented in **Section 15**.

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LIST OF ABBREVIATIONS

A list of the common abbreviations used throughout this report is provided below:

ACM	Asbestos Containing Material
AF/FA	Asbestos Fines / Fibrous Asbestos
AEC	Area of Environmental Concern
AG	Alliance Geotechnical Pty Ltd
AHD	Australian Height Datum
B(a)P TEQ	Benzo(a)pyrene Toxic Equivalence Quotient
BTEX	Benzene, toluene, ethyl benzene and xylenes
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DSI	Detailed Site Investigation
DP	Deposited Plan
EPA	NSW Environment Protection Authority
m	metres
m ²	square metres
m bgs	metres below ground surface
mg/kg	milligrams per kilogram
OCP	Organochlorine pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit

1. INTRODUCTION

1.1. Background

Alliance Geotechnical Pty Ltd (AG) was engaged by Ward Civil, to undertake a supplementary contamination assessment (SCA) for Meadowbank Education and Employment Precinct Schools Project at 2 Rhodes Street, Meadowbank, NSW (refer **Figure 1** with the 'site' boundaries outlined in **Figure 2**).

This report has been prepared by AG on behalf of the NSW Department of Education (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9343) for the Meadowbank Education and Employment Precinct Schools Project (hereafter referred to as MEEPSP) at 2 Rhodes Street, Meadowbank (the site).

MEEPSP will cater for 1,000 primary school students and 1,620 high school students. The proposal seeks consent for:

- A multi-level, multi-purpose, integrated school building with a primary school wing and high school wing. The school building is connected by a centralised library that is embedded into the landscape. The school building contains:
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 - Laboratories and workshops;
 - Staff workplaces;
 - Canteens;
 - Indoor gymnasium;
 - Multipurpose communal hall;
 - Outdoor learning, play and recreational areas (both covered and uncovered).
- Associated site landscaping and public domain improvements;
- An on-site car park for 60 parking spaces; and
- Construction of ancillary infrastructure and utilities as required.

1.2. Objectives

The objectives of this project were to:

- Assess data gaps from previous investigations and delineate the identified contamination presented in the Stage 2 – Detailed Site Investigation (DSI) completed by AG in 2018 (AG, 2018b) and the Remedial Action Plan (RAP) completed by AG in 2018 (AG, 2018c);
- Assess the potential nature and extent of identified contaminants of potential concern on the site, with reference to the areas of environmental concern (AECs) reported by AG in (AG, 2018b & AG, 2018c);
- Provide advice on whether the site would be suitable (in the context of land contamination) for the proposed land use setting;

- Provide recommendations for further investigation, management and/or remediation (if warranted).

1.3. Scope of Work

AG undertook the following scope of works to address the project objectives:

- A desktop review of the previous investigation reports and other relevant information relating to the site;
- A site walkover to understand current site conditions;
- Conducted an intrusive site investigation using both excavators and ute-mounted drill rig to assess subsurface ground conditions and to facilitate the collection of representative soil samples;
- Laboratory analysis to compliment the in-situ testing completed during the field investigation; and
- Data assessment and report preparation.

A **Supplementary Contamination Assessment** is required by the Secretary's Environmental Assessment Requirements (SEARs) for SSD 18_9343. This table identifies the SEARs and relevant reference within this report.

Table 1.1 – SEARs and Relevant Reference

SEARs Item	Report Reference
<u>13 Contamination</u> Assess and quantify any soil and groundwater contamination and demonstrate that the site is suitable for the proposed use in accordance with SEPP 55.	Whole Report

2. SITE IDENTIFICATION

The site is registered with NSW Land and Property Information as a portion of Portion of Lot 1 in DP837179 (Lot 10 in DP1232584).

A registered Lot survey plan of acquisition drawing provided by the client indicates the site is Lot 10 in DP1232584 being part of Lot 1 in DP837179.

The Section 10.7 (formally Section 149) planning certificate for the site (refer Alliance Geotechnical (2018a)) refers to the site as being Lot 10 in DP1232584, with a street address of 2 Rhodes Street, Meadowbank, NSW.

For the purpose of this investigation, the site will be defined as Lot 10 in DP1232584 being part of Lot 1 in DP837179.

The approximate geographic coordinates of the middle of the site, inferred from Google Earth were 33°48'46" S and 151°05'27" E.

The locality of the site is set out in **Figure 1**.

The general layout of the site is set out in **Figure 2**.

The site covers an area of 3.329 hectares (by Lot survey plan).

A copy of a detail and level survey and the Lot plan survey is presented in **Appendix A**.

3. SITE CONDITIONS AND SURROUNDING ENVIRONMENT

3.1. Geology

A review of the Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1) 1983, indicated that the site is underlain by Middle Triassic Hawkesbury Sandstone, which is comprised of medium to coarse grained quartz sandstone, very minor shale and laminite lenses. A portion of the eastern boundary of the site is in close proximity to Ashfield Shale, which is comprised of black to dark grey shale and laminite.

3.2. Acid Sulfate Soils

A review of the Prospect Parramatta Acid Sulfate Soil Risk Map (1:25,000 scale) indicates that the site is in a map class description of **“No Known Occurrence”**. Land management activities are not likely to be affected by acid sulfate soil materials.

3.3. Topography

The site topography was generally undulating, with overall slopes generally towards the south and south west, and some localised slopes in the northern portion, towards the east.

The detail and level survey presented in **Appendix A** provides further information on surface contours and elevations.

3.4. Hydrogeology

Surface water courses proximal to the site included:

- Parramatta River located approximately 400m to the south of the site.

Based on distances to the nearest surface water course and the site topography, groundwater flow in the vicinity of the site is considered likely to be towards the south.

A review of the NSW Office of Water groundwater database ([www.http://allwaterdata.water.nsw.gov.au/water](http://allwaterdata.water.nsw.gov.au/water)) indicated there are three (3) registered groundwater features located within a 500m radius of the site (GW1048997, GW1048998, and GW1048999):

- GW1048997 with an authorised purpose for “monitoring bore”. The water bearing zone for the feature was at 2.4m and the standing water level in that bore was measured at 2.32m.
- GW1048998 with an authorised purpose for “monitoring bore”. The water bearing zone for the feature was at 2.1m and the standing water level in that bore was measured at 2.5m.
- GW1048999 with an authorised purpose for “monitoring bore”. The water bearing zone for the feature was at 2.4m and the standing water level in that bore was measured at 2.32m.

Each of the three features were located to the west of the site, considered to be in an inferred down or cross gradient location, relative to the site.

4. PREVIOUS CONTAMINATION ASSESSMENTS

The following reports were considered during the undertaking of this project:

- AG 2018a, '*Stage 1 Preliminary Site Investigation, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW*', dated June 2019, ref: 6179-ER-1-1 REV5;
- AG 2018b, '*Stage 2 Detailed Site Investigation, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW*', dated June 2019, ref: 6179-ER-1-2 REV6;
- AG 2018c, '*Remedial Action Plan, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW*', dated 12 June 2019, ref: 6179-ER-1-3 REV5.

A summary of these reports is presented in **Section 4.1 to 4.3**.

4.1. Alliance Geotechnical (2018a)

Alliance Geotechnical Pty Ltd (AG) was engaged by Woods Bagot in 2017, to conduct a Stage 1 – Preliminary Site Investigation (PSI) for a portion of the Meadowbank Education and Employment Precinct Schools Project site at 2 Rhodes Street, Meadowbank, NSW (the site).

For this investigation, AG had the following project appreciation:

- TAFE and NSW Department of Education are in negotiations for the sale/purchase of the site;
- the site is being considered for redevelopment, comprising a primary school and secondary school; and
- contamination assessment works are required to inform the property transaction process and master planning process.

The objectives of this investigation were to:

- assess the potential for contamination to be present on the site as a result of past and current land use activities;
- provide advice on whether the site would be suitable (in the context of land contamination) for a primary school and secondary school land use setting; and
- provide recommendations for further investigation, management and/or remediation (if warranted).

The scope of works undertaken to address the investigation objectives, included:

- a desktop review;
- a site walkover; and
- data assessment and reporting.

Alliance Geotechnical (2018a) reported that the predominant historical land title holdings for the site included the Metropolitan Water Sewerage and Drainage Board, and the Meadowbank Manufacturing Company.

The site history data collected and site walkover observations made were assessed within the objectives of the investigation and in the context of the proposed development works. That assessment identified areas of environmental concern (AEC) and contaminants of potential concern (COPC) which have the potential to be present onsite.

Based on AG's assessment of the desktop review and site walkover data, in the context of the proposed development scenario, AG concluded that:

- there is a moderate potential for land contamination to be present on the site, as a result of past and current land use activities; and
- further investigation would be required to make an assessment of the suitability of the site, for a primary school and secondary school land use setting.

Based on these conclusions, AG made the following recommendations:

- A Stage 2 – Detailed Site Investigation (DSI) should be undertaken for the site. AG notes that, if a Stage 2 – DSI is undertaken while the site remains operational and/or while existing buildings and infrastructure remain on the site, there will likely be constraints limiting further assessment of some areas of the site, which may increase uncertainty around the contamination status of the site; and
- The Stage 2 – DSI should be undertaken by a suitably experienced environmental consultant.

4.2. Alliance Geotechnical (2018b)

Alliance Geotechnical Pty Ltd (AG) was engaged by Woods Bagot (the client), to conduct a Stage 2 – Detailed Site Investigation (DSI) for a portion of the Meadowbank Education and Employment Precinct Schools Project site at 2 Rhodes Street, Meadowbank, NSW (the site).

For this investigation, AG had the following project appreciation:

- TAFE and NSW Department of Education are in negotiations for the sale/purchase of the site;
- The site is being considered for redevelopment, comprising a primary school and secondary school; and
- contamination assessment works are required to inform the property transaction process and master planning process.

The objectives of this investigation were to:

- assess the nature and likely extent of identified contaminants of potential concern (COPC) in the identified areas of environmental concern;
- provide advice on whether the identified COPC present an unacceptable human health exposure risk (in the context of land contamination) for the proposed land use setting; and
- provide recommendations for further investigation, management and/or remediation (if warranted).

The scope of works undertaken to address the investigation objectives, included:

- a desktop review;
- intrusive drilling and soil sampling fieldwork;
- laboratory analysis; and

- data assessment and reporting.

The site history data collected and site walkover observations made were assessed within the objectives of this investigation and in the context of the proposed development works. That assessment identified areas of environmental concern (AEC) and contaminants of potential concern (COPC) which have the potential to be present on site. The identified AEC and associated COPC are presented in **Table 4.2**.

Table 4.2 AEC and COPC

ID	AEC	Land Use Activity	Contaminants of Potential Concern
AEC01	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC02	Block Y1	Boat building and chemical storage / handling	Hydrocarbons and metals
AEC03	Block Y6	Boat building and chemical storage / handling	Hydrocarbons and metals
AEC04	Former dwelling	Uncontrolled demolition	Metals and asbestos
AEC05	Former dwelling	Uncontrolled demolition	Metals and asbestos
AEC06	Open space	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC07	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC08	Former building	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC09	Former dwelling	Uncontrolled demolition	Metals and asbestos
AEC10	Former greenhouse	Pesticide storage / handling	Pesticides and metals
AEC11	Multipurpose courts	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos

ID	AEC	Land Use Activity	Contaminants of Potential Concern
AEC12	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC13	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC14	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos.
AEC15	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC16	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC17	Carpark and grassed area	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC18	Small embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC19	Embankment next to path	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
-	General site footprint	Potential uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos

Soil sampling was undertaken by AG on 13 and 14 January 2018. A total of 44 sampling points (BH01 to BH41 and SS01 to SS03) were established on site. Sampling points BH01 to BH41 were excavated using a track mounted drilling rig fitted with push tube and solid flight augers, or a hand auger where access was limited. Soil samples at SS01 to SS03 were collected as grab samples from the surface.

Based on AG's assessment of the desktop review information, fieldwork data and laboratory analytical data, in the context of the proposed redevelopment scenario, AG made the following conclusions:

- the concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable direct contact human health exposure risk, with the exception of:

- lead in soil at BH02 (560mg/kg), lead in soil at BH22 (490mg/kg) and lead in soil at BH24 (610mg/kg);
- benzo(a)pyrene (TEQ) in soil at BH04 (8.5mg/kg), BH16 (18mg/kg), and BH23 (8.4mg/kg); and
- asbestos in soils in the vicinity of sampling points BH07, SS02, SS03, BH30, BH40 and BH41;
- the concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable inhalation / vapour intrusion human health exposure risk;
- the concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present a petroleum hydrocarbon management limit risk;
- the asbestos detected in the soils assessed, may present an unacceptable human health exposure risk and unacceptable aesthetics risk;
- the site could be made suitable for the proposed land use setting, subject to the further assessment, management and/or remediation of potential unacceptable contamination risks and those areas unable to be assessed.

Based on these conclusions, AG made the following recommendations:

- a Supplementary Contamination Assessment should be undertaken by a suitably experienced environmental consultant to:
 - further characterise the nature and extent of the elevated concentrations of lead in soil risks and benzo(a)pyrene (TEQ) in soil risks;
 - further characterise the nature and extent of asbestos in soil risks, and provide a quantitative assessment of those risks;
 - address data gaps associated with AEC13, the southern portion of AEC10, and the central portions of AEC02, AEC03, AEC09, AEC12, AEC14, AEC15, AEC16 (constrained due to the presence of existing structures and/or accessibility constraints);
- consideration should be given to removal of existing structure and accessibility constraints, prior to undertaking the supplementary contamination assessment. Removal of access constraints would likely also require provision for significant surface and pavement disturbance across the site to facilitate quantitative asbestos in soil risk assessment;
- pending the findings of the supplementary contamination assessment, a remedial action plan should be prepared to address unacceptable soil contamination related human health exposure risks. The RAP should be prepared by a suitably experience consultant with reference to NSW OEH (2011) and include (but not be limited to) the following:
 - a remedial goal for the site;
 - an assessment of remedial options available to address the identified asbestos risks. These options may include removal offsite, in-situ containment, ex-situ containment, or a combination of these:
 - Offsite removal would likely involve excavation and disposal of impacted materials. Subject to successful removal of all impacted material, it is unlikely that a long term operational environmental management plan (EMP) would be required for the proposed development site;
 - In-situ containment could include application of a capping layer across the site. Typically, concrete and/or asphalt pavements are adequate for non-exposed soils, while a minimum 0.5m thickness of clean fill (excluding planting media) would be

required in unsealed areas (e.g. playgrounds, soft landscaping etc). Depending on design levels for the development, a portion of the impacted soils may require removal offsite to allow for capping layer thicknesses. This remedial strategy would likely require a long-term environmental management plan (EMP) for the proposed development site, and notification on the Section 10.7 (formally Section 149) planning certificate and/or title for the site;

- Ex-situ containment could include excavation and relocation of a portion of the impacted material elsewhere on the site, and application of a capping layer (similar to that discussed for in-situ containment). This remedial strategy would likely require a long term operational environmental management plan (EMP) for the proposed development site, and notification on the Section 10.7 (formally Section 149) planning certificate and/or title for the site;
- the proposed testing to validate the site after remediation;
- the proposed testing to validate the site after remediation;
- a contingency plan to address unexpected finds or if the selected remedial strategy fails; and
- a site management plan (for the remediation works).

4.3. Alliance Geotechnical (2018c)

Alliance Geotechnical Pty Ltd (AG) was engaged by Woods Bagot, to prepare a Remedial Action Plan (RAP) for the site.

AG had the following project appreciation:

- The site is being considered for redevelopment, comprising a primary school and secondary school;
- A Stage 1 Preliminary Site Investigation (PSI) and Stage 2 Detailed Site Investigation (DSI) of the site were reported by AG in February 2018;
- The Stage 2 DSI were considered adequate in providing a reasonable characterisation of land contamination at the site, in those areas that were accessible at the time the Stage 2 DSI works were undertaken;
- It is not considered reasonable (nor would it be considered to be industry accepted practice) to assume that the condition of the land in areas that were inaccessible, would be the same as the land nearby which may have been investigated as part of the Stage 2 DSI;
- It is considered impractical to assess the condition of the land in those inaccessible areas, prior to demolition and removal of access constraints on site (including buildings and hardstand materials), as those constraints would prevent implementation of industry accepted investigation techniques required to address relevant data gaps identified in the Stage 2 DSI;
- A Remedial Action Plan (RAP) is required to provide a strategy for addressing contamination already identified at the site, as well as a strategy for addressing contamination related data gaps identified in the Stage 2 DSI. AG considers this is an industry accepted approach to managing sites where further contamination assessment works may be constrained by site accessibility, and that development consent for a site would incorporate a condition requiring implementation of all strategies in the RAP (including any supplementary contamination assessment works necessary);
- The RAP is required to include remedial strategies for contamination identified to date (by way of the previously reported Stage 2 DSI), and remedial strategies for unexpected finds

(which may be identified by supplementary contamination assessment works and/or during planned remedial works);

- A supplementary RAP would not be needed following supplementary contamination assessment works. Rather, an addendum to the existing RAP would be produced (if needed), to further refine the extent of remedial works required in those areas already nominated for remedial works, as well as confirm the extent of remedial works (if any) in areas which might be identified during supplementary contamination assessment works; and
- The RAP should address the need for, and structure of, an addendum to the RAP.

The objectives of this project were to prepare a remedial action plan to address:

- Investigation of areas of environmental concern identified in the previous AG contamination assessments, that have not yet been investigated;
- Supplementary investigation of those areas of environmental concern identified in the previous AG contamination assessments, where additional investigation is required to characterise those AEC; and
- Management and/or remediation of already identified unacceptable land contamination risks.

AG notes that, subsequent to the findings of the supplementary contamination assessment works being undertaken, an addendum to this RAP may be required to address newly identified unacceptable land contamination risks.

AG undertook the following scope of works to address the project objectives:

- A desktop review; and
- Reporting.

The site history data collected was assessed within the objectives of this project and in the context of the proposed development works. That assessment identified the following areas of environmental concern (AEC) and contaminants of potential concern (COPC) which either require assessment, further assessment, and/or remediation. The AEC identified and associated COPC are presented in the table below.

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC01	Previous sampling point BH02	Uncontrolled filling	Lead
AEC02 (central portion)	Block Y1	Boat building and chemical storage / handling	Hydrocarbons and metals
AEC02	Previous sampling point BH04	Boat building and chemical storage / handling	Benzo(a)pyrene (TEQ)
AEC03 (central portion)	Block Y6	Boat building and chemical storage / handling	Hydrocarbons and metals

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC05	Previous sampling point BH07	Uncontrolled demolition	Asbestos
AEC09 (central portion)	Former dwelling	Uncontrolled demolition	Metals and asbestos
AEC10 (southern portion)	Former greenhouse	Pesticide storage / handling	Pesticides and metals
AEC11	Previous sampling point BH16	Manufacturing and demolition	Benzo(a)pyrene (TEQ)
AEC12 (central portion)	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC13	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC14 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos.
AEC14 (BH22)	Previous sampling point BH22	Manufacturing and demolition	Lead
AEC15 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC15	Previous sampling point BH23	Manufacturing and demolition	Benzo(a)pyrene (TEQ)
AEC15	Previous sampling point BH24	Manufacturing and demolition	Lead
AEC16 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC18	Previous sampling point SS03	Uncontrolled filling	Asbestos
AEC19	Previous sampling point BH30	Uncontrolled filling	Asbestos

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
-	Previous sampling point SS02	Potential uncontrolled filling	Asbestos
-	Previous sampling point BH40	Potential uncontrolled filling	Asbestos
-	Previous sampling point BH41	Potential uncontrolled filling	Asbestos

The remedial goal for this site is to remediate potential soil contamination (where identified) to a level that does not present an unacceptable human health exposure risk, based on the proposed land use setting. AG notes that the client would prefer that the remedial works be undertaken in a manner that does not result in the need for:

- Notation on a planning certificate for the site;
- A covenant registered on the title to the land; or
- A long-term environmental management plan (EMP).

The lateral extent of remediation on the site is considered to be, as a minimum, the following:

- lead impacted soils in the vicinity of BH02;
- benzo(a)pyrene TEQ impacted soils in the vicinity of BH04;
- asbestos impacted soils in the vicinity of BH07;
- benzo(a)pyrene TEQ impacted soils in the vicinity of BH16;
- lead impacted soils in the vicinity of BH22;
- benzo(a)pyrene TEQ impacted soils in the vicinity of BH23;
- lead impacted soils in the vicinity of BH24;
- asbestos impacted soils in the vicinity of SS03;
- asbestos impacted soils in the vicinity of SS02;
- asbestos impacted soils in the vicinity of BH40; and
- asbestos impacted soils in the vicinity of BH41.

It is noted that the extent of remediation may be altered, pending the outcomes of the supplementary contamination assessment works, still needing to be undertaken on the site. The nature and extent of supplementary assessment works is set out in this RAP.

Based on the extent of the remediation identified, and the proposed site redevelopment works, remedial options considered appropriate for this site include:

- In-situ containment by capping;
- Ex-situ containment by capping;
- Excavation and removal off site.

Taking into consideration the client's objectives for the site, and the nature and extent of the proposed site redevelopment works, the preferred remedial option for the site is:

- excavation and offsite disposal.

Based on the information presented in the historical contamination assessment reports, AG made the following conclusions:

- Implementation of the strategies, methodologies and measures set out in this remedial action plan would:
 - provide information to address previously identified data gaps for the site;
 - facilitate further characterisation of previously identified potentially unacceptable land contamination risks;
 - facilitate management and/or remediation of potentially unacceptable land contamination risks;
- should newly identified unacceptable land contamination risks be identified during supplementary assessment works, an addendum to this RAP may be required. The addendum should be prepared by a suitably experienced environmental consultant;
- Prior to any removal of soils from site for offsite disposal during remedial works, a waste classification for those soils should be prepared by a suitably experienced environmental consultant;
- Future remedial works should be monitored and validated by a suitably experienced environmental consultant.

5. CONCEPTUAL SITE MODEL

The site history data collected was assessed within the objectives of this project and in the context of the proposed development works. That assessment identified the following areas of environmental concern (AEC) and contaminants of potential concern (COPC) which either require assessment, further assessment, and/or remediation. The AECs identified are presented in attached **Figure 3** and associated COPC are presented in **Table 5.1**.

Table 5.1: AEC and COPC

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC01	Previous sampling point BH02	Uncontrolled filling	Lead
AEC02 (central portion)	Block Y1	Boat building and chemical storage / handling	Hydrocarbons and metals
AEC02	Previous sampling point BH04	Boat building and chemical storage / handling	Benzo(a)pyrene (TEQ)
AEC03 (central portion)	Block Y6	Boat building and chemical storage / handling	Hydrocarbons and metals
AEC05	Previous sampling point BH07	Uncontrolled demolition	Asbestos
AEC09 (central portion)	Former dwelling	Uncontrolled demolition	Metals and asbestos
AEC10 (southern portion)	Former greenhouse	Pesticide storage / handling	Pesticides and metals
AEC11	Previous sampling point BH16	Manufacturing and demolition	Benzo(a)pyrene (TEQ)
AEC12 (central portion)	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC13	Embankment	Uncontrolled filling	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC14 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos.
AEC14 (BH22)	Previous sampling point BH22	Manufacturing and demolition	Lead
AEC15 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC15	Previous sampling point BH23	Manufacturing and demolition	Benzo(a)pyrene (TEQ)
AEC15	Previous sampling point BH24	Manufacturing and demolition	Lead
AEC16 (central portion)	Former industrial building	Manufacturing and demolition	Hydrocarbons, pesticides, polychlorinated biphenyl, metals, asbestos
AEC18	Previous sampling point SS03	Uncontrolled filling	Asbestos
AEC19	Previous sampling point BH30	Uncontrolled filling	Asbestos
-	Previous sampling point SS02	Potential uncontrolled filling	Asbestos
-	Previous sampling point BH40	Potential uncontrolled filling	Asbestos
-	Previous sampling point BH41	Potential uncontrolled filling	Asbestos

5.1. Land Use Setting

AG understands that the proposed development works includes the demolition of historical site structures and construction of a combined primary-high school and associated infrastructure.

Based on the proposed development works and guidance provided in Section 2.2 of NEPC (1999a), AG considers it reasonable to adopt the 'HIL A – residential with accessible soils' land use setting, for the purpose of assessing land contamination exposure risks.

5.2. Direct Contact – Human Health

Portions of the site will be covered with building footprints and hardstand areas; however, some exposed soil areas will likely remain, in the form of playground areas, sporting fields, and general softscape. It is considered that a complete direct contact exposure pathway for may exist in these areas.

5.3. Inhalation / Vapour Intrusion – Human Health

In order for a potentially unacceptable inhalation / vapour intrusion human health exposure risk to exist, a primary vapour source (e.g. underground storage tank) or secondary vapour source (e.g. significantly contaminated soil or groundwater) is required.

The historical evidence reviewed did not indicate a potential for a primary source to be present on the site.

The same historical evidence indicated a potential land use activity to be uncontrolled filling. The excavation, transport, placement and spreading of imported (uncontrolled) fill material involves significant disturbance of soils which typically results in volatilisation of vapour producing contaminants.

A groundwater source of vapours was not identified for the site.

The potential for vapours to be present in soils on site at concentrations which might present an unacceptable exposure risk, is considered to be low to negligible, however, further assessment is considered warranted, given the sensitive nature of the proposed land use setting.

5.4. Management Limits for Petroleum Hydrocarbon Compounds

NEPC (1999a) notes that there are a number of policy considerations which reflect the nature and properties of petroleum hydrocarbons:

- formation of observable light non-aqueous phase liquids (LNAPL);
- fire and explosive hazards; and
- effects on buried infrastructure (e.g. penetration of or damage to, in-ground services by hydrocarbons).

NEPC (1999a) includes ‘management limits’ to avoid or minimise these potential effects. Application of the management limits requires consideration of site-specific factors such as the depth of building basements and services and depth to groundwater, to determine the maximum depth to which the limits should apply. NEPC (1999a) also notes that management limits may have less relevance at operating industrial sites which have no or limited sensitive receptors in the area of potential impact, and when management limits are exceeded, further site-specific assessment and management may enable any identified risk to be addressed.

Given the nature of the identified contaminants of potential concern at the site, further assessment against these management limits is considered warranted.

5.5. Aesthetics – Human Health

Section 3.6.3 of NEPC (1999a) advises that there are no specific numeric aesthetic guidelines, however site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

Portions of the site will be covered with building footprints and hardstand areas, however, some exposed soil areas will likely remain, in the form of playground areas, sporting fields, and general softscape. It is considered that a complete aesthetics exposure pathway for may exist in these areas.

5.6. Terrestrial Ecosystems

NEPC (1999) requires a pragmatic risk-based approach should be taken in applying ecological investigation and screening levels in residential and commercial / industrial land use settings.

It is noted that vegetation on site and on adjacent properties did not display evidence of significant or widespread phytotoxic impact (i.e. plant stress or dieback).

Further assessment of unacceptable risk to terrestrial ecosystems is considered not warranted.

6. DATA QUALITY OBJECTIVES

Appendix B of NEPC (1999b) provides guidance on the development of data quality objectives (DQO) using a seven-step process.

The DQO for this project are set out in **Sections 6.1 to 6.7** of this report.

6.1. Step 1: State the problem

The first step involves summarising the contamination problem that will require new data and identifying the resources available to resolve the problem.

The key objectives of this project are to assess the data gaps and delineate the identified contamination presented in (AG, 2018b & AG, 2018c) and provide recommendations for further investigation, management and/or remediation (if warranted) in accordance with the proposed land use setting.

This project is being undertaken because:

- the site is the subject of redevelopment works; and
- historically identified areas of environmental concern on the site, have the potential to present an unacceptable human health exposure risk in the context of the proposed land use setting.

The project team identified for this project includes Alliance Geotechnical Pty Ltd, the developer and the planning consent authority.

The regulatory authorities identified for this investigation include NSW EPA and the local Council.

6.2. Step 2: Identify the decision/goal of the study

The second step involves identifying decisions that need to be made about the contamination problem and the new environmental data required to make them.

The decisions that need to be made during this investigation include:

- Is the environmental data collected for the project, suitable for assessing relevant land contamination exposure risks?
- Have the data gaps presented in (AG, 2018b) been addressed;
- Has the contamination identified in (AG2018b & AG, 2018c) been delineated;
- Do the concentrations of identified contaminants of potential concern (COPC) present an unacceptable exposure risk to identified receptors, for the proposed land use setting?
- Is the site suitable or can the site be deemed suitable for the proposed land use setting, in the context of land contamination?

6.3. Step 3: Identify the information inputs

The third step involves identifying the information needed to support decisions and whether new environmental data will be needed.

The inputs required to make the decisions set out in **Section 6.2** for this investigation, will include:

- data obtained during searches of the site's history;
- the nature and extent of sampling at the site, including both density and distribution;
- samples of relevant site media;
- the NATA accredited analysis of physical and/or chemical parameters of the relevant site media samples; and
- assessment criteria adopted for each of the media sampled.

Taking into consideration the objectives of this project, and the conceptual site model and land use setting presented in **Section** Error! Reference source not found. of this project, the assessment criteria relevant to the proposed land use setting have been adopted for this investigation:

- Human health direct contact – HILs in Table 1A (1) in NEPC (1999a) and HSLs in Table B4 of Friebel, E & Nadebaum, P (2011);
- Human health inhalation/vapour intrusion – HSLs in Table 1 (A) in NEPC (1999a);
- Human health (asbestos) – HSLs in Table 7 of NEPC (1999a);
- Petroleum hydrocarbon compounds (management limits) – Table 1 B(7) of NEPC (1999a); and
- Aesthetics – no highly malodorous site media (e.g. strong residual petroleum hydrocarbon odours, hydrogen sulphide in site media, organosulfur compounds), no hydrocarbon sheen on surface water, no discoloured chemical deposits or soil staining with chemical waste other than of a very minor nature, no large monolithic deposits of otherwise low risk material (e.g. gypsum as powder or plasterboard, cement kiln dust), no presence of putrescible refuse including material that may generate hazardous levels of methane such as a deep-fill profile of green waste or large quantities of timber waste, and no soils containing residue from animal burial (e.g. former abattoir sites).

6.4. Step 4: Define the boundaries of the study

The fourth step involves specifying the spatial and temporal aspects of the environmental media that the data must represent to support decisions.

The spatial extent of the project will be limited to the site as defined by its boundaries.

The temporal boundaries of the project include:

- the project timeframes presented in the AG proposal for this project, and subsequent remediation contractor works program;
- unacceptable weather conditions at the time of undertaking fieldwork, including rainfall, cold and/or heat;
- access availability of the site (to be defined by the site owner/representative); and
- availability of AG field staff (typically normal daylight working hours, Monday to Friday).

The lateral extent that contamination is expected to be distributed across, based on the conceptual site model, is defined by the inferred boundaries of the areas of environmental concern (AEC).

The vertical extent that contamination is expected to be distributed across, based on the conceptual site model and the project scope, is limited to base of fill material.

The scale of the decisions required will be based on the entire site.

Constraints which may affect the carrying out of this investigation may include access limitations, presence of above and below ground infrastructure, and hazards creating health and safety risks.

6.5. Step 5: Develop the analytical approach (or decision rule)

The fifth step involves defining the parameter of interest, specifying the action level, and integrating information from Steps 1 to 4 into a single statement that gives a logical basis for choosing between alternative actions.

6.5.1. Rinsate Blanks

One rinsate blank will be collected and scheduled for analysis, for each day of sampling undertaken, if non-disposable sampling equipment was used on that day. The rinsate blank will be analysed for at least one of the analytes the sample/s collected that day are being scheduled for analysis for (with the exception of asbestos).

6.5.2. Trip Spikes and Trip Blank Samples

One trip spike and trip blank sample will be used and scheduled for analysis, for each day of sampling undertaken, if site samples being collected that day are being analysed for volatile contaminants of concern (typically BTEX and/or TRH C₆-C₁₀).

6.5.3. Field Duplicates and Field Triplicates

Field duplicate and Field triplicates will be collected at a rate of one per twenty (5%) site samples collected. The duplicates and triplicates collected will be analysed for at least one of the analytes that the parent sample of the duplicate/triplicate is being scheduled for analysis for (with the exception of asbestos).

The relevant percent difference (RPD) of concentrations of relevant analytes, between the parent sample and the duplicate/triplicate will be calculated.

6.5.4. Laboratory Analysis Quality Assurance / Quality Control

The analytical laboratory QA/QC program will typically include laboratory method blank samples, matrix spike samples, surrogate spike samples, laboratory control samples, and laboratory duplicate samples.

6.5.5. If/Then Decision Rules

AG has adopted the following 'if/then' decision rules for this investigation:

- If the result of the assessment of field data and laboratory analytical data is considered acceptable, then that field data and laboratory analytical data is suitable for interpretation within the scope of this investigation; and
- If the field data and laboratory analytical data is within the constraints of the assessment criteria adopted for this investigation (refer **Section 6.3**), then the contamination exposure risks to identified receptors, are considered acceptable.

In the event the assessment of field data and/or laboratory analytical data results in the data being not suitable for interpretation, then AG will determine if additional data is required to allow interpretation to be undertaken.

In the event that field data and/or laboratory analytical data exceeds the assessment criteria adopted for this investigation (refer **Section 6.3**), AG will undertake an assessment of the exceedance in the

context of the project objectives to determine if additional data is required and whether management and/or remediation is required.

6.6. Step 6: Specify the performance or acceptance criteria

The sixth step involves specifying the decision maker’s acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data. When assessing contaminated land, there are generally two types of errors in decision making:

- Contamination exposure risks for a specific land use setting are acceptable, when they are not; and
- Contamination exposure risks for a specific land use setting are not acceptable, when they are.

AG will mitigate the risk of decision error by:

- Calculation of the 95% upper confidence limit (UCL) statistic to assess the mean concentration of relevant contaminants of potential concern;
- Assignment of fieldwork tasks to suitably experienced AG consulting staff, and suitably experienced contractors;
- Assignment of laboratory analytical tasks to reputable NATA accredited laboratories;
- Assignment of data interpretation tasks to suitably experienced AG consulting staff, and outsourcing to technical experts where required.

AG will also adopt a range of data quality indicators (DQI) to facilitate assessment of the completeness, comparability, representativeness, precision and accuracy (bias).

Completeness			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Critical locations sampled	Refer Section 6.7	Critical samples analysed according to DQO	Refer Section 6.7
Critical samples collected	Refer Section 6.7	Analytes analysed according to DQO	Refer Section 6.7
SOPs appropriate and complied with	100%	Appropriate laboratory analytical methods and LORs	Refer Section 6.7
Field documentation complete	All sampling point logs, calibration logs and chain of custody forms	Sample documentation complete	All sample receipt advices, all certificates of analysis
		Sample extraction and holding times complied with	Refer Section 6.7
Comparability			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion

Same SOPs used on each occasion	100%	Same analytical methods used by primary laboratory	Refer Section 6.7
Climatic conditions	Samples stored in insulated containers with ice, immediately after collection	Same LORs at primary laboratory	Refer Section 6.7
Same types of samples collected, and handled/preserved in same manner	All soil samples same size, all stored in insulated containers with ice	Same laboratory for primary sample analysis	All primary samples to SGS Environmental
		Same analytical measurement units	Refer Section 6.7
Representativeness			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Appropriate media sampled according to SAQP	Refer Section 6.4	Samples analysed according to SAQP	Refer Section 6.7
Media identified in SAQP sampled	Refer Section 6.4		
Precision			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Field duplicate / triplicate RPD	Minimum 5% duplicates and triplicates No limit for analytical results <10 times LOR 50% for analytical results 10-20 times LOR 30% for analytical results >20 times LOR	Laboratory duplicates	No exceedances of laboratory acceptance criteria
SOPs appropriate and complied with	100%		
Accuracy (bias)			
Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Rinsate blanks	Less than laboratory limit of reporting	Laboratory method blank	No exceedances of laboratory acceptance criteria

Field trip spikes	Recoveries between 60% and 140%	Matrix spike recovery	No exceedances of laboratory acceptance criteria
Field trip blanks	Analyte concentration <LOR	Surrogate spike recovery	No exceedances of laboratory acceptance criteria
		Laboratory control sample recovery	No exceedances of laboratory acceptance criteria

6.7. Step 7: Develop the plan for obtaining data

The seventh step involves identifying the most resource effective sampling and analysis design for generating the data that is required to satisfy the DQOs.

6.7.1. Sampling Point Layout Plan

Table A in NSW EPA (1995) provides guidance on minimum sampling point densities required for site characterisation, based on detecting circular hot spots by using a systematic sampling pattern. This guidance assumes the investigator has little knowledge about the probable locations of the contamination, the distribution of the contamination is expected to be random (e.g. land fill sites) or the distribution of the contamination is expected to be fairly homogenous (e.g. agricultural lands).

However, Section 3.1 of NSW EPA (1995) states that a judgemental sampling pattern can be used where there is enough information on the probable locations of contamination. Further to this, Section 6.2.1 of NEPC (1999b) states that the number and location of sampling points is based on knowledge of the site and professional judgement. Sampling should be localised to known or potentially contaminated areas identified from knowledge of the site either from site history or an earlier phase of site investigation. Judgemental sampling can be used to investigate sub-surface contamination issues in site assessment.

As this investigation has included gathering data which provides a reasonable understanding of site history (in the context of potential areas of environmental concern on the site) and taking into consideration Table 1 in WA DOH (2009), it is considered reasonable to adopt a judgemental sampling pattern, where necessary, for each AEC.

The proposed sampling point layout arrangement for this project is presented in **Table 6.7.1**. The locations of the proposed sampling points are set out in **Figure 4**.

Table 6.7.1 Validation Sampling

Area of Environmental Concern	Sampling Point ID	Validation Sampling
AEC01	BH02A-BH02D	Four step-out soil bores around sampling point BH02 to a target depth of 0.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC02 (central portion)	TP42-TP43	Two test-pits to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.

Area of Environmental Concern	Sampling Point ID	Validation Sampling
AEC02	TP04A-TP04D	Four step out test-pits to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC03 (central portion)	TP44	One test-pit to a target depth of 1.7m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC05	TP07A – TP07D	Four step out test-pits to a target depth of 0.6m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC09 (central portion)	TP45	One test-pit to a target depth of 0.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC10 (southern portion)	TP46	One test-pit to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC11	TP16A – TP16D	Four step out test-pits to a target depth of 2.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC12 (central portion)	TP47	One test-pit to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC13	TP49 – TP54	Six test-pits to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC14 (central portion)	TP55	One test-pit to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC14	TP22A-TP22D	Four step out test-pits to a target depth of 1.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC15 (central portion)	TP56	One test-pit to a target depth of 0.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC15	TP23A-TP23D	Four step out test-pits to a target depth of 0.5m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.

Area of Environmental Concern	Sampling Point ID	Validation Sampling
AEC15	TP24A-TP24D	Four step out test-pits to a target depth of 0.6m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC16 (central portion)	TP57	One test-pit to a target depth of 1.0, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC18	SS03A-SS03C	Four step out test-pits to a target depth of 1.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
AEC19	TP30A-TP30D	Three test-pits to a target depth of 2.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
-	SS02A-SS02D	Four step out test-pits to a target depth of 1.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
-	BH40A-BH40D	Four step out test-pits to a target depth of 2.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.
-	BH41A-BH41D	Four step out test-pits to a target depth of 2.0m, or 0.3m into inferred natural material, or practical refusal, whichever occurs first.

If visual or olfactory observations indicated a potential for soil contamination to be present, then collection of additional samples will be considered.

The location of each sampling point will be marked on a site plan.

6.7.2. Identification, Storage and Handling of Samples

Sample identifiers will be used for each sample collected, based on the sampling point number and the depth/interval the sample was collected from, e.g. a sample collected from test pit TP03 at a depth of 0.2m to 0.4m below ground level, would be identified as TP03/0.2-0.4.

Project samples will be stored in laboratory prepared glass jars (chemical) and zip lock bags (asbestos).

Soil samples in glass jars will be placed in insulated container/s with ice.

Samples will be transported to the relevant analytical laboratory, with chain of custody (COC) documentation that includes the following information:

AG project identification number

- Each sample identifier
- Date each sample was collected
- Sample type (e.g. soil or water)

- Container type/s for each sample collected
- Preservation method used for each sample (e.g. ice)
- Analytical requirements for each sample and turnaround times
- Date and time of dispatch and receipt of samples (including signatures)

6.7.3. Headspace Screening

Where the contaminants of potential concern include volatiles (e.g. TRH, BTEX), project soil samples will be subjected to field screening for ionisable volatile organic compounds (VOC), using a photo-ionisation detector (PID). The results of field screening will be recorded on sampling point log.

6.7.4. Decontamination

In the event that non-disposable sampling equipment is used, that equipment will be decontaminated before and in between sampling events, to mitigate potential for cross contamination between samples collected. The decontamination methodology to be adopted for this project will include:

- Washing relevant sampling equipment using potable water with a phosphate free detergent (i.e. Decon 90 or similar) mixed into the water;
- Rinsing the washed non-disposable sampling equipment with distilled or de-ionised water; and
- Air drying as required.

6.7.5. Laboratory Selection

The analytical laboratories used for this project will be NATA accredited for the analysis undertaken.

6.7.6. Laboratory Analytical Schedule

Project samples will be scheduled for NATA accredited laboratory analysis, using a combination of:

- Observations made in the field of the media sampled;
- Headspace screening results (where available);
- The contaminants of potential concern (COPC) identified for the area of environmental concern that the sample was collected from.

Based on site history and completed contamination assessments (AG, 2018b), AG has adopted the laboratory analytical schedule presented in **Table 6.7.6** for this project.

Table 6.7.6 Laboratory Analytical Schedule

AEC	Sampling Point ID	Analytical Schedule
AEC01	BH02A-BH02D	8 x lead
AEC02 (central portion)	TP42-TP43	4 x TRH, BTEX and metals (8)
AEC02	TP04A-TP04D	8 x PAH
AEC03 (central portion)	TP44	2 x TRH, BTEX and metals (8)
AEC05	TP07A – TP07D	4 x asbestos (ACM and 0.001%)
AEC09 (central portion)	TP45	1 x Metals (8) and Asbestos (ACM and 0.001%)

AEC	Sampling Point ID	Analytical Schedule
AEC10 (southern portion)	TP46	2 x OCP and metals (8)
AEC11	TP16A – TP16D	8 x PAH
AEC12 (central portion)	TP47	1 x TRH, BTEX, PAH, OCP, PCB, metals (8) and asbestos (ACM and 0.001%)
AEC13	TP49 – TP54	6 x TRH, BTEX, PAH, OCP, PCB, metals (8) and asbestos (ACM and 0.001%)
AEC14 (central portion)	TP55	1 x TRH, BTEX, PAH, OCP, PCB, metals (8) and asbestos (ACM and 0.001%)
AEC14	TP22A-TP22D	8 x lead
AEC15 (central portion)	TP56	1 x TRH, BTEX, PAH, OCP, PCB, metals (8) and asbestos (ACM and 0.001%)
AEC15	TP23A-TP23D	8 x PAH
AEC15	TP24A-TP24D	8 x lead
AEC16 (central portion)	TP57	1 x TRH, BTEX, PAH, OCP, PCB, metals (8) and asbestos (ACM and 0.001%)
AEC18	SS03A-SS03C	3 x asbestos (ACM and 0.001%)
AEC19	TP30A-TP30D	6 x asbestos (ACM and 0.001%)
-	SS02A-SS02D	4 x asbestos (ACM and 0.001%)
-	BH40A-BH40D	8 x asbestos (ACM and 0.001%)
-	BH41A-BH41D	8 x asbestos (ACM and 0.001%)

6.7.7. Laboratory Holding Times, Analytical Methods and Limits of Reporting

The laboratory holding times, analytical methods and limits of reporting (LOR) being used for this project, are presented in **Table 6.7.7**.

Table 6.7.7 Laboratory Holding Times, Analytical Methods and Limits of Reporting

Analyte	Holding Time	Analytical Method	Limit of Reporting (mg/kg)
BTEX and TRH C ₆ -C ₁₀	14 days	USEPA 5030, 8260B and 8020	0.2-0.5
TRH >C ₁₀ -C ₄₀	14 days	USEPA 8015B & C	20-100

Analyte	Holding Time	Analytical Method	Limit of Reporting (mg/kg)
PAH	14 days	USEPA 8270	0.1-0.5
VOC	14 days	USEPA 8260	0.1-0.5
Metals	14 days	USEPA 8015B & C	0.05 – 2
Asbestos	No limit	AS4964:2004	Absence / presence
Asbestos	No limit	Inhouse Method	0.001% w/w

7. FIELDWORK

7.1. Soil Sampling

Soil sampling was undertaken by AG on 18, 19 and 20 June 2019.

A total of 61 sampling points were established onsite. Sampling points were established to address data gaps or to delineate contamination identified within previous contamination reports (AG, 2018b & AG, 2018c). Sampling points (BH02A to BH02D, BH40A to BH40B and BH41A to BH41D) were advanced using a utility mounted drill rig fitted with solid flight augers, or a hand-held mechanically operated push tube where access was limited. The remaining sampling points were excavated using an excavator and operator supplied by the client.

The locations of the sampling points established onsite are presented in **Figure 4**.

Image 7.1.1 View of sampling point BH40C



Samples were collected at each sampling point and placed in laboratory supplied acid-rinsed glass jars with Teflon lined lids (where required) and laboratory supplied 500ml zip-lock asbestos sample bags (where required). The jars and bags were labelled with the project number, sample identifier and date the samples were collected on.

Each sampling point was backfilled and track rolled at the completion of the sampling task.

Each sampling point established was marked on a site plan. The locations of these sampling points are presented in **Figure 4**.

7.2. Site Geology

Observations were made of soils encountered during sampling work. These observations were recorded on borehole logs. A copy of these logs is presented in **Appendix B**.

Anthropogenic materials observed in some of the fill material encountered included asphalt, metal, wood, glass, brick and potential ACM (in the form of fibrous cement sheeting fragments).

7.3. Headspace Screening

Samples collected were subjected to headspace screening. A sub sample from each sampling point was placed in a zip lock bag, sealed and shaken. Each bag was then pierced with the probe tip of a calibrated photoionisation detector (PID) and the screening results recorded. These results are recorded on the borehole logs presented in **Appendix B**.

The results of the headspace screening indicated the potential for ionisable volatile organic compounds (VOC) to be present in the samples, was generally low.

A copy of the calibration record for the PID is presented in **Appendix C**.

7.4. Odours

Olfactory evidence of odours in the soil samples collected, was not detected.

7.5. Staining

Visual evidence of staining in the soil samples collected, was not detected.

7.6. Potential Asbestos Containing Materials

Visual evidence of potential asbestos containing materials (ACM) was observed at several sampling points, including both on the surface and within the fill soil profile (TP04B, TP07A, TP30B, TP30C, TP40C and TP42). The evidence was in the form fibrous cement sheeting fragments. Samples of these fragments were collected when observed and submitted for analysis at a NATA accredited laboratory.

8. LABORATORY ANALYSIS

The samples collected were transported to the analytical laboratory, using chain of custody (COC) protocols. A selection of these samples was scheduled for analysis, with reference to the relevant COPC identified for the AEC that the samples were collected from.

A copy of the analytical laboratory certificates of analysis, is presented in **Appendix D**.

The sample analytical results were tabulated and presented in the attached **Table 1, Table 2 and Table 3**.

9. DATA QUALITY INDICATOR ASSESSMENT

9.1. Completeness

An assessment of the completeness of data collected was undertaken, and the results presented in **Table 9.1**.

Table 9.1 Completeness DQI

Field Considerations	Target	Actual	Comment
Critical locations sampled	61	61	Performance against indicator considered acceptable.
Critical samples collected	Refer Section 6.7	Refer Section 6.7	Performance against indicator considered acceptable.
SOPs appropriate and complied with	100%	100%	Performance against indicator considered acceptable.
Field documentation complete	All sampling point logs, calibration logs and chain of custody forms	All sampling point logs, calibration logs and chain of custody forms	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Critical samples analysed according to DQO	Refer Section 6.7	Refer Section 6.7	Performance against indicator considered acceptable.
Analytes analysed according to DQO	Refer Section 6.7	Refer Section 6.7	Performance against indicator considered acceptable.
Appropriate laboratory analytical methods and LORs	Refer Section 6.7	Refer Section 6.7	Performance against indicator considered acceptable.
Sample documentation complete	All sample receipt advices, all certificates of analysis	100%	Performance against indicator considered acceptable.
Sample extraction and holding times complied with	Refer Section 6.7	100%	Performance against indicator considered acceptable.

The data collected is considered to be adequately complete within the objectives and constraints of the project.

9.2. Comparability

An assessment of the comparability of data collected was undertaken, and the results presented in **Table 9.2**.

Table 9.2 Comparability DQI

Field Considerations	Target	Actual	Comment
Same SOPs used on each occasion	100%	100%	Performance against indicator considered acceptable.
Climatic conditions	Samples stored in insulated containers with ice, immediately after collection	100%	Performance against indicator considered acceptable.
Same types of samples collected, and handled/preserved in same manner	All soil samples same size, all stored in insulated containers with ice	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Same analytical methods used by primary laboratory	Refer Section 6.7	100%	Performance against indicator considered acceptable.
Same LORs at primary laboratory	Refer Section 6.7	100%	Performance against indicator considered acceptable.
Same laboratory for primary sample analysis	All primary samples to Eurofins MGT	100%	Performance against indicator considered acceptable.
Same analytical measurement units	Refer Section 6.7	100%	Performance against indicator considered acceptable.

The data collected is considered to be adequately comparable.

9.3. Representativeness

An assessment of the representativeness of data collected was undertaken, and the results presented in **Table 9.3**.

Table 9.3 Representativeness DQI

Field Considerations	Target	Actual	Comment
Appropriate media sampled according to DQO	Refer Section 6.7	100%	Performance against indicator considered acceptable.

Media identified in DQO sampled	Refer Section 6.7	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Samples analysed according to DQO	Refer Section 6.7	Refer comments	Performance against indicator considered acceptable.

The data collected is considered to be adequately complete within the objectives and constraints of the project.

9.4. Precision

An assessment of the precision of data collected was undertaken, and the results presented in **Table 9.4**.

Table 9.4 Precision DQI

Field Considerations	Target	Actual	Comment
Field duplicate / triplicate RPD	Minimum 5% duplicates and triplicates	8.3 % duplicates and 8.3 % triplicates	Parent duplicate/triplicate relationships are as follows: DUP01/1A – TP054-0.0-0.2 DUP02/2A – TP30C-0.0-0.2 DUP03/3A – TP30A-0.0-0.2 DUP04/4A – TP057-0.0-0.2 DUP05/5A – TP23D-0.1-0.4
	No limit for analytical results <10 times LOR	Nil	Exceedances included:
	50% for analytical results 10-20 times LOR	Nil	<ul style="list-style-type: none"> zinc RPD for DUP01; and lead RPD for DUP1A.
	30% for analytical results >20 times LOR	Nil	AG considers these exceedances are likely to be attributable to heterogeneity in each of the discrete soil samples, as the parent sample could not be homogenised prior to splitting, due to the potential for volatile and semi volatile contaminants to be present. As a conservative measure, the sample reporting the higher concentration of the relevant analyte should be used when making decisions regarding contamination risks on the site. Performance against indicator considered acceptable. Refer to Table 4
SOPs appropriate and complied with	100%	100%	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Laboratory duplicates	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.

The data collected is considered to be adequately precise.

9.5. Accuracy

An assessment of the precision of data collected was undertaken, and the results presented in **Table 9.5**.

Table 9.5 Accuracy DQI

Field Considerations	Target	Actual	Comment
Rinsate blanks	Less than laboratory limit of reporting	Not applicable	Not applicable
Field trip spikes	Recoveries between 60% and 140%	Recoveries were between 60% and 140%	Performance against indicator considered acceptable.
Field trip blanks	Analyte concentration <LOR	Analyte concentrations were <LOR	Performance against indicator considered acceptable.
Laboratory Considerations	Target	Actual	Comment
Laboratory method blank	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Matrix spike recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Surrogate spike recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.
Laboratory control sample recovery	No exceedances of laboratory acceptance criteria	No exceedances of laboratory acceptance criteria	Performance against indicator considered acceptable.

The data collected is considered to be adequately accurate.

10. DATA GAP ASSESSMENT (PREVIOUSLY INACCESSIBLE AREAS)

A discussion on comparison of laboratory analytical results and field observations carried out to assess the data gaps associated with (AG, 2018b), in the context of the assessment criteria adopted for this project, is presented in **Section 10.1** to **Section 10.3**. A summary of the laboratory analytical results for the data gap assessment completed at the site is presented in **Table 1** and sampling points are shown in **Figure 4**.

10.1. Human Health - Direct Contact

10.1.1. TRH

The concentrations of TRH C_6-C_{10} , $>C_{10}-C_{16}$, $>C_{16}-C_{34}$ and $>C_{34}-C_{40}$ detected in the soil samples analysed, were less than the laboratory limit of reporting and/or less than the applicable adopted direct contact human health exposure criteria.

10.1.2. BTEX

The concentrations of benzene, toluene, ethyl benzene and xylenes detected in the soil samples analysed, were less than the laboratory limit of reporting and less than the applicable adopted direct contact human health exposure criteria.

10.1.3. PAH

The concentrations of naphthalene detected in the soil samples analysed, were less than the laboratory limit of reporting and less than the applicable adopted direct contact human health exposure criteria.

The concentrations of benzo(a)pyrene TEQ detected in the soil samples analysed, were less than the laboratory limit of reporting and less than the applicable adopted direct contact human health exposure criteria.

The concentration of total PAH detected in the soil samples analysed, were less than the laboratory limit of reporting and/or less than the applicable adopted direct contact human health exposure criteria.

10.1.4. OCP

The concentration of relevant OCP compounds detected in the soil samples analysed, were less than the laboratory limit of reporting and/or less than the applicable adopted direct contact human health exposure criteria or less than laboratory limits of reporting.

10.1.5. PCB

The concentration of relevant PCB compounds detected in the soil samples analysed, were less than the laboratory limit of reporting and less than the applicable adopted direct contact human health exposure criteria.

10.1.6. Metals

The concentrations of arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury detected in the soil samples analysed, were less than the applicable adopted direct contact human health exposure criteria.

10.1.7. Asbestos in Soil – Fibrous Asbestos (FA)/ Asbestos Fines (AF)

Fibrous asbestos and asbestos fines (FA and AF) were not detected in the relevant soil samples analysed, with the exception of asbestos concentrations at sampling points:

- **TP53-0.9-1.1:** (FA): chrysotile, amosite and crocidolite asbestos detected in weathered fibre cement fragments. No asbestos detected at the reporting limit of 0.001% w/w; and
- **TP57-0.0-0.2** (FA): chrysotile asbestos detected in weathered fibre cement fragments and (AF) chrysotile asbestos detected in the form of loose fibre bundles. Total estimated asbestos concentration in FA and AF was 0.0013% w/w.

10.2. Human Health – Inhalation / Vapour Intrusion (Residential)

10.2.1. TRH

The concentrations of TRH C₆-C₁₀ (minus BTEX) and >C₁₀-C₁₆ (minus naphthalene) detected in the soil samples analysed, were less than the applicable adopted inhalation / vapour intrusion human health exposure criteria.

10.2.2. BTEX

The concentrations of benzene, toluene, ethyl benzene and xylenes detected in the soil samples analysed, were less than the applicable adopted inhalation / vapour intrusion human health exposure criteria.

10.2.3. PAH

The concentrations of naphthalene detected in the soil samples analysed, were less than the applicable adopted inhalation / vapour intrusion human health exposure criteria.

10.3. TPH Management Limits (Residential)

The concentrations of TRH C₆-C₁₀, >C₁₀-C₁₆, >C₁₆-C₃₄ and >C₃₄-C₄₀ detected in the soil samples analysed, were less than the applicable adopted TRH management limits or less than laboratory limits of reporting.

11. CHEMICAL DELINEATION ASSESSMENT

A summary of the laboratory analytical results for the chemical delineation assessment completed at the site, is presented in **Table 2** and sampling points are shown in **Figures 5a** and **5b**.

11.1. Lead

The concentrations of lead detected in the delineation soil samples analysed, were less than the applicable adopted direct contact human health exposure criteria, with the exception of:

- **TP22D-1.1-1.3:** 460mg/kg.

The detected concentrations of lead in the original soil samples collected at sampling point BH22 in addition to the delineation soil samples collected during this investigation, were subjected to a statistical analysis using ProUCL 5.1. The maximum value of the data set was 490 mg/kg, the standard deviation of the data set was 161.2, while the 95% upper confidence limit was 298.4, which is less than the adopted direct contact human health exposure criteria for lead (300mg/kg) at the site. A copy of the lead ProUCL output is presented in **Appendix E**.

11.2. Benzo(a)pyrene

The concentrations of benzo(a)pyrene detected in the delineation soil samples analysed, were less than the applicable adopted direct contact human health exposure criteria (refer to **Figures 5a** and **5b**).

12. ASBESTOS DELINEATION ASSESSMENT

A summary of the laboratory analytical results for the asbestos delineation assessment completed at the site is presented in **Table 3** and sampling points are shown in **Figures 6a** and **6b**.

12.1. Asbestos in Soil – Fibrous Asbestos (FA)/ Asbestos Fines (AF)

Fibrous asbestos and asbestos fines (FA and AF) were not detected in the relevant soil samples analysed, with the exception of asbestos concentrations at sampling points:

- **SS02D-0.0-0.3** (FA): chrysotile asbestos detected in the form of weathered fibre cement fragments. Total estimated asbestos concentration in FA asbestos was 0.0011% w/w;
- **TP30A-1.7-1.9** (AF): chrysotile and crocidolite asbestos detected in the form of loose fibre bundles. No asbestos detected at the reporting limit of 0.001% w/w; and
- **BH40D-0.9-1.1** (AF): chrysotile asbestos detected in the form of loose fibre bundles. No asbestos detected at the reporting limit of 0.001% w/w;

12.2. Non-friable Asbestos Containing Material (ACM)

Non-friable ACM was not detected in the delineation samples analysed, with the exception of:

- **TP04B**: chrysotile and amosite asbestos detected;
- **TP07A**: chrysotile asbestos detected;
- **TP30B**: chrysotile asbestos detected; and
- **TP30C**: chrysotile asbestos detected.

13. INDICATIVE WASTE CLASSIFICATION ASSESSMENT

Soil samples TP47_0.0-0.2, TP49_0.0-0.2, TP50_0.0-0.2, TP51_0.0-0.2, TP51_0.8-1.0, TP52_0.0-0.2, TP52_1.2-1.4, TP53_0.9-1.1, TP54_0.0-0.2, TP54_1.3-1.5, TP55-0.0-0.2, TP56-0.1-0.4 and TP57_0.0-0.2 collected during this investigation were compared to relevant contamination criteria outlined in the NSW EPA *Waste Classification Guidelines* (2014), to provide an indicative waste classification for the site.

The 6-step classification procedure in NSW EPA (2014) was followed, with the results presented in **Table 13.1**.

Table 13.1. NSW EPA *Waste Classification Guidelines* (2014) 6 Step Classification Procedure

Step	Material Observation
1 <i>Is the waste special waste?</i>	<p>Yes.</p> <p>TP53-0.9-1.1: (FA): chrysotile, amosite and crocidolite asbestos detected in weathered fibre cement fragments. No asbestos detected at the reporting limit of 0.001% w/w; and</p> <p>TP57-0.0-0.2 (FA): chrysotile asbestos detected in weathered fibre cement fragments and (AF) chrysotile asbestos detected in the form of loose fibre bundles. Total estimated asbestos concentration in FA and AF was 0.0013% w/w.</p>
2 <i>Is the waste liquid waste?</i>	No.
3 <i>Is the waste pre-classified?</i>	No.
4 <i>Does the waste possess hazardous characteristics</i>	No.

Step	Material Observation
5 <i>Waste classification using chemical assessment.</i>	<p>Yes. Soil sample (TP52_0.0-0.2) returned analytical results exceeding the general solid waste contaminant threshold (CT1) criteria for lead outlined in the NSW EPA <i>Waste Classification Guidelines</i> (2014). As such, a toxicity characteristic leaching potential (TCLP) preparation of this soil sample (TP52_0.0-0.2) and subsequent analysis of the elutriate for lead was completed. The analytical result (0.03 mg/L) did not exceed the general solid waste TCLP1 maximum concentration (5 mg/L) outlined in the NSW EPA <i>Waste Classification Guidelines</i> (2014). As TCLP analysis was undertaken, a revised specific contaminant concentration (SCC1) was applicable (1,500 mg/kg). The results did not exceed the General Solid Waste TCLP1/SCC1 criteria outlined in the NSW EPA <i>Waste Classification Guidelines</i> (2014).</p> <p>The remaining laboratory analytical results did not exceed the General Solid Waste CT1 criteria outlined in the NSW EPA <i>Waste Classification Guidelines</i> (2014).</p> <p>Refer to laboratory analytical results summary Table 5.</p>
6 <i>Is the waste putrescible or non-putrescible?</i>	<p>Non-putrescible.</p>

Based on AG's assessment of fieldwork observations and laboratory analytical data, and as of the date of this report, the material assessed would classify as:

- **General Solid Waste (Special Waste)**

This conclusion must be read in conjunction with the statement of limitations presented in **Section 15**.

14. CONCLUSIONS AND RECOMMENDATIONS

Based on AG's assessment of the desktop review information, fieldwork data and laboratory analytical data, in the context of the proposed redevelopment scenario, AG makes the following conclusions:

Data Gap Assessment (previously inaccessible areas)

- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable direct contact human health exposure risk;
- fibrous asbestos and asbestos fines detected in the soils assessed, may present an unacceptable human health exposure risk, at sampling points **TP53** and **TP57**;
- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present an unacceptable inhalation / vapour intrusion human health exposure risk; and
- the detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present a petroleum hydrocarbon management limit risk.

Chemical Delineation Assessment

- the extent of previously identified lead contamination at sampling points **BH02**, **BH22** and **BH24**, is considered to have been adequately delineated; and
- the extent of previously identified benzo(a)pyrene contamination at sampling points **BH04**, **BH16** and **BH23**, is considered to have been adequately delineated.

Asbestos Delineation Assessment

- the extent of previously identified asbestos contamination at sampling points **SS02**, **SS03**, **BH30**, **BH40**, **BH41** and **TP53** is considered to have been adequately delineated;
- the extent of previously identified asbestos contamination at sampling point **BH07**, has not been adequately delineated; and
- Non-friable ACM identified at sampling point **TP04B** may present an unacceptable human health exposure risk and has not been adequately delineated.

Indicative Waste Classification

- General Solid Waste (Special Waste).

Based on these conclusions, AG makes the following recommendations:

- further supplementary contamination assessments could be undertaken to further understand and delineate the nature and extent of asbestos contamination identified at sampling points **TP04B**, **TP07A** and **TP57**; or
- alternatively, AG (2018c) could be updated to include the recently identified contamination risks onsite and outline the appropriate remedial measures to adequately remove the contamination pathway and associated human health exposure risks. It is recommended that any update to AG (2018c) be undertaken by an appropriately experienced environmental consultant.

This report, including its conclusions and recommendations, must be read in conjunction with the limitations presented in **Section 15**.

15. STATEMENT OF LIMITATIONS

The findings presented in this report are based on specific searches of relevant, government historical databases and anecdotal information that were made available during the course of this investigation. To the best of our knowledge, these observations represent a reasonable interpretation of the general condition of the site at the time of report completion.

This report has been prepared solely for the use of the client to whom it is addressed and no other party is entitled to rely on its findings.

No warranties are made as to the information provided in this report. All conclusions and recommendations made in this report are of the professional opinions of personnel involved with the project and while normal checking of the accuracy of data has been conducted, any circumstances outside the scope of this report or which are not made known to personnel and which may impact on those opinions is not the responsibility of Alliance Geotechnical Pty Ltd. Should information become available regarding conditions at the site including previously unknown sources of contamination, AG reserves the right to review the report in the context of the additional information.

This report must be reviewed in its entirety and in conjunction with the objectives, scope and terms applicable to AG's engagement. The report must not be used for any purpose other than the purpose specified at the time AG was engaged to prepare the report.

Logs, figures, and drawings are generated for this report based on individual AG consultant interpretations of nominated data, as well as observations made at the time site walkover/s were completed.

Data and/or information presented in this report must not be redrawn for its inclusion in other reports, plans or documents, nor should that data and/or information be separated from this report in any way.

Should additional information that may impact on the findings of this report be encountered or site conditions change, AG reserves the right to review and amend this report.

16. REFERENCES

AG 2018a, *'Stage 1 Preliminary Site Investigation, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW'*, dated June 2019, ref: 6179-ER-1-1 REV5;

AG 2018b, *'Stage 2 Detailed Site Investigation, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW'*, dated June 2019, ref: 6179-ER-1-2 REV6;

AG 2018c, *'Remedial Action Plan, Portion of Lot 1 in DP837179 (Lot 10 in DP1232584), Meadowbank Education and Employment Precinct Schools Project, 2 Rhodes Street, Meadowbank, NSW'*, dated 12 June 2019, ref: 6179-ER-1-3 REV5.

National Environment Protection Council (NEPC) 1999a, *'Schedule B (1) Guideline on Investigation Levels for Soil and Groundwater, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013'*.

National Environment Protection Council (NEPC) 1999b, *'Schedule B (2) Guideline on Site Characterisation, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013'*.

NSW DEC 2006, *'Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition)'*.

NSW EPA 1995, *'Contaminated Sites: Sampling Design Guidelines'*.

NSW OEH 2011, *'Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites'*.

WA DOH 2009, *'Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia'* dated May 2009.

SITE FIGURES

DATA SUMMARY TABLES

APPENDIX A
SITE SURVEY

APPENDIX B

BOREHOLE LOGS

APPENDIX C

CALIBRATION CERTIFICATES

APPENDIX D

NATA ACCREDITED LABORATORY DOCUMENTATION

APPENDIX E

ProUCL CALCULATIONS – LEAD SAMPLES

