



Douglas Partners
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Report on
Remediation Action Plan

Proposed Residential & Commercial Development
Section 5, Constitution Avenue
Campbell ACT

Prepared for
Land Development Agency

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Integrated Practical Solutions





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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Executive Summary

This report describes the details of the Remediation Action Plan (RAP) for Section 5 Campbell, ACT. Preparation of the RAP was commissioned by the Land Development Agency (LDA). It is understood that the site is to be developed for open space, high density residential and commercial purposes. An independent Site Auditor, Mr Lange Jorstad of Golder Associates Pty Ltd, has been appointed by the LDA under Section 9 of the *Contaminated Land Environmental Protection Policy* (November 2009) to review the RAP. The Auditor will issue a site audit report and site audit statement upon the completion of the assessment, remediation and validation works, indicating which land uses (if any) the site is suitable for from a contamination perspective.

Douglas Partners Pty Ltd (DP) has previously undertaken a Phase 1 and Phase 2 Contamination Assessment. The assessment identified bonded asbestos (asbestos containing material – ACM) contamination, heavy metal concentrations exceeding the Ecological Investigation Levels (EIL) within filling containing anthropogenic materials such as builder's rubble, rubbish and/or household waste with a limited area of long chain hydrocarbon and lead contamination. The assessment also identified bonded asbestos impacted topsoils in localised parts of the site. The areas requiring remediation are indicated as Areas of Environmental Concern (AEC) shown on Drawing 1 in Appendix A.

The objective of the proposed remediation program is to remediate the identified contamination present in the fill across the subject site to a condition where the land is considered suitable for the proposed uses and delineate the extent of contamination at the southern end of the site both on and off-site as required by ACT Environment Protection Unit (EPU).

The majority of the site is identified as Section 5 in Campbell within the Canberra Central District of the ACT. The remaining part of the site includes the Constitution Avenue road corridor adjacent to the area identified as Section 5. The land which the site is located on is "designated" land overseen by the National Capital Authority (NCA) through the National Capital Plan (NCP). Section 5 is currently divided into three blocks (Blocks 2, 4 and 5) with two land uses being Land Use A and Open Space. Permissible land uses under *Land Use A* and *Open Space* are further defined in Section 1.5.4 of the NCP, and are summarised as residential and commercial for *Land Use A*; and parks, recreational open space and commercial land use for *Open Space*.

Following remedial and validation works undertaken as detailed in this RAP, it is considered that the site would be suitable for redevelopment for residential, commercial and open space land-use subject to the implementation of the following plans:

- a long term Environmental Management Plan (EMP) for the Constitution Avenue verge on-site containment of contaminated fill, and
- a Construction, Environmental and Management Plan (CEMP) for Section 5 development area.

Once the construction of internal roadways and services have been completed and the development blocks have been created the CEMP would be required to be converted, with some modifications where required, into a long term EMP. The EMP would address potential unexpected finds by developers, primarily concerning the potential for ACM fragments being present at shallow depths within surface (topsoils) soils or previously obscured by vegetation (heavy grass cover).

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Report on Remediation Action Plan

Proposed Residential and Commercial Development

Section 5, Constitution Avenue, Campbell ACT

1. Introduction

1.1 Purpose

This report describes the details of the Remediation Action Plan (RAP) for Section 5 Campbell, ACT. Preparation of the RAP was commissioned by the Land Development Agency (LDA). It is understood that the site is to be developed for open space, high density residential and commercial purposes. An independent Site Auditor, Mr Lange Jorstad of Golder Associates Pty Ltd, has been appointed by the LDA under Section 9 of the *Contaminated Land Environmental Protection Policy* (November 2009) to review the RAP. The Auditor will issue a site audit report and site audit statement upon the completion of the assessment, remediation and validation works, indicating which land uses (if any) the site is suitable for from a contamination perspective.

Douglas Partners Pty Ltd (DP) has previously undertaken a Phase 1 and Phase 2 Contamination Assessment. The assessment identified bonded asbestos (asbestos containing material – ACM) contamination, heavy metal concentrations exceeding the Ecological Investigation Levels (EIL) within filling containing anthropogenic materials such as builder's rubble, rubbish and/or household waste with a limited area of long chain hydrocarbon and lead contamination. The assessment also identified bonded asbestos impacted topsoils in localised parts of the site. The areas requiring remediation are indicated as Areas of Environmental Concern (AEC) shown on Drawing 1 in Appendix A.

This report should be read in conjunction with the waste disposal plan, approved by The Auditor and ACT Environment Protection Unit (EPU) (titled: *Waste Disposal Plan, Section 5 Campbell*, Project 50584 Doc 4 Rev1, dated 27 March 2012) and notes *About this Report* in Appendix A.

1.2 Objective

The objective of the proposed remediation program is to remediate the identified contamination present in the fill across the subject site to a condition where the land is considered suitable for the proposed uses and delineate the extent of contamination at the southern end of the site both on and off-site as required by ACT EPU.

1.3 Scope of Works

The scope of the RAP has been established on the basis of the findings of the previous investigation, with the RAP aimed at providing:

- An appropriate remedial strategy, which comprises localised remedial actions so as to render the site suitable for the proposed open space, residential and commercial use;

- Appropriate requirements for the validation and verification of the successful implementation of the remediation strategy and the remediation acceptance criteria to be adopted;
- Appropriate environmental safeguards required to conduct the remediation works in an environmentally acceptable manner;
- OH&S procedures required to conduct the remediation works in a manner that will not pose a threat to the health of site workers or users.
- Delineation of the “extent of contamination” extending into the Constitution Avenue road corridor adjacent to AEC 4.

1.4 Site Accessibility

It is the remediation contractor's responsibility to securely fence the site to prevent unauthorised entry to the site and in particular the remediation areas during the excavation works. Access to the Golden Sun Moth habitats and treed areas around the boundaries of the site was restricted during the contamination assessment. Currently, the Project Manager / Developer is in the process of obtaining approval to access the Golden Sun Moth habitat for proposed remediation (where required) and landscaping. Access to the treed areas and/or removal of trees is also to be provided and managed by the Project Manager / Developer, who will obtain the approval from the relevant authorities. There should be no access to these areas until the approval has been obtained.

2. Previous Contamination Assessment

A contamination assessment of the current site was previously undertaken by DP. The report (titled: *Phase 1 and Phase 2 Contamination Assessment, Proposed Residential and Commercial Development, Block 2 and 3 Section 5, Campbell*; Project 50584, dated 18 November 2011 [DP 2011]) included the following information:

- Desktop study of topographic and geological and hydrogeological maps;
- Search of groundwater bore register maintained by ACT Water Resources;
- Regulatory Notices search with ACT Department of Environment and Heritage;
- ACT WorkSafe records search for registered dangerous substances;
- A review of selected historical aerial photography archived with the NSW Land and Property Information Centre;
- A review of previous site ownership records through the Land Titles Office;
- Review of previous investigations;
- Site inspection;
- Soil sampling at 79 locations over the site, see Drawing 2 in Appendix A, (Pits 66 and 67), were not excavated due to Golden Sun Moth habitat);

- Laboratory testing of 251 selected soil samples (including 41 QA/QC) for a range of potential organic and inorganic contaminants;
- Interpretation of the results of laboratory testing in the context of field observations, local geology and hydrogeology and history of the site;
- Preparation of this Phase 1 and Phase 2 Contamination Assessment report which discusses the findings of the assessment.

The report found that the desktop review and sampling and analysis for a range of potential chemical contaminants undertaken in the assessment confirmed contamination associated with filling within the southern part of the site. The principal contaminant is asbestos in a bonded form. Minor contamination outside of this area has also been identified including asbestos at three locations (Pits 11, 27 and 48). Building wastes were also encountered in the filling in the southern part of the site which was found to be at least 2.5 m deep (where a former dam that has been filled). Building wastes are aesthetically unsuitable to remain on the site and will need to be removed. The removal of asbestos and building wastes will also include the removal of minor heavy fraction petroleum hydrocarbons and lead hot spot and soil where the EIL have been exceeded. Tables 1A and 1B show the reported exceedances during the assessment. The approximate extent of the contamination is shown on Drawings 1 and 2, Appendix A.

Table 1A: Reported Inorganic Exceedances

Sample	Arsenic	Copper	Lead	Nickel	Zinc	Asbestos
Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
HILA	100	1000	300	600	7000	
EIL	20	100	600	60	200	
Pit 11/0.05m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 27/0.05m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 44/0.3m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 46/0.3m	<SAC	<SAC	<SAC	<SAC	270	Detected
Pit 48/1.1m	<SAC	<SAC	<SAC	<SAC	1700	Detected
Pit 57/1.6m	<SAC	<SAC	<SAC	<SAC	310	ND
Pit 57/2.1m	<SAC	<SAC	430	<SAC	310	Detected
Pit 57/2.5	21	<SAC	<SAC	<SAC	<SAC	NT
Pit 58/1.1m	<SAC	<SAC	<SAC	<SAC	320	Detected
Pit 58/1.6m	<SAC	<SAC	390	<SAC	340	Detected
Pit 58/2.1m	<SAC	<SAC	810	<SAC	<SAC	NT
Pit 59/1.1m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 59/2.1m	<SAC	<SAC	<SAC	<SAC	830	ND
Pit 60/0.6m	<SAC	110	<SAC	<SAC	<SAC	ND
Pit 60/1.1m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 60/1.6m	<SAC	<SAC	<SAC	<SAC	300	ND
Pit 61/1.1m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 61/1.6m	<SAC	<SAC	<SAC	<SAC	550	Detected
Pit 75/0.2m	<SAC	<SAC	<SAC	85	250	NT
Pit 75/0.5m	<SAC	<SAC	<SAC	<SAC	<SAC	Detected
Pit 75/1.0m	<SAC	<SAC	<SAC	<SAC	590	Detected

Note: HILA – NEPM Guidelines on Investigation levels for Soil and Groundwater (1999) Soil Investigation Levels for Residential with full soil access (HIL Column A)
 EIL – NEPM Guidelines on Investigation levels for Soil and Groundwater (1999) Soil Investigation Levels for Residential with full soil access (EIL Interim Urban)
 SAC – Site assessment criteria
 NT – Not tested
 ND – No asbestos detected

Table 1B: Reported Organic Exceedances

Sample	Total Petroleum Hydrocarbons C ₁₀ – C ₃₆
Unit	mg/kg
NSW EPA (1994) Service Station Guidelines threshold concentrations for sensitive land-use	1000
Pit 57/2.1m	3200

Although wet conditions were found in the subsurface investigations, these conditions were identified at the interface of the filling and underlying natural soils in an area of a former farm dam in the southern portion of the site. It was considered any intermittent surface water that infiltrates the filling is unlikely to enter the groundwater, but rather migrate along the interface of the filling and natural soils laterally in a southerly direction off site. Given that there was no gross chemical contamination of the site and that the site is located down-gradient of residential land and there are no high risk neighbouring land uses (such as a service station) and no volatile TPH fraction was identified, the investigation of groundwater quality does not appear warranted.

The assessment was limited by the vegetation across the site comprising both heavy grass cover and mature trees. The vegetation and heavy grass cover obscured observations for signs contamination and in particular fragments of ACM on or near ground surface across site surface. Further limitations imposed on the extent of the assessment by the client included the exclusion areas within the tree drip line around mature trees and Golden Sun Moth habitat.

The contamination assessment recommended that remediation would need to be undertaken in accordance with a Remedial Action Plan (RAP). The remediation methods will need to be agreed between all parties including the Auditor.

The assessment did not include the Constitution Avenue corridor; however inclusion of Constitution Avenue, in particular the northern verge has been requested by the ACT EPA and developer to delineate the “extent of contamination” and assist future proposed construction works.

3. Site Identification

The site is in two distinct parts which will be subject to separate site audit statements. The larger part is identified as Section 5 in Campbell which is defined by the Section's cadastral boundaries. The remaining part of the site includes that part of the Constitution Avenue road corridor adjacent to the southern cadastral boundary of Section 5 and includes both the northern and southern verges and roadway of Constitution Avenue along the length of the Section 5 southern cadastral boundary which is about 233 m in length. Both parts constitute the site but are referenced separately in this report as the Section 5 site and Constitution Avenue site or, when considered together, referred to as the site. The Section 5 and Constitution Avenue sites are shown on Drawings 1 and 2 in Appendix A.

The land which the site is located on is “designated” land overseen by the National Capital Authority (NCA) through the National Capital Plan (NCP). Section 5 is currently divided into three blocks (Blocks 2, 4 and 5). Blocks 4 and 5 are a division of a previous block known as Block 3. The land uses indicated on Figure 12 of the NCP for Block 2 is *Land Use A* and for Blocks 4 and 5 *Open Space*. Permissible land uses under *Land Use A* and *Open Space* are further defined in Section 1.5.4 of the NCP, and are summarised as residential and commercial for *Land Use A*; and parks, recreational open space and commercial land use for *Open Space*.

The site is bordered by Anzac Park (East) to the west, Page Street to the north, Chowne Street to the east and Creswell Street to the southeast, with government and commercial development surrounding the southern portion of the site and residential development surrounding the site to the north, east and west.

The site is irregular in shape and approximately 7.0 ha in area (Section 5 development approx. 6.4 ha and Constitution Avenue approx. 0.6 ha) with unrestricted access to the site (refer Drawings 1 and 2, Appendix A).

The Constitution Avenue site boundaries are preliminary at this stage. Section 12.2 outlines the delineation requirements to determine the “extent of contamination” in this part of the site. Once this has been determined the site (audit) boundaries should be redefined by survey, to reflect the “extent of contamination” within the road corridor, with revisions to the site drawings made accordingly.

4. Site History

The site history review indicated that the site had primarily been used for broad acre and arable agricultural purposes prior to the surrounding residential, commercial and government development being established around the site. Additionally, the EPU records indicated that the site had been used for the disposal of builders’ wastes and that asbestos was present. An earlier report by ACT Geotechnical Engineers Pty Ltd did not confirm the presence of these wastes. However, there are areas with an increased potential of contamination associated, principally, with the identified filling on site and the potential backfilling of a former farm dam.

5. Site Condition

The irregular shaped site comprises the developed Constitution Avenue corridor and the currently vacant Section 5 development area to the north which has no observed signs of past development. The site is located east of Cresswell Street and west of Anzac Park (East) with government and commercial development surrounding the southern portion of the site and residential development to the north, east and west.

Timber bollards are located on the western and eastern site boundaries with Anzac Park and Creswell Street. Rows of trees are located on the majority of the site boundaries and between Section 5 and Constitution Avenue. Six trees are also located within the central southern portion of the site. The remainder of the site is cleared and currently heavily grassed or paved.

The site is positioned at the base of the southern slopes of Mount Ainslie. A broad gully characterises a majority of the site with the overall site sloping to the south. Two drainage gullies enter the site from collected local street drainage. One gully discharges from a headwall to the west of the site into a short drainage channel at the edge of the site, midway along the boundary with Anzac Park East. The second drainage line enters the site from the north, midway along the boundary with Chowne Street. The confluence of the gullies is within the centre of the site and a single gully discharges into the street gutter system on Constitution Avenue.

A knoll of elevated land is located in the western portion of the site. The Constitution Avenue part of the site is near level with concrete kerb and cutter down each side of the roadway. The remaining parts of the site slope slightly to moderately across the Section 5 site in the directions of east, west and south at estimated grades of 1 in 5 to 1 in 50 (vertical to horizontal) with an estimated overall difference in level of 6 m to 8 m.

A network of stormwater pipes pass through the site carrying water collected from the street drainage system in the northwest corner and midway along the northern and eastern site boundaries. The stormwater pipes connect to a trunk line within the centre of the site. This trunk line continues in a southerly direction beyond the southern site boundary. A sewer pipe is also located through the centre of the site in a north to south direction carrying waste water from neighbouring residential development bounding the site to the north. Traffic lights are located on the Wendouree Drive intersection with Constitution Avenue. The approximate locations of these services are indicated on Drawing 1 (Appendix A).

An area of 3 m in diameter contains burnt material such as small metal objects (rods, wire, and sheeting), rubber and glass, located in the northwest corner of site.

6. Geology and Hydrogeology

Reference to the 1:10 000 Geological Series Sheet for Central Canberra indicates that the site is located on the boundaries of three rock units of Silurian age and an alluvial deposit unit of Tertiary age. These units include:

- Canberra Formation – typically comprising sandstone, siltstone, shale and limestone,
- Narrabundah Ashstone Member – typically comprising tuff, ashstone and chert,
- Ainslie Volcanics - typically comprising dacite, and
- Tertiary alluvial deposits – typically comprising high level deposits of gravel, sand, silt and clay.

A dacitic dyke is also indicated in the south western corner of the site which is likely characterised in the sites topography by a knoll.

The nearest surface water receptor is approximately 390 m to the south west of the site and is Lake Burley Griffin. The depth to groundwater at the site has been estimated as 5 to 10 m in a previous geotechnical investigation for the site by ACT Geotechnical Engineers Pty Ltd (titled: *Development of Block 1 Section 5 Campbell, Preliminary Geotechnical Investigation Report, October 2007*). Free groundwater underlying the site is most likely to be with in the weathered rock zone.

The surface drainage lines that flow through the site are grassed and intermittent and don't have a specific base flow but rather convey surface runoff during rain events. The site contains portions of mostly clayey soils overlying sedimentary of volcanic igneous weathered rock. The clay content of the soils is likely to hinder infiltration of groundwater seepage to the underlying groundwater table. Groundwater levels are likely to be within the weathered bedrock.

Groundwater seepage from the affected filling on site is more likely to occur as lateral transport mechanism at the base of filling or at the underlying silty and sandy slopewash and clayey soils interface. Alternatively lateral migration of seepage water along stormwater and sewer pipe line backfilling is also possible. Migration of seepage water through the filling on site is dependent on infiltration of intermittent surface water runoff that flows onto the site mainly during rainfall events.

It is considered possible that a limited amount of seepage water may develop at the base of filling or at the underlying silty and sandy slope wash and clayey soils interface. No perched groundwater was observed during the subsurface investigation.

7. Remediation Goals

The main objectives of the remediation programme will be to:

- Remove all impacted fill materials from Section 5 identified in the contamination assessment (either due to exceedance of the adopted site assessment criteria, bonded asbestos impacts or on aesthetic grounds).
- Remove contaminated filling within the road verges of Constitution Avenue to a minimum 0.5 m depth or deeper at nominated (planting) locations or to natural ground and then provide a barrier layer of geo-textile and a minimum 0.5 m containment cover (or 0.7 m in line with final verge design levels in the northern verge) of certified clean fill will be placed over the remaining contaminated fill.
- Remove all impacted (bonded asbestos) topsoil from the areas of the site identified the contamination assessment.
- Undertake validation sampling and analysis to confirm that any contaminated or aesthetically unsuitable material has been removed and remaining soils are suitable for the proposed reuse.
- Delineate the extent of contamination at the southern end of the site both on Section 5 and within Constitution Avenue as required by ACT EPA.

8. Extent of Remediation

The Areas of Environmental Concern (AEC) identified in DP (2011) within Section 5, Campbell, are presented in Table 2 below and are represented on Drawing 1 in Appendix A. The AEC are approximate and have been estimated based on either known AEC boundary points based on trench excavations that intersected the boundary of contaminated and 'clean' fill or approximating half way between known 'clean' and 'contaminated' test locations. Table 2 also includes the test locations and GPS coordinates, approximate size and depth.

Mature trees and heavy grass cover limited the ability to assess the site for signs contamination and, in particular, fragments of ACM on or near the ground surface across the site surface. Further, limitations in previous assessments have included the exclusion areas within the tree drip line around mature trees and Golden Sun Moth habitat (see Section 1.4).

Table 2: Sources of Contamination

Location of AEC	Contaminants / Reason for Remediation	Pit	GPS Coordinates	Depth Range (m)	Approximate Size (m)
1 – Topsoils containing ACM (northwest)	Asbestos, aesthetic impacts	11	0694979 6092914	0.0 – 0.2	To be confirmed
2 – Topsoils containing ACM (southwest)	Asbestos, aesthetic impacts	27	0694883 6092719	0.0 – 0.2	To be confirmed
3 – Filling containing anthropogenic material underlying topsoil filling	Asbestos, zinc exceedance of EILs and aesthetic impacts	48	0694971 6092758	1.0 – 1.3	3 x 3
4 – Filling containing anthropogenic material underlying general filling (south eastern portion of site, includes former dam)	Asbestos, EIL exceedances (arsenic, copper, nickel and zinc), TPH, lead and aesthetic impacts	44	0694908 6092675	0.25 – 0.7	100 x 100
		45	0694930 6092689	0.1 – 0.5	
		46	0694939 6092716	0.2 – 0.4	
		57	0694965 6092702	1.4 – 2.2	
		58	0694950 6092679	1.4 – 2.1	
		59	0694936 6092655	0.5 – 2.5	
		60	0694954 6092638	0.7 – 1.9	
		61	0694973 6092662	1.0 – 2.3	
		75	0694955 6092616	0.4 – 2.3	
5 – Localised area of minor burnt material (located within the Golden Sun Moth habitat) ^{#1}	Aesthetic impacts, possible heavy metals, TPH, BTEX and PAH	-	0694957 6092902	0.0 – 0.2	2 x 3

Note: #1 – Refer to comments below regarding issues remediating AEC 5

The bonded asbestos (ACM) identified during the contamination assessment at the location of Pits 11 and 27 (AEC 1 and 2 respectively) was confined to the topsoils. ACM was not found in any of the adjacent test pits.

The approximate size of AEC 1 and 2 is difficult to estimate and is 'to be confirmed' through delineation during remediation. The surrounding land adjacent to the delineated AEC will be inspected by the Environmental Consultant during validation works. The approximate size of the remaining AEC 3 to 5 have been estimated, these will also be confirmed through delineation during remediation.

Fill material within AEC 3 and 4 found to contain contamination should be excavated to the full extent practicable. Excavation should continue until the underlying natural soil shows no further signs of impact (e.g.: anthropogenic material, chemical staining and odours) including the results of validation sampling. Due to the geological characteristics underlying the site (with shallow *in situ* clays and weathered bedrock) and the form of contamination involved (as listed above), it is envisaged that the vertical extent of contamination is restricted to the fill and has not adversely affected the underlying natural soils and/or the groundwater.

The ACM contaminated filling (in AEC 3 and 4) is underlying unaffected topsoil and/or general (clean) fill, which ranges in depth from 0.4 m 1.4 m across the two AEC. It is considered that the uncontaminated topsoil and general fill will be removed and stockpiled separately for reuse onsite. At the test pit locations the ACM contaminated soil will be dispersed through the full fill profile. At these localised locations the full fill profile will need to be remediated. For further details on the remediation process, see Section 12.

AEC 5 is located within the Golden Sun Moth habitat and it is understood that approval to disturb the area (see Section 1.4) would need to be sought in order to scrape back and remediate the identified burnt area.

9. Evaluation of Remedial Options

A summary of the hierarchical policy for site remediation options (*Guidelines for the NSW Site Auditors Scheme* NSW DEC 2006) 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. 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 open space 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 and the primary

objective of the Land Development Agency is to have a site without any encumbrances, such as being listed on the Register of Contaminated Sites, this option is also considered not suitable as development approval for the proposed land-uses (i.e. residential) are unlikely to be granted; and

- Dig and dump – 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. Off-site transport of contaminated soil increases the risk of exposure within the surrounding community and is the least preferred option in the hierarchy of waste management as identified in the ACT EPA Contaminated Sites Information Sheet 4: Requirements for the Re-use and Disposal of Contaminated Soil.

Based on an assessment of the options and considering the proposed land-uses and development, two remediation options have been adopted for different parts of the site:

- The proposed development within Section 5 is to include basement car parking in the area where the majority of the contamination (AEC 4) is located; the dig and dump strategy is considered to be the most appropriate remedial strategy for the Section 5 development area. Off-site transport of contaminated soil increases the risk of exposure within the community and is the least preferred option in the ACT EPA hierarchy of waste management. However, given that ACM is not amenable to destruction “treatment” technologies for on-site or off-site treatment to destroy the contaminant (or reduce it to an acceptable level) the removal of the contaminated soil is therefore the preferred remediation option in hierarchical policy for site remediation in the *Guidelines for the Site Auditors Scheme NSW DEC 2006*. The removal of the contamination will also avoid the future blocks in the Section 5 development being registered as a contaminated site and will mean that any future development or the sale of land in the future will not be affected.
- Given the land-use and proposed upgrading of Constitution Avenue including its verges, the partial removal (dig and dump) and an on-site containment strategy is considered to be the most appropriate remedial strategy for this part of the site. The on-site containment of contaminated fill would reduce the disruption to the existing roadway and allow proposed verge construction works to occur over the containment cover. A suitable containment cover for the verges would contain a geo-textile barrier over the contaminated fill, capped with a minimum of 0.5 m of clean soil in line with the (ANZECC 1999) *Guidelines for the Assessment of On-Site Containment of Contaminated Soil* for a “Physical Separation Cover” for immobile contaminants. The geo-textile barrier would provide warning of the presence of underlying soil contamination. A long-term environmental management plan (EMP) would also be required to be prepared at the completion of remediation for additional assurance that the protective measures will be maintained and potentially affected parties (service providers) will be kept informed of possible risks.

10. Remediation Acceptance Criteria

The adopted Remediation Acceptance Criteria (RAC) for the site is provided in Table 3 and includes the health-based investigation levels (HIL) for parks, recreational open space and playing fields as contained in Table 5A, Column E, of Schedule B(1) of the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM 1999). Ecologically based investigation

levels (EIL) Column Interim Urban of NEPM (1999), which are derived on the basis of phytotoxicity-based investigation levels, have also been provided.

The contaminant levels must conform to the RAC given in Table 3. Based on the proposed development for the site consisting of high density residential with limited soil access, commercial and open space; the RAC values given are based on the NEPM (1999) health-based investigation levels for parks, recreational open space and playing fields as they are more stringent land use criteria when compared with high density residential and commercial land use criteria. This will allow for soil to be moved around the site during likely cut and fill operations. The EIL guidelines for heavy metals are also included in Table 3; any contaminant levels in all validation soil samples that exceed the EIL guidelines should be remediated and re-validated or alternatively managed by being located under buildings and/or pavement areas or below 1 m of the finished surface level and covered with VENM in open space areas. If the form/type of proposed development is changed, the RAC may need to be appropriately revised to suit the proposed development.

Table 3: Proposed Site Remediation Acceptance Criteria (RAC) for Soil

Contaminant	RAC for soils based HIL and sensitive land-use criteria (mg/kg)	EIL Interim Urban ^a (mg/kg)
Arsenic	200 ^b	20
Cadmium	40 ^b	3
Chromium	200 ^b	400
Copper	2000 ^b	100
Lead	600 ^b	600
Mercury	30 ^b	1
Nickel	600 ^b	60
Zinc	14000 ^b	200
TPH: C6 – C9	65 ^c	NC
TPH: C10 – C36	1000 ^c	NC
Benzene	1 ^c	NC
Toluene	1.4 ^c	NC
Ethyl benzene	3.1 ^c	NC
Xylene	14 ^c	NC
PAH (total)	20 ^b	NC
Benzo(A)pyrene	1 ^b	NC
Phenols (total)	17000 ^b	NC
PCBs (total)	20 ^b	NC
Aldrin and Dieldrin	20 ^b	NC
Chlordane	100 ^b	NC
DDT+DDD + DDE	400 ^b	NC
Heptachlor	20 ^b	NC
Asbestos (FA/ AF)	0.001% w/w ^d	NC

Notes:

- a NEPC Guidelines on the Investigation for Soil and Groundwater (1999) Ecological Investigation Levels (EILs) – Interim Urban, considerations of Phytotoxicity (EILs).
- b NEPC Guidelines on the Investigation Levels for Soil and Groundwater (1999) Soil Investigation Levels for parks, recreational open space and playing fields (HIL Column E).
- c NSW EPA (1994) *Contaminated Sites: Guidelines for Assessing Service Station Sites, Threshold values for sensitive site use*.
 Note: Guideline C has been incorporated in view of the absence of NEPC endorsed, comprehensive health based investigation levels for TRH/BTEX.
- d WA DoH (2009) Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia
 FA = fibrous asbestos
 AF = asbestos fines
- NC No Criteria

According to Western Australia Department of Health's (DOH) *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*, May 2009, the threshold level of ACM material in soil for Parks, recreational open spaces etc. (i.e. the most sensitive proposed land-use of the site) is 0.02 %w/w. A sieve analysis using the WA methodology is likely to be impractical as the validation samples in natural material will be clay soils which are not amenable to sieving. On this basis, DP has adopted the method detection limit as the screening assessment criteria for asbestos in soil. In summary, a "nil" asbestos detection implies that there would be no adverse impacts due to asbestos. Validation and soil sampling for asbestos will be undertaken by raking the wetted natural soil surface to visually assess the presence of ACM. Laboratory analysis will be undertaken for fibrous asbestos (FA) and asbestos fines (AF) by taking 500 ml soil samples and will be analysed based on the criteria in indicated in Table 3. The raking and sampling will be based on the sampling density specified in Section 15.1.

The list of analytes to be tested has been extended to cover a wider range of common contaminants that may be encountered during the remediation works. However, for the AEC at this stage it is anticipated that the contaminants list in Table 2 including all eight (8) heavy metals should be undertaken as a minimum. The EIL are considered a screening guide, if exceedances of EILs are detected during the validation process reference should be made to either ANZECC soil data (background ranges) or any available local soil information.

11. Roles and Responsibilities

In order to achieve the goals of the remediation programme, the following roles have been identified for the developer, contractor, environmental consultant and site auditor.

Prior to the commencement of remediation works a site meeting between the Project Manager for Development/Developer, Contractor, Environmental Consultant and Site Auditor is recommended to confirm responsibilities and procedures in accordance with the RAP.

11.1 Project Manager for Development / Developer

The Project Manager/Developer would be responsible for the implementation of this RAP. In this regard, the Project Manager or his nominee would have the following particular responsibilities:

- engage an Accredited Site Auditor;
- engage a remediation contractor(s) holding Class A Asbestos Removal License;
- distribution of information to all relevant parties on the requirements of this RAP;
- obtaining approval to access the Golden Sun Moth habitat and to the treed areas and/or removal of trees for proposed remediation (where required);
- analysis of non-conformance and oversight of corrective action taken; and
- taking appropriate action in response to any complaints or expressions of concern.

11.2 Class A Licensed Asbestos Contractor

The Contractor is responsible for on-site operations including:

- engage Environmental Consultant;
- compliance with all aspects of this RAP;
- co-ordinating and managing remediation activities;
- handling of contaminated materials including excavations, stockpiles, and disposal;
- maintaining site records including excavations, stockpiling and disposal of contaminated materials and importation (if required) and placement of clean fill materials;
- provision of all necessary training and occupation health and safety of all personnel and sub-contractors into the requirements of this RAP;
- safety of all personnel on site;
- preparation and implementation of site specific OH&S plan to ensure adequate compliance measures are incorporated into work processes;
- constantly monitor work practices to ensure full compliance with this RAP and all statutory licensing and approval conditions;
- engage an occupation hygienist for the set-up and maintenance, inspections, analysis and reporting of air monitoring for air-borne asbestos fibres during remediation;
- measures to minimise environmental effects;
- record compliance with the RAP and measures carried out under the RAP;
- act promptly to implement and record corrective actions for non-conformances; and
- assist the Environmental Consultant by supplying earthmoving equipment (excavator) during validation and delineation works required during and to finalise remediation works.

11.3 Environmental Consultant

A suitably qualified Environmental Consultant should undertake inspections, sampling and validation reporting during remediation consistent with ACT EPU requirements including:

- review contractor's procedures and compliance to the RAP;
- set out of AEC;
- undertake full time surveillance of the removal of topsoil and surface fill from AEC 3 and 4, to be stockpiled for reuse onsite;
- agree appropriate procedure for visual screening of contaminated material with contractors;
- assess any material from an "unexpected find" for chemical contamination and waste classification;
- inspect and sample the base and walls to validate the remediation of each AEC;
- confirm the extent of remediation undertaken;

- providing final validation report(s) on the completion of remediation including any further recommendations; and
- providing site specific environmental management plan(s).

11.4 Site Auditor

The Site Auditor would be responsible for the review of remediation and that the validation findings by the environmental consultant are consistent with ACT EPU requirements including:

- review and approve RAP;
- review Environmental Consultant's validation report(s);
- review Environmental Consultant's environmental management plan(s);
- issue a site audit report(s); and
- issue a site audit statement(s)

12. Remediation Strategy

12.1 Licensing and Approvals

It is the Project Manager/Developer's responsibility to obtain the necessary NCA Works Approvals to undertake remediation on the site and for approval to access those areas (Golden sun Moth habitat and treed areas) of the site previously restricted. It is the Contractor's responsibility to ensure that the NCA Works Approvals have been issued by the Project Manager/Developer, as well as abiding by all statutory laws and licensing requirements. A summary of approvals and licensing requirements is provided below as a general guide, it is considered that this list is not exhaustive and there maybe other requirements that may need to be considered.

- approval of this RAP,
- development approvals for remediation and earthworks,
- access approvals (Golden Sun Moth habitat and treed areas),
- tree removal (where required),
- implementation of the Waste Disposal Plan,
- ACT EPA requirements for contaminated sites, including the Contaminated Sites Information Sheet Series,
- ACT WorkSafe approvals and licensing,
- approval for transporting ACM contaminated soil to an appropriate licensed landfill,
- Class A licensed asbestos removalist, and
- disposal of stormwater from remediation areas.

12.2 General Remediation Sequence

The detailed remedial works procedures and works sequence undertaken during the remediation process will be developed by the remediation contractor, who would also be responsible for the appropriate execution of the works plan and procedures.

It is the contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment.

It is also the contractor's responsibility to securely fence the site to prevent unauthorised entry to the site and in particular the remediation areas during the excavation works. Approval for the contractor to enter or disturb the Golden Sun Moth habitats and / or treed parts of the site will need to be granted by the Project Manager / Developer.

This RAP does not relieve the contractor(s) of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the immediate workspace. This RAP sets out the minimum standards and guidelines for remediation that will need to be used in preparing individual method statements for each remediation location.

The remediation works proposed will need to comprise the following steps depending on the contamination characteristics and the waste disposal approval from the ACT Environmental Protection (EPU):

Staging

- It is understood that the remediation of the site is planned to be undertaken in stages to allow development to proceed in parts of the site prior to the remediation of the whole site being completed;
- It is understood the remediation of AEC 1, 2 and 5 will be undertaken in the first stage, with the remediation of AEC 3 and 4 to completed in subsequent stages;
- In staging the remediation the site will need to be divided by readily identifiable features (i.e. proposed roadways or block boundaries) which are yet to be confirmed, so that future individual blocks will not traverse stage boundaries;
- The future stages of remediation will need to have sufficient area such that the remediation works and access to those works can be undertaken in a safe manor;
- Once a stage of the site has been remediated and validated it must be defined by survey and fenced off and will not be accessed from the remaining remediation areas thus protecting the validated areas from cross or recontamination with other contaminated parts of the site;
- Each stage of remediation will be validated and reported in a separate validation report, which would then be reviewed by the Site Auditor, who will issue separate site audit reports and site audit statements for each stage indicating what use the land with in the stage is suitable for; and
- Construction works to develop in a stage of the site would not be permitted to commence until a site audit statement for that stage has been received and approved by the ACT EPA, indicating that the land is suitable for its intended use.

General

- Securely fence and signpost the site as an asbestos removal area;
- The grass vegetation should be mown as short as possible prior to remediation works being undertaken;
- Once the grass vegetation is mown, if the visibility of the ground surface is noticeably improved then an inspection of the surface across the site should be undertaken by an Asbestos Class A Assessor. Where asbestos is found, remediation works should extend to include the new area(s) of concern. Once the inspections have been completed and the known asbestos has been removed then an asbestos clearance certificate should be issued. If by mowing the grass no significant improvement in the visibility of the ground surface is gained this limitation on the site assessment would remain;
- The AEC are to be set out by the Environmental Consultant in consultation with the remediation Contractor and the LDA or representative;
- Set out haul roads which minimise potential impacts to uncontaminated parts of the site and restrict access to remediated and validated portions of the site (to prevent recontamination) the contamination status of internal haul roads will be addressed during and following completion of remediation;
- The remediation areas are to be surveyed at the start and end of remediation to approximate excavation and removal/disposal quantities and to confirm the limits of the remediation;
- Undertake daily air monitoring during remediation works to confirm no asbestos fibres are leaving the remediation areas;
- It is suggested that monitoring is conducted both inside and outside the remediation areas using the "Membrane Filter Method". The air monitoring programme will be detailed by a suitably qualified Occupational Hygienist and be submitted by the Class A licensed asbestos removal contractor with his tender;
- Depending on the disposal requirements contaminated soil and other deleterious materials or topsoils from each AEC may need to be individually stockpiled. The stockpiling will be undertaken within the footprint of each AEC or if space is required, stockpiling could be undertaken on AEC 4 once 'clean' soil has been stripped, so as to not impact other areas of the site. The stockpiling would be required for waste classification purposes;
- During excavation, the base and walls of the impacted areas, where applicable, should be scraped back to natural soils that shows no signs of concern (e.g.: fragments of ACM, waste materials, odours and chemical staining);
- Removal of all waste materials encountered within the delineated AEC by an appropriately licensed (Class A) Asbestos Contractor. The removal and transportation process must be undertaken in accordance with the relevant ACT WorkSafe and environmental legislations;
- A mobile water cart will be available full time on site during the remedial works. Care should be undertaken to ensure the soil is not over-wetted. If unacceptable level of dust is generated, works will be halted and additional dust suppression techniques will be employed;
- During the excavation process the contaminated filling and/or topsoils will be scraped back in all directions at the AEC limits to remove any signs of asbestos contamination and/or aesthetic impacts. The area adjacent to the remediation areas will be inspected by the Environmental

Consultant to confirm that contamination has not been further spread through the area during loading;

- Disposal of the material to an appropriately licensed waste facility, material from AEC 1 – 4 will be classified as asbestos contaminated builders waste as a minimum. If further chemically impacted material found not to contain asbestos is to be removed from the site (i.e. the sub soils) it must be waste classified in accordance with Section 12.5;
- Following the completion of the excavation of topsoils and excavation of impacted fill areas, a visual inspection by the Environmental Consultant of each remediation area will be undertaken and validation sampling completed in accordance with the sampling guidelines described in Section 15;
- Preparation of an air monitoring report by a suitably qualified occupational hygienist; and
- Backfilling of the excavation with material validated in accordance with the guidelines endorsed by the ACT EPA. The backfill material must be Virgin Excavated Natural Material (VENM).

AEC 1 and 2

- Depending on ACT EPU approval all scraped ACM contaminated soil should be suitable for off site disposal without a formal chemical waste classification once the leachability status of the heavy metals has been established based on the *Waste Disposal Plan* (DP 2012) and could be loaded straight into trucks and transported to the pre-approved waste facility; and
- The ACM contaminated soil within the AEC should be scraped up and stockpiled and/or loaded within the footprint of the individual AEC.

AEC 3 and 4

- Prior to excavation works proceeding in the vicinity of the southeast portion of the site, the stability of the excavation will need to be considered, further detail is provided in Section 12.3.
- All uncontaminated topsoil fill and general fill should be removed and stockpiled in an approved location outside the AEC for reuse on site, the removal of the fill must be done under full time supervision of an Environmental Consultant to minimise the potential for cross contamination with dispersed contaminated soil from the test pits (excavated during the contamination assessment) and/or underlying contaminated soil;
- The topsoil fill should be stockpiled separately to the underlying general fill as the topsoil filling will be geotechnically unsuitable for reused as engineered fill due to its silt and organic content;
- The general 'clean' fill should be distinguishable from the underlying 'contaminated' fill as it is generally yellow, orange and red in colour and placed in compacted layers absent of deleterious materials, this is in contrast to the 'contaminated' fill which is brown, grey and black and loosely placed with abundant amounts of deleterious materials;
- Validation sampling as detailed in Section 15.1 for the stockpiled fill will be required to confirm the suitability of the soil to stay on site;
- The lead and TPH contamination in Pits 57 and 58 will be required to be remediated first to delineate the potential chemical contamination that exists. The remediation should be conducted under full time supervision by the environmental consultant to confirm the extent of chemically affected soil. The soil will need to be stockpiled and undergo a waste classification to establish

the leachability status of the lead and establish a better characterisation the total concentration of TPH as a mobile contaminant in this soil;

- The remediation of AEC 4 will need to be undertaken in stages so that stockpiling (where required) can be undertaken within the area of the AEC 4 and to control dust generation, excavated;
- Stockpiles of 'contaminated' fill should not exceed 250 m³ if required;
- Any potentially chemically contaminated soil should be stockpiled separately and subjected to a formal waste classification in accordance with Section 12.5;
- Depending on ACT EPU approval all excavated ACM contaminated soil should be suitable for off site disposal without a formal chemical waste classification once the leachability status of the heavy metals has been established based on the *Waste Disposal Plan* (DP 2012) and could be loaded straight into trucks and transported to the pre-approved licensed waste facility;
- During the excavation of contaminated soil any building rubble or waste materials (i.e. timber, steel, tyres etc.) should be separated out where possible and recycled or treated separately; and
- If during the removal of contamination it is found through delineation of the contamination that the trunk of a tree is located over contaminated soil, the tree will need to be removed in order to remediate the affected area. If only a portion of the roots are required to be removed and it is desired to preserve the tree then an arborist should be employed to determine if the tree should remain;

Constitution Avenue Corridor

- The Constitution Avenue corridor was outside the scope of the contamination assessment for the Section 5 development undertaken by DP and, as such, a contamination assessment including subsurface investigation of the road reserve is required by the ACT EPA where the "extent of contamination" is unable to be delineated within the Section 5 development (i.e. along the southern Section boundary) during remediation works;
- Prior to the completion of the remediation works a series of test pits along the road verge beyond the remediation works of AEC 4, will need to be undertaken to assess the "extent of contamination" associated with AEC 4 beyond the southern cadastral boundary of Section 5. The investigation would need to assess and where possible delineate whether:
 - o the contamination terminates in the northern verge of Constitution Avenue;
 - o extends or terminates potentially beneath, Constitution Avenue; or
 - o extends or terminates with the southern verge of Constitution Avenue.
- The investigation around AEC 4 would extend south until delineation of contamination had been established. All contamination within the northern verge would need to be remediated such that any contaminated fill is either removed or is subjected to the requirements of on-site containment detailed in Section 9;
- An SAQP will be developed to outline the proposed testing and analysis programme to be adopted in delineating the "extent of contamination" within AEC 4 beyond the Section 5 development;

- Where contamination is confirmed a marker or barrier layer (geo-textile fabric such as Bidim A14 or similar) will be established at the Section 5 cadastral boundary and over any contaminated fill to be left in place in the verge;
- Detailed survey of the “extent of contamination” to be contained on-site will be required for future management and validation of the site;
- Within the verge a minimum of 0.5 m of contaminated soil below the existing surface levels or to natural ground or deeper at nominated locations (for tree plantings) will be excavated and removed. A barrier layer of geo-textile is to be placed over the remaining contaminated fill followed by certified clean fill to create the containment cover of a minimum 0.5 m; and
- The geo-textile (e.g. Bidim A14) must be water permeable, highly visible, rot-proof and chemically inert, have high tensile strength and must be layered 0.5 m beyond the contaminated area where practical in parallel sheets fixed together or overlapped by 0.2 m.

AEC 5

- Depending on the approval to disturb the Golden Sun Moth Habitat the burnt material at the surface should be scraped up and stockpiled within the AEC footprint and then subjected to a formal waste classification prior to disposal.

The removal of the asbestos contaminated material will require the commissioning of an appropriately licensed Class A Asbestos Contractor and the process must also meet relevant OHS requirements laid down by the relevant authorities. Daily airborne asbestos fibre monitoring must be undertaken by a qualified Occupational Hygienist during the removal. All asbestos contaminated fill material must be disposed of to an appropriately licensed waste depot.

Contamination within AEC 4 is likely to exist beyond the southern boundary to Section 5 (to be assessed) and, where this is encountered; a geo-textile marker layer will be put in place. This will help to prevent asbestos contamination entering the Section 5 site from the road reserve prior to backfilling or basement construction and provide a marker layer to provide an indicator that future redevelopment works may encounter contamination within the Constitution Avenue corridor.

Remediation of the AEC is required to be undertaken prior to construction of the proposed development. Any potentially contaminated material identified following remediation of the site must be managed under a Construction, Environmental and Management Plan (CEMP) which would include an ‘unexpected finds protocol’, assessment, validation and disposal.

12.3 Excavation Stability

Excavation depths of at least 2.5 m are anticipated in AEC 4 within the southeast portion of the site. Validation sampling at this location will require that the walls of the excavation are stepped and battered or battered to reduce any potential hazard. The composition of filling along the southern boundary of site is unknown at this stage. It is likely that the filling will be around 2.5 m in depth and its ability to stand vertically for any period of time is unknown. Consideration will also have to be given to services when excavating near the Section 5 site boundary, as service trenches in the road verge may provide a zone of weakness which could cause soil and filling to collapse.

Where there are no buried services and there is available space temporary battering of the filling could be attempted by the Contractor. It is the Contractors responsibility to construct safe batter slopes based on the site conditions exposed and risk assessment based process. A suitably qualified geotechnical engineer should be engaged to assess the stability and provide further recommendations on batter stability and shoring requirements where necessary. With respect to unsupported excavations, reference should also be made to the model Code of Practice for Excavation Work issued by Safe Work Australia and adopted by WorkSafe ACT (August 2012),

In the situation where battering is not feasible, it is assumed a permanent retaining wall structure will be needed to be installed. It is understood the retaining wall proposed will comprise bored piers with concrete infill panels; the inclusion of a geo-textile fabric (such as Bidim A14 or similar) separation layer behind the concrete panels should be included for occupation health and safety reasons during construction. The drilling of bored piers for the wall would need to comply with the requirements of this RAP specifically when intercepting contaminated filling.

12.4 Contingencies for Unexpected Finds

12.4.1 General

Should unexpected contamination or other unexpected find (tanks, drums etc) be identified during the remediation or construction phases of the redevelopment, the following general approach will be adopted:

- Stop all works at the location of the unexpected finds.
- Notify the Remediation Contractor's Site Supervisor of the find;
- At the instruction of the Remediation Contractor's Site Supervisor, place barricades around the affected area and cease work in that area; and
- Notify the Environmental Consultant for an assessment of the find in terms of the potential impact to human health and the environment.

Further remediation may be required following the assessment by the Environmental Consultant; however, this will be dependant upon the type of the find and the severity of the potential impact.

If during remedial works, further suspected asbestos containing material is observed within parts of the site where it has not yet been identified then the remedial works should cease immediately and an appropriately qualified consultant should review and assess the material and/or the site condition. If the presence of asbestos is confirmed, then the remedial works should be expanded to include these areas.

12.4.2 Groundwater

Given that groundwater is believed to exist at depth in the subject area and the site is underlain by clay and likely shallow bedrock (thereby reducing the potential transport pathways), a groundwater assessment of the site has not been undertaken. If during the validation process, contamination is found to have extended in depth such that the base of the remediation area has to be substantially extended, further assessment should be undertaken to assess whether the contamination has

adversely affected the groundwater. Assessment should include the installation of a number of groundwater monitoring wells to enable a groundwater assessment. Groundwater quality must be assessed against appropriate groundwater investigation levels (GILs) based on ANZECC (2000) *Guidelines for Fresh and Marine Water Quality* for potential beneficial use unless it can reasonably be excluded on the basis of water quality or aquifer hydraulic properties.

12.5 Minimisation of Cross Contamination

Given the work area and nature of the site, measures should be enforced to eliminate the potential for cross contamination.

- Areas that are to be remediated, should be delineated and isolated. Plant and vehicle movements from these areas should be restricted to a defined path. Plant and vehicles will pass over a wheel shaker bay before exiting the site onto the public road system;
- Plant/truck movements within areas of active remediation should also be restricted and monitored to ensure vehicles do not pass over previously excavated and/or validated areas.

12.6 Waste Disposal

All material to be disposed off site, that is not pre-approved by the ACT EPU to be disposed of, must undergo appropriate sampling and analysis at a minimum frequency of 1 sample per 25 m³ to provide a classification of the materials for waste disposal in accordance with the *ACT's Environmental Standards: Assessment, Classification, & Management of Liquid & Non-Liquid Wastes* (2000). No material is to be removed off site without Environment Protection Unit approval. If the material contains asbestos it will automatically classify as *asbestos contaminated soils* and be classified accordingly under the above guidelines. As the asbestos waste facilities within the ACT are not within a landfill containment cell they are dependant on the chemical concentrations within the waste.

Guidance in the form of thresholds for the disposal of contaminated soils at landfills without performing a TCLP (leaching) test are provided by the Environment Protection Unit of Environment and Sustainable Development Directorate in the *Environmental Standards: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (2000) and relevant parameters are shown in Table 4. Stockpile materials that exceed maximum concentration thresholds in Table 4 will be further tested for leachability to confirm its classification. As shown in Table 5 disposal concentrations when used together with TCLP values are increased. Disposal methods will depend on the results obtained.

Table 4: Contaminant Threshold Values for Waste Classification without doing the Leachate Test

Contaminant	Maximum Values of Total Concentration for Classification without TCLP (mg/kg)			CAS Registry Number
	Inert Waste	Solid Waste	Industrial Waste	
Arsenic	10	100	400	-
Benzene	1	10	40	71-43-2
Benzo(a)pyrene	0.08	0.8	3.2	50-32-8
Cadmium	2	20	80	
Chromium (total)	10	100	400	
Ethylbenzene	60	600	2400	100-41-4
Lead	10	100	400	
Mercury	0.4	4	16	
Nickel	4	40	160	
C6-C9 petroleum hydrocarbons	N/A	N/A	N/A	-
C10-C36 petroleum hydrocarbons	N/A	N/A	N/A	-
Phenol (non-halogenated)	28.8	288	1152	108-95-2
Polychlorinated biphenyls	N/A	N/A	N/A	1336-36-3
Polycyclic aromatic hydrocarbons (total)	N/A	N/A	N/A	-
Toluene	28.8	288	1152	108-88-3
1,1,1-Trichloroethane	60	600	2400	71-55-6
1,1,2-Trichloroethane	2.4	24	96	79-00-5
Xylenes (total)	100	1000	4000	1330-20-7

Notes: For additional information refer to the Environmental ACT Standards: Assessment, Classification & Management of Liquid & Non-liquid Wastes (2000).

Table 5: Leachable Concentration (TCLP) and Total Concentration (SCC) Values for Waste Classification

Contaminant	Maximum Values for Leachable Concentration and Total Concentration when used together						CAS Registry Number
	Inert Waste		Solid Waste		Industrial Waste		
	Leachable Conc. TCLP1 (mg/L)	Total Conc. SCC1 (mg/kg)	Leachable Conc. TCLP2 (mg/L)	Total Conc. SCC2 (mg/kg)	Leachable Conc. TCLP3 (mg/L)	Total Conc. SCC3 (mg/kg)	
Arsenic	0.5	500	5.0	500	20	2000	
Benzene	0.05	18	0.5	18	2	72	71-43-2
Benzo(a)pyrene	0.004	1	0.04	10	0.16	23	50-32-8
Cadmium	0.1	100	1.0	100	4	400	-
Chromium (total)	0.5	1900	5	1900	20	7600	-
Cresol (total)	20	7200	200	7200	800	28800	1319-77-3
Ethylbenzene	3	1080	30	1080	120	4320	100-41-4
Lead	0.5	1500	5	1500	20	6000	-
Mercury	0.02	50	0.2	50	0.8	200	-
Nickel	0.2	1050	2	1050	8	4200	-
C6-C9 petroleum hydrocarbons	-	650	-	650	-	2600	-
C10-C36 petroleum hydrocarbons	-	5000	-	10000	-	40,000	-
Phenol (non-halogenated)	1.44	518	14.4	518	57.6	2073	108-95-2
Polycyclic aromatic hydrocarbons (total)	-	200	-	200	-	800	-
1,1,1-Trichloroethane	3	1080	30	1080	120	4320	71-55-6
1,1,2-Trichloroethane	0.12	43.2	1.2	43.2	4.8	172.8	79-00-5
Xylenes	5	1800	50	1800	200	7200	1330-20-7

Notes: For additional information refer to the Environmental ACT Standards: Assessment, Classification & Management of Liquid & Non-liquid Wastes (2000).

12.7 Imported Clean Fill

Material imported to site to be used to backfill excavations and/or raise site levels shall be free from all contaminants and appropriately certified as Virgin Excavated Natural Material (VENM). The importation of VENM will be accompanied by an environmental consultant's report for each site certifying that the material is VENM. The report will identify the source site, description and quantity of the VENM, provide a brief description of the history of use of the source site and provide chemical data in comparison to background soil concentrations for a wide range of commonly found contaminants. Depending on the location of the source material the imported fill is recommended to be sampled at a minimum 1 in 400 m³.

13. Environmental Management Plan

13.1 General

The work shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The contractor shall have in place an Environmental Management Plan (EMP) such that work on the site complies with the requirements of relevant occupational and environmental legislation.

In particular, the EMP will provide documented procedures for control of asbestos management, water run-off (including sediment control, erosion and leachate controls) and control of fugitive dust emissions.

The contractor shall also be responsible to ensure that the site works comply with the following conditions:

- Fugitive dust leaving the confines of the remediation areas is minimised;
- No water containing any suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- Stockpiles (where required) must be suitably managed with bunding or silt fencing to prevent contaminated sediments from leaving the vicinity of the stockpile and adequate dust suppression must be applied to the surface of the stockpile;
- Vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- Noise and vibration levels at the site boundaries comply with the legislative requirements; and
- Contingency measures for the management of the site during periods of heavy rainfall, water within excavation areas, handling and management of saturated soils and equipment failures and spills.

The successful contractor should develop a site emergency response plan (ERP) and occupational health and safety plan (OHSP). These will maintain the safety of the personnel working on the site, given any likely emergency situation that may occur. The OHSP and ERP should include emergency phone numbers and details of local emergency facilities.

13.2 Asbestos Management

An Asbestos Management Plan (AMP) must be included in the EMP. The AMP will set out the responsibilities, procedures and safeguards that will be followed by the Contractor for any unexpected finds and the ongoing management and handling of asbestos contaminated soil within the site.

13.3 Stormwater Management

The site is currently forms part of the stormwater system of the immediate parts of the surrounding suburb. A culvert directs water onto the site from the northwest, while surface runoff from the surrounding streets to the west, north and east allow some surface water runoff to flow onto the site.

As the majority of the remediation works are located within a major site surface drainage path, upstream cut off drains and surface drainage realignment measures may need to be implemented.

13.4 Noise Control

The site is located in a residential area. The nearest receptors are residents living almost adjacent to the area of remediation. No excessively noisy operations (e.g. rock hammering, piling) will be required for the remedial work. Noise and vibration will be restricted to reasonable levels. Remedial works will be undertaken between the hours of 7 a.m. and 6 p.m. Monday to Saturday in accordance with the ACT regulations unless otherwise stated in relevant conditions of the development approval. It is not proposed to employ any specific noise mitigation measures.

13.5 Odour Control

Given the nature of the identified contaminants and the observations made during the contamination assessment, no odour issues are envisaged as a result of the remediation of this site. However, in the event that unexpected odorous material is encountered or odour complaints are received from the surrounding community then the protocols outlined in Section 12.3 for 'unexpected finds' will need to be followed.

13.6 Traffic Control/Management

Given that Constitution Avenue is an arterial road some form of traffic control measures are envisaged. These measures will depend on how access arrangements are designed for the site. Local residents should be advised of the potential for traffic disruptions via the Community Consultation process. All on-site vehicular traffic shall use only demarcated internal routes and approved public highway routes to and from the selected landfill.

All loads shall be covered and lightly wetted to ensure that no materials or dust are dropped or deposited outside or within the site. Each truck, prior to exiting the site, shall proceed through an appropriate shaker bar and lead-in and lead-out crushed rock/ concrete located near the designated exit point. The streets near the exit point must be cleaned at the end of each day by a mechanical sweeper or be hand swept depending on the extent of deposited material on the street.

Each truck exiting the site shall be inspected by the contractor or remediation consultant prior to despatch and either logged out as clean wheels and chassis or hosed down into the wheel wash or wash down bay until deemed clean by the remediation consultant or contractor.

13.7 Public Complaints System

Any complaints received during the works shall be noted and the Developer/Project Manager will take all necessary actions to address the cause of complaint.

13.8 Dust Management Program

The site is located in both a residential and commercial area. The potential for substantial dust generation during the excavation and scraping process or during stockpile formation is elevated. To control the generation of dust from the site during remedial works it is proposed to implement a dust management program consisting of:

- In AEC 1 and 2 where the contamination is ACM in topsoil, water spraying the remediation area should be undertaken prior to commencement of the remediation works (i.e. the day before) to appropriately “condition” (dampen) the soil to the depth of scraping. This could also be undertaken at the end of each day in deeper excavation areas to “condition” the fill for the next days remedial works;
- If during excavation, appreciable volumes of dust are produced (this will be determined by a visual inspection), dust control measures will be intensified and the works area will be watered down with light water spray to “condition” the material;
- The application of water to the excavated or scraped material being stockpiled for waste classification purposes and during the loading of trucks (if dust is being generated);
- Vehicle access will be limited to those vehicles required within the area of remediation;
- Temporary haul roads should be created using cones/witches hats;
- Previously remediated areas will be off limits to vehicular traffic (with the exception of the water cart (properly washed down and decontaminated) if dust suppression is required);
- Trucks will be loaded on site and not on the street;
- Drop height will be minimised when loading ACM impacted soil onto trucks; and
- Haul routes, if created will be wetted as required and scraped at the completion of works.

The implementation of the above dust management methods will be refined with input from the appointed earthwork contractor.

13.9 Decontamination Procedures

The Contractor shall reduce, as far as is practicable, the potential for soil to be tracked off the site through adherence on the tyres of vehicles. This could include a restriction on off-site vehicle movement during wet conditions, the manual cleaning of vehicle wheels prior to vehicles leaving the site, the use of a shaker bar and lead-in and lead-out crushed rock/ concrete.

14. Occupational Health and Safety

14.1 General

The contractor will prepare a Safe Work Method Statement (SWMS) to be reviewed by an Occupational Hygienist to ensure suitable OH&S measures for working with asbestos are adopted. All personnel on site should be required to wear the following protection at all times:

- Steel-capped boots;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary, particularly during demolition);
- Hard hat meeting AS1801-1981 requirements; and
- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards.

When personnel are required to work within the asbestos remediation areas where potential contact with contaminated soil, other materials or water, the following, additional Modified Level D Protection will be required:

- Disposable coveralls (if necessary) to prevent contact with asbestos, splashed soil, materials or water;
- Respiratory protection meeting AS1715-2009 requirements;
- Nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves;
- Any additional protection identified by the Occupation Hygienist.

Earthwork machinery operators should stay in the air-conditioned cab of their vehicle while in the area where remedial works are being undertaken. Workers not in air-conditioned vehicles or while out of their vehicles should wear a dust mask while within the area of remedial works. The remediation areas shall be demarcated.

All contractors are required to show compliance with relevant Occupational Health and Safety Regulations, including the preparation of a Site Safety Management Plan and Safe Work Method Statements.

14.2 Para-occupational Monitoring

A Para-occupational Monitoring Plan must be developed by the Class A licensed asbestos removal contractor and approved by a suitably qualified Occupational Hygienist. Monitoring will use the "Membrane Filter Method" with monitoring locations situated both inside and outside the works area. Sampling will be undertaken over each day of remedial works. The monitoring locations will need to be placed based on wind direction (to be determined on the day) and located at sensitive receptors (i.e. surrounding residential development and site office located outside the remediation areas). The Plan should be detailed and indicate monitoring locations, number, methods and turnaround time for reporting in case of positive detections. The Plan should be provided as part of the contractors' tender.

Para-occupational samples will be submitted to a NATA accredited lab for analysis. It should be noted that the analytical method does not differentiate between the types of fibres and reported fibres may not be asbestos.

15. Validation Plan

15.1 Validation Sample Collection and Analysis

15.1.1 Stockpiled Topsoil and General Fill (AEC 3 and 4)

Once uncontaminated topsoil and general fill, overlying the contaminated fill in AEC 3 and 4, have been removed and stockpiled, the stockpiled soil must be assessed and validated to confirm the suitability of the soil to remain on site for reuse.

It is anticipated that the 'clean' fill will be distinguishable from the 'contaminated' fill and that there will be more than 2500 m³ of 'clean fill to be removed and stockpiled. Based on the *Victorian EPA (June 2009) Industrial Waste Resource Guidelines 702: Soil Sampling*, sampling rates of 1 in 250 m³ could be adopted. However if there is any uncertainty in segregating the fill materials or if the volumes are less than anticipated the, a greater sampling frequency would be warranted.

Test pits must be excavated within the stockpile(s) to the full depth, with samples collected and analyses based on 1 sample per 250 m³ of stockpiled soil as detailed above or 1 per stockpile which ever is the greater. The minimum number of test pits will be governed by the number of samples required with one sample analysed from each test pit. Samples must be analysed for the full analytical suite of contaminants listed in Table 3.

If results of the assessment indicate that the stockpile(s) do not comply with the RAC then further separation, assessment and removal of contaminated soil will be required. All material requiring off-site disposal will require waste classification in accordance with Section 12.5 and all final disposal dockets to the approved waste facility will need to be forwarded to the Environmental Consultant for reporting.

15.1.2 Remediated AEC

Excavation of contaminated material shall continue until the analytical results indicate the remaining material complies with the RAC. If results indicate that additional excavation is necessary, such excavation shall extend until the validation samples indicate that the material remaining complies with the RAC.

Samples must be collected from the base (and walls where applicable) of all AEC to confirm that no contamination remains on site. All locations should be both visually and analytically assessed.

15.1.2.1 Asbestos Validation

Validation for ACM would be undertaken by visually assessing the base and walls of the excavations. Visual assessment will be undertaken by a walkover of the delineated AEC and raking of the surface to assess the upper 10cm of the remediated soil surface. For AEC that are delineated to an area less than 100 m² (likely to be AEC 1 to 3) the entire wetted natural soil surface should be raked including walls and base of the excavation. For delineated AEC greater than 100 m², (likely to be only AEC 4) the base and walls should be assessed by raking a 1 m x 1 m point at varies grid (base) and linear (walls) points within the wetted natural soil surface for a visual assessment the number of points will be dependant on the delineated remediation area of each AEC. A 500 ml sample for laboratory

assessment for asbestos fines (AF) and fibrous asbestos (FA) will also be collected at each assessment point, based on the Western Australia (WA) Department of Health (DoH) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA DoH, 2009)

Based on the *WA DoH, 2009 – Table 1*, once remediation has been undertaken the likelihood of ACM within an AEC would be considered as “Likely” before being validated.

Given the WA DoH 2009 guidelines, a validation regime would include a site walkover conducted in a grid pattern at two times the minimum sampling grid given in the NSW *Sampling Design Guidelines*, 1995 for the area of each delineated AEC and sampling (raking points) also based on two times the minimum sampling grid given in the NSW *Sampling Design Guidelines*, 1995 for the area of each AEC. In addition the entire length of the walls of each AEC excavation will be inspected and sampling (raking) will be undertaken at a minimum of 1 location per 5 linear metres at depth intervals of 1 m (if the excavation is circular the wall should be divided in to four segments, measured and sampled accordingly) as recommended in the WA DoH 2009 guidelines.

Land surrounding the delineated AEC 1 and 2 should be assessed for ACM contamination within the superficial topsoil layer by a series of shallow test pits at ‘step out’ locations of 1 m to 2 m from the AEC boundary. The test pits should be excavated between the samples required in the wall of the excavation.

15.1.2.2 Chemical Validation

A visual inspection must be undertaken and validation samples must be collected at the following densities for field screening with a photoionisation detector (PID) and laboratory analysis. Laboratory analysis must be undertaken on the full analytical suite of contaminants listed in Table 3 at AEC 3, 4 and 5 (refer to Drawings 1 and 2 Appendix A):

- In the upper 1 m of the existing soil profile and for the full depth in areas where chemical contamination has previously been identified (i.e. Pits 57 and 58) or for AEC 3 and 5:
 - o One sample per wall at a minimum density of 1 sample per 10 linear metres (if the excavation is circular the wall should be divided into four segments, measured and sampled accordingly);
 - o A minimum of two samples from the base of each AEC at a minimum density of 1 sample per 5 m grid.
- In the soil profile below existing surface levels in AEC 4
 - o One sample per wall at a minimum density of 1 sample per 20 linear metres at depth intervals of 1 m (if the excavation is circular the wall should be divided into four segments, measured and sampled accordingly);
 - o A minimum of four samples from the base of each AEC at a minimum density of 1 sample per 20 m grid.

It is estimated that AEC 4 will cover an area of 100 m by 100 m (1 ha), as such it is considered that a sampling grid size of 20 m would be appropriate for the base of the excavation based on the minimum

sampling points required for an area of this size (based on the *NSW EPA (1995) Sampling Design Guidelines*).

If sampling indicates contamination levels in excess of the adopted guideline the material should be 'chased out' via "step-out" excavation and the excavated material disposed of accordingly. All material requiring off-site disposal will require approval to be transported and may require waste classification in accordance with Section 12.5. All final disposal dockets to the approved waste facility will need to be forwarded to the Environmental Consultant for reporting.

15.2 Sample Collection and Handling

Sampling must be undertaken directly from the exposed surface of excavations or stripped areas. Sampling data shall be recorded to comply with routine Chain of Custody requirements.

The general sampling, handling, transport and tracking procedures comprises:

- The use of stainless steel sampling equipment;
- Washing of all non-disposable sampling equipment, such as hand tools, in a 3% solution of phosphate-free detergent (Decon 90), then rinsing with 'clean' water prior to each sample being collected; transfer of the sample into new glass jars, sealed with a Teflon lined lid, or plastic bags, with each plastic bag individually sealed to eliminate cross contamination during transportation to the laboratory;
- Labelling of the sample containers with individual and unique identification including project and sample number;
- Placement of the containers into a chilled, enclosed and secure container for transport to the laboratory; and
- Use of Chain of Custody documentation to ensure that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

15.3 Quality Assurance Plan

15.3.1 Field Quality Assurance and Quality Control

Quality Assurance (QA) and Quality Control (QC) procedures will be adopted throughout the field sampling programme to ensure sampling precision and accuracy and prevent cross contamination. The environmental consultant will ensure sampling accuracy and precision through the minimum analysis of 1 intra-laboratory replicate per 10 samples analysed and one inter-laboratory replicate per 20 samples analysed for QA/QC checks.

Trip blank samples will be included for each day of sampling operations and analysed for the same analyte set as the replicates (above) to confirm that cross contamination of the samples has not occurred during transportation. Where non-disposable sampling equipment is used a rinsate sample for each day of sampling operations will be included. Appropriate sampling procedures will be undertaken to ensure that cross contamination does not occur. It should be specified that:

- Standard operating procedures are followed;
- Site safety plans are developed prior to commencement of works;
- Replicate field samples are collected and analysed;
- Samples are stored under secure, temperature controlled conditions;
- Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory; and that
- Proper disposal of contaminated soil, fill or groundwater originating from the site area is completed.

15.3.2 Laboratory Quality Assurance and Quality Control

The laboratory will undertake in-house QA/QC procedures involving the routine testing of:

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;
- Analysis of control standards;
- Calibration standards and blanks; and
- Statistical analysis of QC data including control standards and recovery plots.

In addition, the analytical laboratory will be required to provide evidence that their analytical results are correct, through analysis of certified reference material and/or reanalysis of extracts by another NATA accredited laboratory.

The laboratory in-house QA/QC testing procedures for asbestos testing are not possible as the results are a 'detected' or 'not detected' answer involving observations of samples by qualified personal from a NATA accredited laboratory.

15.4 Achievement of Data Quality Indicators

Based on the analysis of quality control samples i.e.: replicates and in-house laboratory QA/QC procedures, the following data quality objectives will be required to be achieved:

- Conformance with specified holding times;
- Accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants);
- Field replicate and laboratory duplicate samples to have a precision average of +/- 35% relative percent difference (RPD) for inorganic analytes and +/- 50% RPD for organic analytes; and
- Field replicates will be collected at a frequency of 10% of all samples.
- Trip blanks will be included with each day of sampling and shall be below or close to laboratory detection limits.

Based on a fulfilment of the data quality objectives an assessment of the overall data quality will be presented in the final validation report.

15.5 Evaluation of Validation Sampling Results

The information obtained through the validation assessment to be undertaken will be used to characterise the subject site in terms of contamination issues and risk to human health and/or environment. To characterise the AEC as successfully remediated, the following will need to be satisfied (based on the *NSW EPA (1995) Sampling Design Guidelines*):

- The 95% UCL of the arithmetic mean of the data set is less than the SAC;
- The standard deviation of the data set is less than 50% of the SAC;
- No individual test result is greater than 250% of the SAC.

15.6 Validation Reporting

A validation assessment report will be prepared by the Environmental Consultant in accordance with the ACT EPA *Contaminated Sites Environment Protection Policy* (2009) and other appropriate guidance documentation. The validation report shall confirm that each given area of contamination has been remediated to a suitable standard for the proposed redevelopment and occupation and that no related adverse human health and environmental effects have occurred as a result of the temporary works. The validation report shall also include a summary of the information from previous investigations.

The validation report shall include:

- Scope of work
- Site identification
- A summary of the site history, site condition and the surrounding environment, geology and hydrogeology;
- Details of the total volume of contaminated materials removed from the site;
- Drawings showing contamination assessment sample locations and validation sample locations as well as any pertinent features;
- Sampling plan and methodology
- Quality Assurance/ Quality Control data evaluation
- Detailed analytical results were obtained;
- Confirmation that placed fill is appropriately certified;
- The final disposal destination of the materials removed from site and
- Conclusions and recommendations.

The objective of the final validation report will be to confirm the site has been appropriately remediated and is therefore suitable for the intended development. Construction must not commence until the

findings of the report are reviewed and endorsed by the Site Auditor and/or Environment Protection Authority. A clear statement must be made in the conclusion of the report that the site is suitable (or not) for the proposed and permitted uses defined in Section 1.5.4 of the NCP.

16. Conclusions and Recommendations

The previous contamination assessment was limited by the vegetation across the site comprising both heavy grass cover and mature trees. The vegetation and heavy grass cover obscured observations for signs contamination and in particular fragments of ACM on or near ground surface across site surface. Further limitations for the assessment included the exclusion areas within the tree drip line around mature trees and Golden Sun Moth habitat. These limitations will also affect the remediation and validation of these areas and the suitability of these areas will not be able to be confirmed.

Following remedial and validation works undertaken as detailed in this RAP, it is considered that the site would be suitable for redevelopment for residential, commercial and open space land-use subject to the implementation of the following plans:

- a long term Environmental Management Plan (EMP) for the Constitution Avenue verge on-site containment of contaminated fill, and
- a Construction, Environmental and Management Plan (CEMP) for Section 5 development area.

The EMP for the verge will detail the aerial extent, the management protocols and controls and the long-term stewardship and responsibilities for the contained contaminated fill. While the CEMP for the Section 5 development area will address those areas inaccessible during the contamination assessment and/or subsequent remedial works. The CEMP will include an unexpected finds protocol for the site to facilitate the appropriate management of unidentified ACM that may be encountered during and following development. In addition to asbestos-containing materials (ACM) the unexpected finds protocol should also include triggers for other potential contaminants of concern and for groundwater assessment. Once the construction of internal roadways and services have been completed and the development blocks have been created the CEMP would be required to be converted, with some modifications where required, into a long term EMP. The EMP would address potential unexpected finds by developers, primarily concerning the potential for ACM fragments being present at shallow depths within surface (topsoils) soils or previously obscured by vegetation (heavy grass cover).

17. Limitations

Douglas Partners (DP) has prepared this report for a project at Section 5, Campbell ACT in accordance with DP's proposal dated 21 September 2010 and acceptance received from the Land Development Agency (LDA) on 30 September 2010. The report is provided for the exclusive use of LDA for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

About this Report
Drawings 1 and 2

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Locality Plan




LEGEND

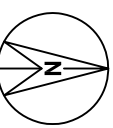
- Approximate Site Boundary
- Approximate Southern Cadastral Boundary of Section 5
- Approximate Extent of AECs
- Approximate Extent of Golden Moth Habitat



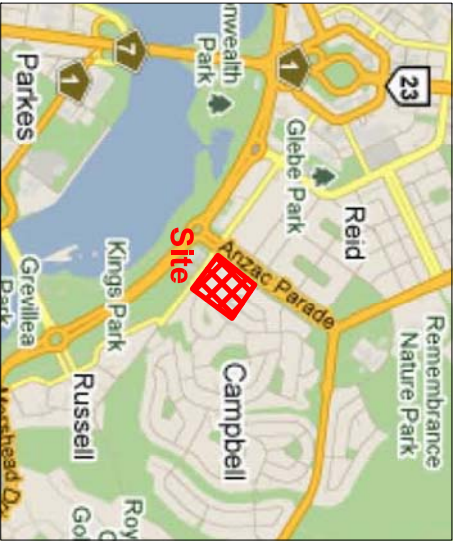
NOTE: Base drawing from Cardno Young Pty Ltd (Drawing 110029-CQT-01, dated 8 November 2011)

**Douglas Partners**
Geotechnics | Environment | Groundwater

CLIENT: Land Development Agency		TITLE: Approximate Areas of Environmental Concern	
OFFICE: Canberra	DRAWN BY: AZR	Remediation Action Plan	
SCALE: As Shown	DATE: 04.02.2013	Section 5, Constitution Avenue, Campbell, ACT	



PROJECT No:	50584
DRAWING No:	1
REVISION:	C



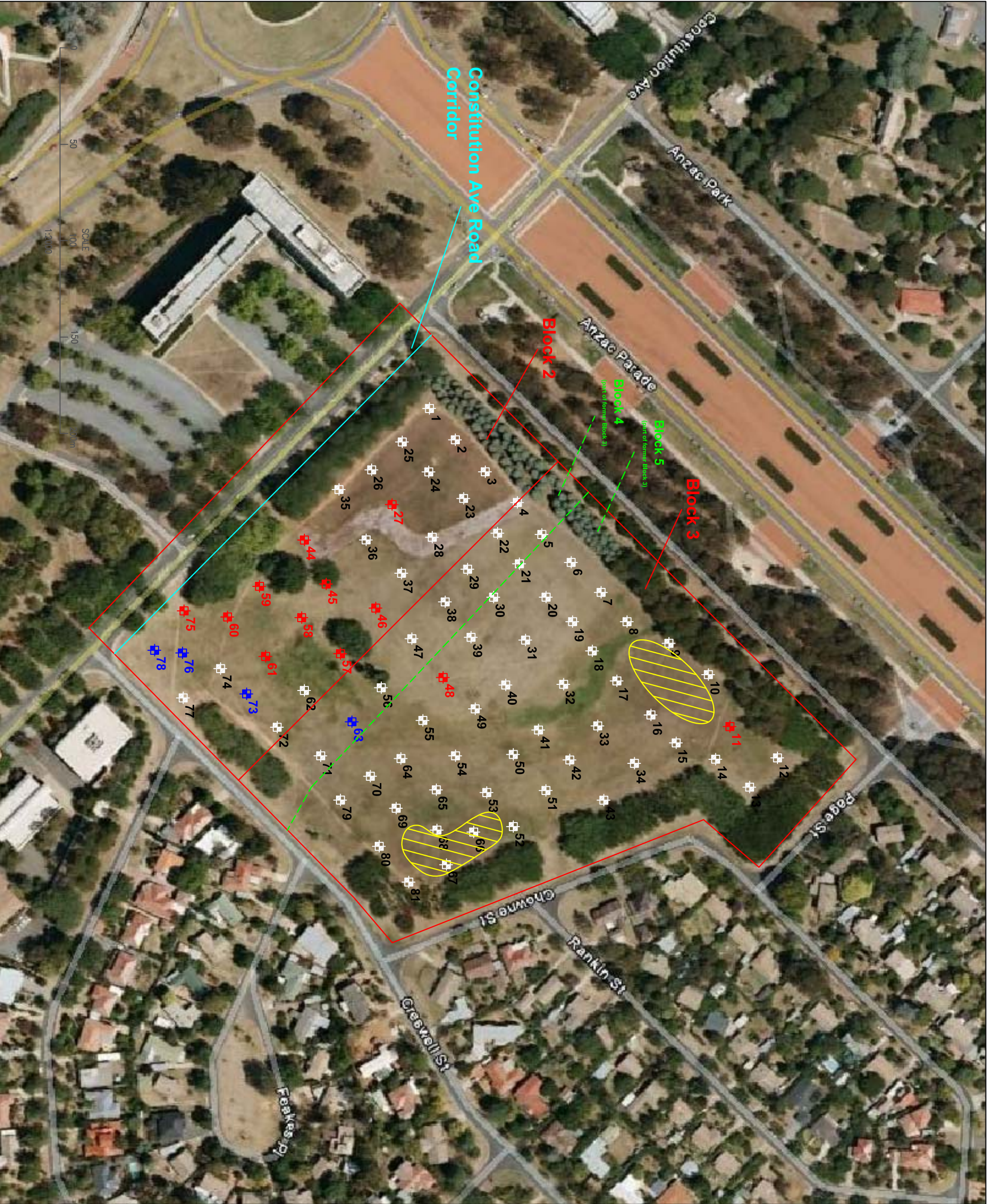
Locality Plan


NOTE:
Base drawing from Google Earth Pro,
Image Captured 1-Mar-2008 (2010 Whereis Sensis)

Pits 66 and 67 where not excavated due to the presence of Golden Sun Moth habitat

LEGEND

- Test Locations where ACM was observed
- Test Locations where minor bricks, concrete etc. no ACM observed
- Test Locations where no building rubble or ACM was observed
- Approximate Site Boundary
- Approximate Boundary of Golden Sun Moth habitat
- Approximate Internal subdivision boundary of Block 3
- Approximate Southern Cadastral Boundary of Section 5



<div>Douglas Partners Geotechnics Environment Groundwater</div>		CLIENT: Land Development Agency		TITLE: Test Locations	
OFFICE: Canberra		DRAWN BY: AZR		Remediation Action Plan Section 5, Constitution Avenue, Campbell, ACT	
SCALE: As shown		DATE: 04.02.2013			
					
				PROJECT No: 50584	
				DRAWING No: 2	
				REVISION: D	