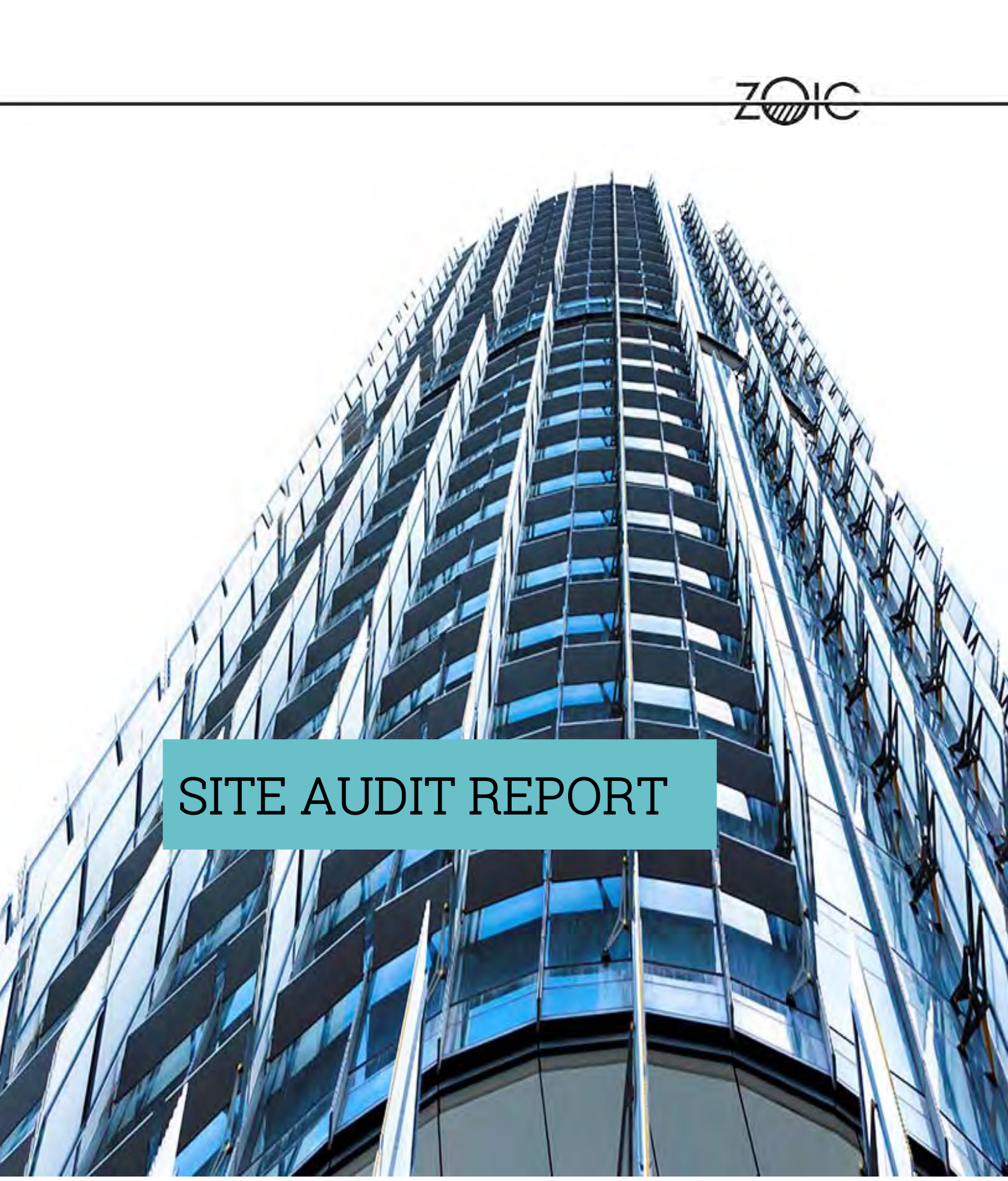

SITE AUDIT REPORT

Molonglo Valley Stage 3 Future Urban Area: Area B

ACT Government Environment, Planning and Sustainable Development Directorate
June 2017

12080SAR23_AreaB

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This report was prepared in accordance with the scope of services set out in the contract between Zoic Environmental Pty Ltd, ABN 23 154 745 525, and the client.

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Executive Summary

The ACT Government Environment, Planning and Sustainable Development Directorate on behalf of the ACT Land Development Authority (LDA), commissioned Rebeka Hall of Zoic Environmental Pty Ltd (Zoic), a New South Wales Environment Protection Authority (NSW EPA) accredited contaminated land Auditor (accreditation number 0802) to conduct a contaminated land Site Audit.

This Site Audit was conducted to provide an independent review of the suitability and appropriateness of environmental investigation works completed in Area B ('the site'), within the Molonglo Valley Stage 3 (MV3) Future Urban Area as shown in Figures in Appendix A. The total MV3 area occupies approximately 1,145 hectares and the property was divided and separately investigated in two parts referred to as:

- Area A (southern portion of MV3) covers approximately 464 hectares with a small portion (5ha) at the central eastern boundary managed by ACT Territory and Municipal Services (TAMS). Area A has predominantly been used as forestry land. Area A is covered under Site Audit SAR23_AreaA (12080_SAR_MV3 AREA A_FINAL 23 February 2017). The Area A Site Audit states that the site is suitable for the proposed residential development, provided the Construction Environmental Management Plan (WSP, 30 June 2016) is implemented.
- Area B (northern portion of MV3) covers 681 hectares of land and has historically been used for rural purposes and grazing. Area B is the subject of this Audit.

This is a non-statutory Site Audit conducted in accordance with ACT Environment Protection Authority Contaminated Sites Environment Protection Policy (EPP, 2009) and the requirements outlined in NSW DEC (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme – Second Edition. The NSW guidance adopted is endorsed by the ACT Environment Protection Authority (EPA) for use in the ACT through the *Contaminated Sites Environment Protection Policy,* 2009.

Since 2005 there have been many environmental investigation works at MV3, with the most recent investigation works across Area B conducted by WSP (between 2015 and 2017).

Environmental investigations in Area B revealed that the land was used for rural agriculture and grazing land, with the southern boundary of the site abutting the northern boundary of Area A. Records also indicated that a large portion of the study Area may have been impacted by unexploded ordinance (UXO) and explosive ordnance waste (EOW) from historical Department of Defence training activities.

Based on the detailed site investigation and additional testing completed by WSP, three areas of environmental concern (AEC) were identified containing contaminants of concern above the adopted investigation guidelines. These were identified as follows:

- WSP_AEC10 (Former Sludge Ponds): Heavy metals, microbiological (Faecal Coliforms and E. Coli) and TRH C_{10}-C_{36} impacted soils / bottom sediments from former sewage treatment works.
- WSP_AEC18 (Former Livestock Plunge Dip and Yards): Arsenic impacted soils from previous livestock plunge dip use and immediately surrounding yard area.
- RobC_AEC22 (Glenloch Sheep Dip): Arsenic impacted soils from previous sheep plunge dip use and immediately surrounding area.

To address the contamination in these AECs, WSP prepared a Remedial Action Plan (RAP, February 2017) for the MV3 Area B Future Urban Area (FUA). The proposed remedial strategy can be summarised as follows:

- Prior to intrusive remedial works occurring, additional UXO survey and clearances to be conducted as outlined in WSP (February 2017) Unexpected Finds Management Plan (UFMP). This is a result of recommendations made by the UXO specialist, Milsearch, in their 2015 post activity report prepared for Molonglo Valley Stage 3.
- WSP_AEC10 (former Sludge Ponds) - the strategy proposed is cap and containment of 20,000m3 impacted material, with a long term Environmental Management Plan (EMP). This area is proposed as open space and part of the Riparian corridor;
- WSP_AEC 18 (Former Livestock Plunge Dip and Yards) - the strategy proposed for the 100m3 of impacted material is a combination of excavation and offsite disposal, or onsite reuse subject to further testing and approvals;
- WSP_AEC 18 (Former Livestock Plunge Dip and Yards) - the strategy proposed for the 100m3 of impacted material is a combination of excavation and offsite disposal, or onsite reuse subject to further testing and approvals;
- Although not chemically contaminated several areas were identified during the completion of investigation works that contained material that was aesthetically unsuitable to remain on land proposed for residential use. These areas are shown in Figure 2 of the WSP RAP (2017).

The investigation reports and proposed remediation strategy reviewed are considered to have been completed in general accordance with ACT EPA endorsed land contamination guidelines and the procedures outlined in the ACT EPP (November 2009). Where WSP's work deviated from the guidelines, the Auditor has discussed this within this SAR and is satisfied that these omissions do not affect the conclusions of the Site Audit.

On this basis a Section B Site Audit Statement will be issued certifying that the Auditor considers the site is capable of being made suitable for redevelopment for mixed residential and urban open space, including recreational and nature reserve along the Molonglo River, with limited core commercial and transport services, if the WSP (February 2017) Remedial Action Plan is implemented and subject to the following conditions:

1. Prior to the commencement of any intrusive works (as part of remediation and/or redevelopment activities), the LDA and the appointed Principal Contractor must ensure that the recommended Unexploded Ordnance (UXO) survey and clearance works have been completed and reported prior to construction works occurring within or near these areas. The scope of this requirement is outlined in WSP (8 February 2017) Unexpected Finds Management Plan (UFMP), Contaminated Land and Unexploded Ordnance (UXO) / Exploded Ordnance Waste (EOW), Molonglo Valley Stage 3 (Future Urban Area) (reference WSP-PB_Rpt_UFP_MV3_FINAL).
2. Upon successful completion of the remediation and validation activities in areas outlined in the WSP (2017) RAP, a validation report prepared in accordance with the requirements of OEH 2011 and DEC 2006 must be provided to the Site Auditor for review. A Site Audit Report and Site Audit Statement should be issued confirming that the remediation objectives have been achieved and the land has been rendered suitable for the proposed future uses. The Site Audit Statement and Site Audit Report shall be submitted to the EPA for endorsement prior to the commencement of development works within the audit area.
3. If the adopted remedial strategy within the Riparian corridor at remediation area WSP_AEC10 (former sludge ponds) comprises a cap and containment solution, the area will require a long term environmental management plan (EMP). The EMP must be reviewed and endorsed by a Site Auditor and EPA, be made legally enforceable with public notification of any land use restrictions.

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Appendices

1. Introduction

This non-statutory site audit was commissioned by the ACT Government Environment, Planning and Sustainable Development Directorate, on behalf of the ACT Land Development Agency (LDA) which is project managing the redevelopment of the site.

This Site Audit Report (SAR23_AreaB) and associated Site Audit Statement (SAS23_AreaB) were produced by Rebeka Hall, employed by Zoic Environmental Pty Ltd (Zoic) to document the findings of a Site Audit. Rebeka Hall is an accredited environmental auditor under the NSW Contaminated Land Management Act 1997 (accreditation number 0802) and therefore approved by the ACT Environmental Protection Authority (ACT EPA) under Section 75(5) of the Environment Protection Act 1997. Diana Turner, also from Zoic, provided assistance during the course of the Audit.

This Site Audit was conducted to provide an independent review of the suitability and appropriateness of environmental works completed in Area B ('the site'), within the Molonglo Valley Stage 3 (MV3) Future Urban Area as shown in Figures in Appendix A. The total MV3 area occupies approximately 1,145 hectares and the property was divided and separately investigated as two separate portions referred to as:

- Area A (southern portion of MV3) covers approximately 464 hectares with a small portion (5ha) at the central eastern boundary managed by ACT Territory and Municipal Services (TAMS). Area A has predominantly been used as forestry land. Area A is covered under Site Audit SAR23_AreaA (12080_SAR_MV3 AREA A_FINAL 23 February 2017). The Area A Site Audit states that the site is suitable for the proposed residential development, provided the WSP Construction Environmental Management Plan (30 June 2016) is implemented.
- Area B (northern portion of MV3) covers 681 hectares of land and has historically been used for rural purposes and grazing. Area B is the subject of this Audit.

Environmental investigations in Area B revealed that the land was used for rural agriculture and grazing land, with the southern boundary of the site abutting the northern boundary of Area A.

ACT EPA records indicate that a large portion of the study Area may have been impacted in the past by unexploded ordinance (UXO) and explosive ordnance waste (EOW) from former Department of Defence activities.

This SAR and associated SAS considers investigation works conducted across the site to form an opinion on whether Area B (as defined by WSP Figures represented in Appendix A), is capable of being made suitable for redevelopment for mixed residential and urban open space, including recreational and nature reserve along the Molonglo River, with limited core commercial and transport services in light of the contamination identified.

This is a non-statutory Site Audit conducted in accordance with ACT Environment Protection Authority Contaminated Sites Environment Protection Policy (EPP, 2009) and the Audit has been conducted in accordance with the requirements outlined in NSW DEC (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme – Second Edition. The NSW guidance adopted is endorsed by the ACT Environment Protection Authority (EPA) for use in the ACT through the *Contaminated Sites Environment Protection Policy,* 2009.

1.1 Objectives of Audit

The objectives for the non-statutory Site Audit were to:

- Confirm the nature and extent of contamination;
- Determine the appropriateness of a detailed Phase 2 environmental investigation conducted by the appointed Environmental Assessor (WSP);
- Conclude whether the Remedial Action Plan prepared for the site is appropriate for the contamination identified and if implement, will enable the site to be made suitable for the proposed future landuse(s) as defined by the zoning outlined in the ACT Territory Plan 2008 (updated 14 December 2012) for Molonglo (NI2008-27).

1.2 Overview of Site Audit Process

This site audit has been conducted in accordance with the contaminated land provisions of the *Environment Protection (EP) Act 1997* (ACT) and *Environment Protection Regulation* (2005), the *Australian Capital Territory Environment Protection Authority* (ACT EPA) Contaminated Sites Environment Protection Policy (EPP, 2009), and relevant policies and guidelines approved by the New South Wales Environment Protection Authority (NSW EPA) relating to contaminated land site audits as endorsed for use in the ACT by the ACT EPA.

The site audit has been conducted in accordance with the requirements of the EP Act, which describes a site audit as (S.91A (2)):

- An environmental audit for assessment or remediation of contaminated land is an audit by an auditor:

a. that relates to an assessment or remediation carried out (whether under this Act or otherwise) in relation to actual or possible contamination of land; and
b. that is conducted for the purposes of determining any 1 or more of the following:

    i. the nature and extent of the assessment or remediation undertaken;
    ii. the nature and extent of any contamination or remaining contamination of the land;
    iii. what further assessment or remediation is necessary before the land is suitable for any specified use or range of uses.
    iv. the appropriateness of any remediation plan, long-term management plan, assessment proposal or remediation proposal.

Sections 91C (5) and 91D (5) of the EP Act describe that in preparing site audits reports, ACT EPA approved Site Auditors must take the following matters into account:

- The provisions of the EP Act and the EP Regulations;
- The permitted and approved uses of the land to which the assessment relates;
- The degree or extent of contamination;
- Any relevant environment protection policies; and
- Any relevant environment protection measures.

NSW DEC (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition), which is approved by the ACT EPA, through the Contaminated Sites Environment Protection Policy, 2009, describes the site assessment and audit process as:

- Consultant is commissioned to assess contamination. The contaminated site consultant designs and undertakes the site assessment and, where required, all remediation and validation activities to achieve the objectives specified by the owner or developer; and

- Site Auditor reviews the consultant's work. The site owner or developer commissions the Site Auditor to review the consultant's work. The Auditor prepares a site audit report and a site audit statement at the conclusion of the review, which are given to the owner or developer.

Therefore, the contaminated land consultant and other relevant parties should be satisfied that the work to be conducted conforms to all appropriate regulations, standards and guidelines and is suitable based on the site history and the proposed land use.

1.3 Guidelines approved by the ACT EPA as listed in the ACT Contaminated Sites Protection Policy 2009

The National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM, April 2013) is prescribed under the Environment Protection Act 1997 and is a National approach to the assessment of land contamination. According to the ACT Environment Protection Authority 'Contaminated Sites Environment Policy' (November 2009) the guidelines listed below should be used, as appropriate, for contaminated land assessment or remediation.

ACT EPA Publications:

- ACT Environmental Standards: Assessment and Classification of Liquid and Non-liquids Wastes (June 2000);
- Information Sheet No.1 - Contaminated Sites - Decommissioning, Assessment and Audit of Sites Containing Above Ground or Underground Fuel Storage Tanks, (October 2016);
- Information Sheet No.2 - Contaminated Sites - Requirements for the Assessment and Validation of Former Service Station Sites in the ACT (October 2016);
- Information Sheet No.3 - Contaminated Sites - Requirements for the Assessment and Validation of Sites Containing Above Ground or Underground Fuel Storage Tanks in the ACT (October 2016);
- Information Sheet No.4 - Contaminated Sites - Requirements for Re-use and Disposal of Contaminated Soil (October 2016);
- Information Sheet No. 5 – Requirements for the Transport and Disposal of Asbestos Contaminated Wastes (October 2016);
- Information Sheet No. 6 – Management of Small Scale, Low Risk Soil Asbestos Contamination (October 2016);
- Information Sheet No. 7 – Guidance for undertaking preliminary contamination investigations for development or lease variation purposes (October 2016);
- Environmental Guidelines for Service Station Sites and Hydrocarbon Storage (January 2014);
- Environmental Protection Guidelines for Construction and Land Development in the ACT (March 2011);
- General Environment Protection Policy (August 2007);
- Water Quality Environment Protection Policy (April 2008); and
- Hazardous Materials Environment Protection Policy (December 2000).

ANZECC, ARMCANZ, enHealth and NHMRC publications:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Paper No. 4, October 2000;
- Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australian and New Zealand Environment and Conservation Council and National Health and Medical Research Council, January 1992;
- Financial Liability for Contaminated Sites Remediation: A Position Paper, Australian and New Zealand Environment and Conservation Council, 1994;

- Guidelines for Groundwater Protection in Australia, Agriculture and Resources Management Council of Australia and New Zealand & Australian and New Zealand Environment and Conservation Council, 1995;
- National Water Quality Management Strategy, Australian Drinking Water Guidelines 6, 2004, National Health and Medical Research Council, Natural Resources Management Ministerial Council, 2004;
- Polychlorinated Biphenyls Management Plan, Australian and New Zealand Environment and Conservation Council, Canberra, April 2003;
- Minimum Construction Requirements for Water Bores in Australia, Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council & Agriculture and Resources Management Council of Australia and New Zealand 1997;
- Guidelines for the Assessment of On-site Containment of Contaminated Soil, Australian and New Zealand Environment and Conservation Council 1999;
- Management of Asbestos in the Non-occupational Environment, enHealth 2005.

NSW DECC publications recognised by ACT EPA are:

- Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report, NSW EPA, 1999
- Guidelines for the NSW Site Auditor Scheme, NSW DEC, 2006
- Guidelines for Assessing Service Station Sites, NSW EPA, 1994
- Sampling Design Guidelines, NSW EPA, 1995
- Guidelines for Consultants Reporting on Contaminated Land, NSW EPA,1997
- Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land, NSW EPA, 1995
- Guideline for Assessing Former Orchards and Market Gardens, NSW EPA, 2005

EPA Victoria publications recognised by ACT EPA are:

- Groundwater Sampling Guidelines: Publication 669, EPA Victoria, 2000
- Hydrogeological Assessment (Groundwater Quality) Guidelines, Publication 668, EPA Victoria, 2006
- A guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, 7th Edition, Publication 441.7, EPA Victoria, 2000
- Classification of Wastes, Publication 448.3, EPA Victoria, 2007

Relevant Australian Standards:

- AS 4482.1 : 2005 Guide to the investigation and sampling of sites with potentially contaminated soil – Non-volatile and semi-volatile compounds
- AS 4361.2-1998 : Guide to lead paint management – Residential and commercial buildings
- AS/NZS 5667.11:1998 : Water quality – Sampling – Guidance on sampling of groundwaters
- AS/NZS 5667.1:1998 Water quality – Sampling – Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

Other publications and references:

- Remediation of Contaminated Soil and Groundwater: Proposals for Criteria and Priority Setting (the Revised Dutch Guidelines), Swartjes, F. A & van den Berg, R., 1993.
- Imray, P & Langley, A. (1996) Health-Based Soil Investigation Levels. National Environmental Health Forum Monographs, Soil Series No.1, SA Health Commission, Adelaide.
- Taylor, R & Langley, A. (1996). Exposure Scenarios and Exposure Settings. National Environmental Health Forum Monographs, Soil Series No.2, SA Health Commission, Adelaide.

- Lock, W. H. Composite Sampling. National Environmental Health Forum Monographs, Soil Series No.3, SA Health Commission, Adelaide.

1.4 Reports Reviewed

The most recent documentation relevant to meet the objectives of this SAR included a detailed review of the following:

1. WSP Environmental (WSP) (12 March 2015) Molonglo Valley Stage 3 (Area B) Sampling, Analysis and Quality Plan (SAQP) (ref: 00039275).
2. WSP (24 June 2016) Molonglo Valley Stage 3 (Area B) Stage 2 Detailed Site Investigation, ACT Land Development Agency (ref: 00039275.002).
3. WSP | PB (WSP) (22 September 2016) Letter Report on Investigation of soils around the Glenloch Property Sheep Dip located within Molonglo Valley Stage 3 Future Urban Area (Area B), Block No. 6 (ref: 2270207A_WSP-PB_Molonglo_Area_B_Glenloch_Dip_v2)
4. WSP | PB (WSP) (8 February 2017) Unexpected Finds Management Plan, Contaminated Land and Unexploded Ordnance (UXO) / Exploded Ordnance Waste (EOW), Molonglo Valley Stage 3 (Future Urban Area) (reference WSP-PB_Rpt_UFP_MV3_FINAL).
5. WSP (13 February 2017) Remedial Action Plan, Molonglo Valley Stage 3 (Area B) (ref: 2270207A).

These reports have been reviewed in accordance with the requirements in the NSW DEC (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition), as endorsed by the ACT Environment Protection Authority (EPA) for use in the ACT through the *Contaminated Sites Environment Protection Policy*, 2009, the reporting checklist in the NSW OEH (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites; and the current requirements outlined in Schedule B2 Guidelines on Site Characterisation in ASC NEPM (May 2013).

For the purposes of this assessment, the focus has been on the most recent documentation received by the Auditor as these were most relevant to the site, being Area B. The other documents provided were reviewed to form an overview of the issues surrounding the overall Molonglo Valley area and its potential contaminants of concern. Data relevant for Area B are derived from the most recent documentation from WSP.

During the course of the Site Audit, the following reports were also provided to the Auditor for background information and were summarised in WSP reports:

- Coffey Geosciences (2005) Molonglo Valley, Preliminary Geotechnical and Contamination Constraints Study.
- Coffey Geosciences (2006) Gungahlin Drive Extension – Preliminary Assessment of Spoil Construction over sludge ponds at Coppins Crossing.
- AECOM (June 2012) Phase 1 Environmental Site Assessment, Molonglo Stage 3, (for Land Development Agency).
- WSP Environmental (September 2012) Phase 1 Environmental Site Assessment, Molonglo Valley Stage 3 ACT (for ACT ESDD).
- WSP Environmental (September 2012) Sampling and Analysis Quality Plan (SAQP) for Phase 2 Environmental Site Assessment, Molonglo Valley Stage 3 ACT (for ACT ESDD).
- Milsearch Pty Ltd (May 2014) Post Activity Report UXO Contamination Assessment Molonglo Development Stage 3 (prepared for LDA).
- Robson Environmental Pty Ltd (May 2014) Phase 1 Environmental Site Assessment Area C, Molonglo Valley Stage 3, ACT.
- Robson Environment Pty Ltd (May 2014) Phase 1 Environmental Site Assessment Areas A and B, Molonglo Valley Stage 3, ACT.

- Milsearch Pty Ltd (30 April 2015) Post Activity Report, Molonglo Stage 3 Urban Development: Geophysical Survey and Remediation of Unexploded Ordnance (V3 Final Draft) (prepared for LDA).

Other information provided which was considered as part of this Site Audit included:

- Coffey Geosciences (2006) Phase 1 Environmental Site Assessment, Former Weston Creek Sewage Treatment Plant, Adjacent Landfill and night spoil area, Weston District, ACT.
- SMEC (2009) Final Phase 1 Environmental Site Assessment Report for the precinct of North Weston in Weston Creek.
- SMEC (2009) Final Phase 1 Environmental Site Assessment Report for Coombs and Wright, Molonglo.
- AECOM (2010) Phase 1 Environmental Site Assessment, Stage 2 Molonglo (West) ACT.

1.5 Audit Meetings and Site Inspection

A site inspection was conducted by the Audit team and appointed assessors, WSP, on 15 October 2014. The inspection involved driving to and observed the Areas of Potential Concern identified by WSP (and others) and targeted for the Phase 2 investigation. The following observations were made relative to Area B:

- The Auditor noted that limited access was available at the time of the site inspection completed by Zoic and WSP (on 15 October 2014). No access was granted to the former sludge ponds / the AFP training ground, however observations were made from perimeter fences and from higher ground.
- Area B comprised many rural properties actively used for grazing (as well as residential homesteads).
- A project meeting was held with EPD, LDA and the Auditor on 6 June 2016 to discuss the outcome of both the detailed site investigations conducted on Area A and B. The original objective of the audit was to form an opinion on the suitability of the site characterisation works. However, given the absence of chemical contamination identified on Area A, it was agreed that two separate Site Audit Reports and Statements would be prepared. For Area A the aim was to obtain a Section A Site Audit Statement given the absence of chemical contamination identified, and a Section B Site Audit Statement (endorsing a remedial action plan) for Area B to address areas of impact that would require remediation prior to or during redevelopment of Area B.

1.6 Audit Correspondence

The Auditor provided feedback during the course of the Site Audit to the consultant and documented them as interim advice letters or email correspondence. A copy of these letters or relevant email correspondence is included in Appendix B together with consultant responses (where provided).

2. Site Identification and Description

This section provides detail on land use, surrounding properties and summarises potential sensitive human health and environmental receptors. This information has been sourced from the reports referenced in Section 1.4.

2.1 Site Identification

The site location is shown in WSP Figures, reproduced in Appendix A. The site identification and land use details include:

Table 2.1: Site Identification

Title	Details
Street Address:	Area B in Molonglo Valley Stage 3 Future Urban Area
Property Description:	• Block 12 • Block 44 • Block 43 • Block 42 • Block 4 • Block 5 • Block 41 • Part Block 6 • Block 1548 • Block 1439 • Block 1549 • Block 1400 • Block 32 • Part Block 7 • Part Block 33 • Block 15 • Block 38 • Block 39 • Block 16 • Part Block 72 • Block 14 • Block 13 • Part Block 46 • Part Block 10 • Part Block 45 • Block 40 • Roads and adjacent verges in the vicinity of the intersections of William Hovell Drive, Coppins Crossing Road and Bindubi Street, in the Molonglo Valley
Current Site Ownership:	ACT Government
Geographical Coordinates: (Sources: LDA, www.ACTmapi.act.gov.au, Nearmap - 7 November 2014.)	Lat: -35.279819 Long: 149.049969.

Title	Details
Property Size:	680 hectares (approximately)
Zoning – Existing:	• Block 12. RZ1: Suburban; CZ4: Local Centre; NUZ4: River Corridor; RZ3: Urban Residential; CF: Community Facilities; PRZ1: Urban Open Space. • Block 44. RZ1: Suburban; PRZ1: Urban Open Space; NUZ3: Hills, Ridges and Buffer Areas. • Blocks 4, 41, 42 and 43. RZ1: Suburban; NUZ3: Hills, Ridges and Buffer Areas. • Block 5. RZ1: Suburban; TSZ1: Transport; NUZ3: Hills, Ridges and Buffer Areas. • Part Block 6. RZ1: Suburban; CZ4: Local Centre; TSZ1: Transport; RZ3: Urban Residential; NUZ3: Hills, Ridges and Buffer Areas. • Block 1400, 1439, 1548, 1549: Des: Designated. • Block 32. NUZ3: Hills, Ridges and Buffer Areas. • Part Block 7. RZ1: Suburban; TSZ1: Transport; RZ3: Urban Residential: Des: Designated; NUZ3: Hills, Ridges and Buffer Areas. • Part Block 33. RZ1: Suburban; TSZ1: Transport; RZ3: Urban Residential; NUZ3: Hills, Ridges and Buffer Areas. • Block 15. RZ1: Suburban; TSZ1: Transport; CF: Community Facilities; PRZ1: Urban Open Space; NUZ3: Hills, Ridges and Buffer Areas; CZ1: Core Zone. • Blocks 38, 39, 13, 14 and 16. RZ1: Suburban. • Part Block 72. RZ1: Suburban; TSZ1: Transport; NUZ4: River Corridor; PRZ1: Urban Open Space; CZ1: Core Zone. • Part Block 46. RZ1: Suburban; NUZ4: River Corridor; RZ3: Urban Residential. • Part Blocks 10, 45. NUZ4: River Corridor • Block 40. RZ1: Suburban; RZ3: Urban Residential. Permissible development for each Land Zoning have been included in Appendix F
Zoning – Previous:	Not provided. However, the site has been historically used for rural, residential use, grazing and sludge ponds.

2.2 Surrounding Land Use

The site is located in a rural area, predominantly developed for agricultural grazing, with nature reserves, the Canberra National Arboretum and Molonglo River being local sensitive receptors. The immediate adjoining land uses are described as follows:

Table 2.2: Immediate Site Surrounds

Title	Details
North:	William Hovell Drive followed by grazing lands and low density residential suburbs of Canberra.
East:	Grazing lands, Canberra National Arboretum, The Tuggeranong Parkway, followed by Lake Burley Griffin.
South:	Molonglo Valley Stage 3 Area A, managed pine forests, grazing lands and infrastructure (John Gorton Drive and bridge over River)
West:	Kama Reserve and parts of Molonglo River

2.3 Site Condition

2.3.1 Current

The site is irregular in shape and has gently undulating to rolling topography.

The site has predominantly been used for rural purposes and grazing along with some historic use of the site as an artillery range. Specific features in Area B include:

- Dams;
- Current and former buildings and structures across the site such as farm houses, hay sheds and agricultural use structures;
- Sheep and cattle spray and dip yards;
- The former Coppins Crossing Sludge Ponds with four (4) open air sludge ponds present. A separate fenced off area had been used as part of AFP training facilities;
- Localised dump areas in the creek beds with car wrecks, metals, household rubbish and potentially other waste materials;
- Herbicides and pesticides associated with agricultural land use and blackberry management along the riparian corridor of the Molonglo River;
- Burial locations of kangaroo carcasses / livestock dumps;
- Filled areas (household construction waste); and
- Presence of unexploded shells / UXO associated with historic use of the site as an artillery range.

The Molonglo River is located along parts of the western boundary of the site, and flows in a north westerly direction, discharging in the Murrumbidgee River. Rainfall is expected to predominantly infiltrate surface soils and flow as surface water into incised drainage lines flowing to Molonglo River to the west.

There are two major creeks within the area with one located in the western portion (Deep Creek), and the second in the central portion (Coppins Creek). In the grazing areas multiple small dams have been constructed in natural drainage lines.

The surrounding land uses are predominantly agricultural grazing land, nature reserves, Canberra National Arboretum and the Molonglo River and riparian zones. The site is further surrounded by Lake Burley Griffin, rural residential lots, and the new residential suburbs of Coombs and Wright.

2.3.2 Proposed

The proposed development includes future urban residential, urban open space including recreation and nature reserve along the Molonglo River corridor with limited core commercial and transport services. Appendix A includes the future urban area landuse for the site.

2.4 Auditor Discussion

The Auditor notes the configuration and referencing of the site area changed during the completion and reporting of various site assessments, resulting in Area A and Area B.

Area B includes three remedial areas, named WSP_AEC10 (Former Sludge Ponds), WSP_AEC18 (Former Livestock Plunge Dip and Yards) and RobC_AEC22 (Glenloch Sheep Dip). The Auditor considers that following remediation of these areas, the site can be made suitable for the proposed residential land use as discussed in this SAR.

The Auditor further notes that descriptions of the proposed future development has not been fully provided, as the final design and layout for the proposed development had not been finalised at the preparation of this SAR.

However, the information required by OEH (2011), in regard to site identification and condition, was generally provided, and is consistent with observations made during the site inspection conducted as part of this audit. Where the information was not provided, the Auditor consulted with the Client and WSP to obtain the necessary information.

3. Stages of Work

3.1 Summary of Works

Table 3.1 provides a summary of the investigation works that have taken place within Area B and the greater Molonglo Valley properties surrounding the site:

Table 3.1: Summary of Works Completed

Date	Report Objectives, Scope and Outcomes
Coffey Geosciences May 2005 Preliminary Geotechnical and Contamination Study	This document was not provided to the Auditor, however was summarised by WSP (2016) DSI. The Coffey 2005 report identified; • A sheep (plunge) dip on Molonglo Valley Block 6; • Major sewage sludge ponds or dry sludge beds within Molonglo Valley Block 10. The ponds were no longer in use at the time of the Coffey assessment. Contaminants of Potential Concern were stated as nitrogen, phosphorous, faecal coliforms, heavy metals and PAH.
Coffey Geosciences July 2006 Preliminary Assessment of Spoil Construction over Sludge Ponds at Coppins Crossing	Coffey reported that the sludge ponds received sludge from the former Western Creek Sewerage Treatment Plant between 1970 and 1978. Sludge depths were reported to be greater than 1.5m in Pond 1, approximately 1.0m in Pond 2, approximately 0.8m in Pond 3 and 1.5 m in Pond 4. The ponds reportedly have clay liners. Elevated concentrations of Dieldrin, Chlordane, Heptachlor, HCB, DDT, DDE, DDD and PCB and heavy metals were reported. The sludge ponds caught fire during the bushfires of January 2003. The Coffey report proposed to cover the ponds with > 2m of clean fill, however these works were not completed.
WSP Environmental September 2012 Phase 1 Environmental Site Assessment	The Phase 1 prepared by WSP covered both Area A and B for MV3 project. The objectives of the Phase 1 ESA were to: • Complete works in accordance with ACT EPA Contaminated Sites Environment Protection Policy (November 2009) and ACT EPA endorsed guidelines including NSW EPA (2011) Guidelines for Consultants Reporting on Contaminated Sites; • Determine the potential for land contamination and identify any associated land use constraints; • Identify all past and present potentially contaminating activities; • Identify potential contamination types; and • For areas identified provide strategic advice on the scope of work required to investigate with greater certainty the contamination status (Phase 2 Detailed Environmental Investigation). The scope of the report included: • Review of existing reports (those listed in Section 1.4); • Review of the environmental setting based on topographical maps, topography, soil and geological maps and a groundwater bore search through the ESDD Environment Protection and Water Regulation; • Review of historical aerial photographs between 1944 and 2009; • Review of historical title deeds for selected blocks; • Contaminated Land Search of the ACT Environmental Protection Authority Records for selected blocks; • Search of Office of Regulatory Services (ORS) WorkCover Records for Dangerous Substances, Dangerous Goods, Underground Storage Tanks and Licence History for selected blocks. Key findings were: • The total combined study area of 1,028 hectares was bordered by: - North: William Hovell Drive; - East: Glenloch Station and the Canberra International Arboretum as well as Tuggeranong Parkway;

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	- West: banks of the Molonglo River; - South: partially bound by banks of Molonglo River and by Block 1419 District of Belconnen. • Property descriptions, at the time of the study, were reported as: - Privately leased land: Blocks 4, 5 and 41 (Mr Maurice Tully). - Unleased land with grazing: Blocks 12, 13, 14, 15, part of 37, 42, 43 and part 46. - Former Pine Plantation: Part Blocks 36, 37 and 46. - Infrastructure corridors: Blocks 34, 38, 39, 40 and roads (Coppins Crossing Road) - Molonglo River and banks: Blocks 11, part 45, 47, 49, 60, 66, part 1214, Weston Ck. - Coppins Crossing and sludge pond: Block 10 • The northern portions of the site (the current Area B) consisted of grazing land for cattle. Specific features in the Study Area included: - Horse paddocks in the north-western portion of Area A along William Hovell Drive. - One farm with several sheds (409 Coppins Crossing Road). - Two occupied dwellings: one near the farm and one across Coppins Crossing Road on the boundary of Blocks 13 and 46. - Coppins Crossing Sludge Ponds. Four (4) derelict ponds in the western portion of the Study Area, located adjacent to Molonglo River. - Several corridors for high voltage power lines and trunk sewer line run across the Study Area. • Surrounding land uses were predominantly agricultural grazing land, Kama Nature Reserve, the Arboretum and residential developments across Molonglo River (MV Stage 2 development). • Historical aerial photographs were reviewed for 1944, 1968, 1985, 1998 and 2009. Major changes to landform and presence of built structures were described over the years. The activities observed were consistent with known land uses registered for the site. Following the review of previous reports, government records, historical aerial photographs, site walkover inspection and anecdotal interviews, WSP identified the following AECs within **Area B** requiring further assessment: • WSP_AEC1, 2, 3, 4, 5 and 7: Dams which may be constructed with imported fill material. Dams may also act as 'sinks' for any applied localised chemicals. • WSP_AEC8: Homestead with associated sheds and stockyards. The homestead may be associated with building materials such as asbestos and lead paint and there may be current or historic storage of small quantities of farming chemicals. • WSP_AEC9: Some localised dumped rubbish in an excavated area. • WSP_AEC10: Sludge Ponds located on Block 10 which received sludge from the former Weston Creek Sewerage Treatment Plant between 1970 and 1978. • WSP_AEC11: Localised suspected asbestos containing materials (ACM) were identified in a small area (5m x 1m x 1m) near the Sludge Ponds (AEC10). • WSP_AEC12: Excavation for burial of kangaroo carcasses from previous culling activities. • WSP_AEC13: Hay shed with various stockpiles including steel barrels, tyres, wood, plastic. • WSP_AEC14: Occupied homestead with associated diesel shed and stockyards. • WSP_AEC15: localised soil staining around a 44 gal oil drum (within homestead of AEC14). • WSP_AEC16: disused old shed and livestock holding yards. • WSP_AEC17: Derelict plunge sheep dip, adjacent to disused shed (AEC16). • WSP_AEC18: Derelict sheep dip spray. • WSP_AEC19: Cattle spray dip • WSP_AEC20: Abandoned car bodies in creek bed. • WSP_AEC21: Scrap metal in multiple locations along the creek (barrels, steel, containers etc.). • WSP_AEC22: Mounded soil with half buried 44 gal drum (potential for other buried material within the mound).

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	• WSP_AEC23: Former building structure as identified in 1968 aerial photograph (but no longer present). • AEC24: Derelict concrete lined sewage overflow pond and related infrastructure, which was part of the former Weston Creek Sewage treatment Plant (Area B). • AEC25: Former grease pits located just outside and up gradient of the Study Area (Area B), which were associated with former Sewage Treatment Farm. • WSP_AEC26: Shed with corrugated steel roof and wooden columns. • WSP_AEC27: Location of a former pioneer's house (exact location not known). • WSP_AEC28: Rubbish dump area. • WSP_AEC29: Pesticide use on the adjacent and topographically up gradient Arboretum. AECs noted during the Robson assessment relevant to Area B as follows: • RobA_AEC5: Dam, potentially receiving runoff from William Hovell Drive. • RobA_AEC7, RobA_AEC8: Two concrete spill points. • RobA_AEC9 to RobA_AEC12: Four drains used to control surface water runoff from up-gradient land uses. • RobC_AEC10: Dam, potentially receiving runoff from William Hovell Drive. • RobC_AEC11, AEC12, AEC13: Dam, potentially receiving runoff from Bindubi Street. • RobC_AEC22: Sheep plunge dip, Glenloch property. • RobC_AEC23: Glenloch property homestead and shed area. • RobC_AEC24: Former orchard area, Glenloch property area. • RobC_AEC25 and RobC_AEC26: Two small farm sheds. • RobC_AEC27: Livestock loading ramp. • RobC_AEC32: Dam, potentially receiving runoff from William Hovell Drive. • RobC_AEC33: Dam, potentially receiving runoff from William Hovell Drive, plus the Glenloch sheep plunge dip and shearing shed area. • RobC_AEC34 to RobC_AEC43 (excluding 37): Ten (10) dams, potentially used for agricultural / grazing purposes. (AEC37 is outside located outside the defined Area B boundary) • RobC_AEC44: Dam, potentially receiving runoff from William Hovell Drive. • RobC_AEC45: Gun Firing Point (1920/1921 Practice). • RobC_AEC46: Gun Firing Point (1920/1921 Practice). In addition to the above specific AECs, WSP also identified 4 additional AECs, for which the exact location within the Study Area could not be determined: • AEC30. Presence of artillery shells (as both Exploded Ordnance Waste (EOW) and Unexploded Ordnance (UXO). Potential occurrence throughout the Study Area, with the possible exception the most southern portion. • AEC31. Herbicides and pesticides associated with agricultural land use, pine plantation operations and nature conservation. • AEC32. Burial locations of kangaroo carcasses. During the site inspection one burial location was identified (AEC12). It is considered possible that multiple similar locations exist. Burial locations are likely to be located in the northwest corner of the Study Area in the portion of 'lower angle slopes underlain by Walker volcanics'. This geotechnical terrain has relatively deep soil to 4 metres (Coffey, 2005) and is the area where a burial location was identified during the field inspection by WSP. • AEC33. Stockpiles and isolated occurrences of burnt timber, likely resulting from the 2001 and 2003 bushfires. WSP completed a limited soil investigation as part of the Phase 1 works, at five of the identified AECs. These included the sheep dips on Block 16 (AEC 17 and 18), the Coppins Crossing Sludge Ponds (AEC10), suspected ACM in AEC11, and the former pine plantation area (AEC31). Shallow soil samples were collected to a maximum depth of 0.5m bgl with a hand auger. The following soil results were reported: • AEC17 and AEC18 – Sheep Dips. All OCP/OPP were below detection limit for 10 samples analysed. Metals were generally below site criteria, with the exception of two exceedances of arsenic.

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	• AEC10 – Coppins Crossing Sludge Ponds. TPH was detected in two of the Sludge Ponds, with one concentration exceeding the site criteria. Copper concentrations were above site criteria in all four Ponds. Lead and cadmium concentrations were also elevated and exceeded in one or more ponds. • AEC11 – Suspected ACM. The analytical results confirmed the presence of chrysotile and amosite asbestos in the fragment. • AEC31 – Former Pine Plantation Area. No exceedances were identified. Based on the work completed in the Phase 1, WSP considered the potential for broad-scale significant contamination across the Study Area was low. However there was the potential for contamination associated with former and current land uses as identified in the 33 AECs as listed above. Based on the results of the Phase 1 ESA, WSP recommended that: • Targeted sampling be conducted across the AECs identified and subsequent development of appropriate remedial action plan and/or management strategy if required; • A hazardous material survey be conducted of various buildings, sheds and structures across the Study Area. Depending on the results, an asbestos management plan may be required; • A protocol be developed to address unexpected findings during the later phases in the study area development.
WSP Environmental May 2013 Sampling and Analysis Quality Plan (SAQP) for Phase 2 ESA	The objectives of the SAQP were to: • Provide a robust sampling strategy to address the 33 AECs identified during the Phase 1 investigation. • Establish Data Quality Objectives (DQOs) for the SAQP to ensure that the data is in accordance with appropriate guidelines. • Determine whether further investigation, management or remediation is required in relation to any of the investigated AECs. The WSP SAQP was prepared for the entire 1028ha of the Molonglo Valley Stage 3 Area.
Milsearch (2014) UXO Contamination Assessment Molonglo Development Stage 3	The objectives of the UXO assessment were to: • Conduct a 10% UXO Technical Assessment of the 265 ha site (located within Area B) by detecting along nominally parallel 1m wide lanes separated at 10m intervals; • Where contamination existed to the border of the 265 ha site, conduct additional 5% contamination sampling assessments along parallel transects until fade out of impact evidence was achieved; and • Conduct a detailed inspection of land within the Federal Police Training Compound located in the central south of the 265 ha site. The purpose of this inspection was to formulate an approach to the conduct of any UXO mitigations thought necessary to allow the Compound to be absorbed into the Molonglo Stage 3 housing development. The UXO survey area was bound by William Hovell Drive to the north, Kama Nature Reserve to the north east, Molonglo River to the south, Coppins Crossing Road to the east and a fence line to the west (which is the boundary of the current Molonglo 3 Audit Area). Conclusions and recommendations of the survey were as follows: • In Milsearch's opinion, significant volumes of explosive ordnance waste (EOW) was encountered in the initial study area as well as land further eastward. • The absence of finds south of Molonglo River (which comprises Molonglo Stage 2 FUA) strongly suggested that the artillery activities were confined to land north of Molonglo River. • No items of UXO were discovered within the survey area; however an UXO was reported on the western boundary suggesting further contamination outside of the assessed land may be present. • The area of impact was not delineated to the east. • It was recommended that a 100% geophysical UXO survey (and where necessary remediation) be conducted for Molonglo Stage 3. Further assessment was also required in land to the west which is under the control of ACT Parks and Conservation. • Land excluded from the May 2014 survey should be assessed. • Install appropriate warning signs and conduct appropriate training of staff/contractors/ consultants who may be conducting works across Molonglo Stage 3.

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	The Auditor considers the recommendations to be appropriate given the potential 'contamination' risk associated with historical military training activities, and given the proposed urban development of the land. Anecdotal evidence indicates the potential burial of live shells at depths > two feet (below plough depth) (as reported by WSP 2012) which warrants further geophysical surveys using methods that can detect buried items.
Robson Environmental (2014) Phase 1 Environmental Site Assessment Robson Areas A and B, Molonglo Valley Stage 3, ACT	The Land Development Agency (LDA) engaged Robson Environmental Pty Ltd (Robson) to complete a Phase 1 for two parcels of land within Molonglo 3. The objectives of the Phase 1 were to: • Identify past and present contaminating activities that may have been formerly undertaken upon the site; • Discuss the current site condition; • Identify potential areas of environmental concern (AECs); • Provide a preliminary assessment site contamination (if any); and • Assess and provide recommendations (if required). Robson Areas A and B comprised the following Blocks: • Robson Area A – Parts of Blocks 10, 12, 45, 46 and 66 Molonglo Valley, and part of Block 8 Section 3 Denman Prospect (of which falls within the current Area B); • Robson Area B – Parts of Blocks 71 and 75 Molonglo Valley (which fall outside of the current Area B audit area). Robson Area A is located on, and north of, the Molonglo River, located to the west of Coppins Crossing. Robson Area B is located on, and north of, the Molonglo River in the area between the residential estates of Coombs and North Weston, the Tuggeranong Parkway and the National Arboretum Canberra. The combined area of the two Robson investigation areas was approximately 249.4 hectares (ha). Based upon the review of the site history and a site walkover, Robson identified the following AECs within the current Area B audit area: • The decommissioned Sewage Treatment Works on Block 10. The former facility included four settlement ponds with part of the compound used by the Australian Federal Police (AFP) for explosive detonation and training. ACM fragments were also observed. There are several concrete spill points on the western side of the facility which direct surface overflow from the site onto the adjacent Block 25; • Robson report that all Blocks were previously utilised as part of artillery firing range. Robson reported that there is the potential for unexploded ordnance (UXO) and explosive ordnance waste (EOW) to be present as a result of ricochet and overshot from the former military firing ranges; • The area was formerly part of commercial forestry plantations and may have been subjected to weed and pest control; • There were at least four drains and associated feeder channels used to control surface water flow which receive runoff from up-gradient areas; • A sewer easement traverses the area. Most of the pipe-work was subsurface however there was a sub aerial pipe spanning the lower portion of the Deep Creek gully. Other associated infrastructure included vent pipes, and a control box with associated subsurface concrete pit. The report included an SAQP for each AEC. In the absence of a conceptual site model (CSM), the Auditor was unable to effectively assess the appropriateness of the proposed SAQP. It was recommended by the Auditor that: • A concise CSM be formulated based on the existing site information; • An assessment of the relative risk for each AEC be conducted. This may result in more rigorous sampling in high risk AECs, with a relaxed and targeted sampling regime in low risk AECs; • For the analytical suite consider the persistency for each possible contaminant and if it could be reasonably expected with the AEC (for example OPPs degrade relatively quickly); • Review of AECs against proposed future land use; • Consider and comment on the necessity and practicality of the scope of the proposed environmental assessment works and whether the project objectives can be achieved with a refined and targeted SAQP (refer to Schedule B2 ASC NEPM (2013) for guidance).

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Robson Environmental (2014) Phase 1 Environmental Site Assessment Robson Area C, Molonglo Valley Stage 3, ACT	LDA engaged Robson to undertake a Phase 1 for a parcel of land within the Molonglo Stage 3. The parcel of land is referred to as Robson Area C and comprises 24 Blocks of registered land (whole and parts of Blocks), plus the roads and adjacent verges in the vicinity of the intersections of William Hovell Drive, Coppins Crossing Road and Bindubi Street, in the Molonglo Valley. Robson Area C is approximately 400 hectares (ha), of which part of the site falls within the area investigated by WSP (2012), and the current Area B audit. Based upon the review of the site history and a site walkover, Robson identified the following AECs: • Most of the site was and continues to be used for rural purposes. AECs associated with rural activities identified were as follows: - Numerous AECs associated with the 'Glenloch' property including a plunge sheep dip, homestead and cottage, shearing shed, garages, sheds and other storage areas, septic tanks, former orchard area, livestock loading ramp made of compacted soil, carcass burial pits, and stockpiles of fencing wire, posts and tyres; - A hay shed, area of former pioneers homestead, and potential fill for resurfacing at a horse dressage paddock; and - At least twenty seven (27) small earth farm dams. Dams have the potential to be receptors of surface drainage from up gradient areas including run-off from agricultural land, nearby roads (particularly William Hovell Drive, Coppins Crossing Road, Bindubi Street and Caswell Drive) and other potential AECs (for example, plunge sheep dip). • A small area of dumped rubbish on road verges including the southeast corner of the intersection of Coppins Crossing Road and William Hovell Drive; • Two (2) former potential quarries / fill areas in the northeast portion of the site, in an area now occupied by a part of the Aranda Bushland Nature Reserve; • The blocks to the south of William Hovell Drive (west and southern portions of the site) have previously been used as part of an artillery firing range by the Department of Defence (circa 1914 and 1920/1921). Two (2) gun firing points were potentially located in the east of the southern portion of the site. Though the target for the range was off-site (to the south of the western portion of the site), it is considered that there is the potential for unexploded ordnance (UXO) and explosive ordnance waste (EOW) to be present elsewhere particularly to the south of William Hovell Drive, as a result of ricochet, overshot or undershot; • Fill material appeared to have been used for the construction of William Hovell Drive, and possibly also on portions of Bindubi Street and Caswell Drive. The fill material may be contaminated as the source of the material was unknown. In addition to the above, Robson considered that there is the potential for off-site sources of contamination to impact the site, particularly off-site chemical application on the adjacent forests of the National Arboretum Canberra and the nearby commercial forestry plantations. Robson assessed that the migration of contaminants onto the site may have occurred via wind drift of sprays, surface run-off and blown dust. Robson recommended a DSI be completed for the land. The report included an SAQP for each AEC identified within the Robson Area C. In the absence of a conceptual site model (CSM), the Auditor was unable to effectively assess the appropriateness of the proposed SAQP. It was recommended by the Auditor that: • A concise CSM be formulated based on the existing site information; • An assessment of the relative risk for each AEC be conducted. This may result in more rigorous sampling in high risk AECs, with a relaxed and targeted sampling regime in low risk AECs; • For the analytical suite consider the persistency for each possible contaminant and if it could be reasonably expected with the AEC (for example OPPs degrade relatively quickly); • Review of AECs against proposed future land use; and • Consider and comment on the necessity and practicality of the scope of the proposed works and whether the project objectives can be achieved with a refined and targeted SAQP (refer to Schedule B2 ASC NEPM (2013) for guidance).

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WSP Environmental (March 2015) Sampling, Analysis and Quality Plan (SAQP) Molonglo Valley Stage 3 (Area B)	This SAQP provided a summary of site history and environmental setting (based on previous consultant reports and site auditor interim advice) and presented the preliminary Conceptual Site Model (CSM) and Data Quality Objectives (DQO) for the proposed Phase 2 DSI for Area B. The objectives of the SAQP were to: • Provide a robust sampling strategy to address the discrete and diffuse AECs identified during previous investigations. • Detail the sampling methods, media and analytical schedule to allow for the characterisation of AECs and ensure enough information is gathered to allow for an appropriate Remedial Action Plan (RAP) be prepared to render to site suitable for the proposed land use, if required. • Establish Data Quality Objectives (DQOs) to ensure that the data is in accordance with appropriate guidelines including the National Environment (Assessment of Site Contamination) Measure, Amended (NEPM, 2013) and in particular Schedule B2 Guideline on Site Characterisation. The SAQP was considered sufficiently robust to characterise the site and to enable the development of an appropriate Remedial Action Plan (RAP) and/or Environmental Management Plan (EMP) to render to site suitable for the proposed land use, if required.
Douglas Partners (April 2015) Preliminary Geotechnical Investigation Proposed Residential Development Molonglo 3	This document was not provided to the Auditor, however was summarised in the WSP (2016) DSI. Douglas Partners (DP) completed a geotechnical investigation across both Area A and Area B in November 2014. The investigation included broad grid based test pitting across the Areas A and B with an unexpected finds protocol (UFP). The UFP was recommended by the Site Auditor (ZOIC) to enable a record of any potential areas of filling, anthropogenic wastes or suspect materials (if encountered) which could be re-visited at a later date. The following is a summary of findings relating to potential contamination risks in Area B: • Test pits TP001 to TP116 and TP184 and TP185 were completed within the Site (Area B). Two test pits were not completed due to access restrictions. • Lithology encountered was typically: - TOPSOIL: sandy silt/silty sand, occasionally with some gravel or clay encountered at all pit locations to depths of 0.1–0.7 m. - SAND, SILT, CLAY AND GRAVEL: variable mixture of sand, silt, clay and gravelly soils to depths of 0.3 m to in excess of 5.0 m. - BEDROCK: variably very low to very high strength, extremely weathered to fresh stained, bedrock below depths of 0.2 – 4.7 m. The bedrock comprised mainly dactite with some areas of siltstone and rhyodacite. The pits were discontinued at depths of 1.0–5.0 m. • The Site was predominantly moderately to heavily grassed with numerous rock outcrops and a series of farm access trails. • Farm dams have been constructed generally with one dam in each major gully. • The site is segmented into a series of small and large paddocks separated by fences and gates across three properties, being 'Glenloch, Killenia and Northern Coppins Crossing'. • High voltage power lines and transmission towers cross the grazing areas. • Rock outcropping was observed in extensive sections of the flanks, and top of ridgelines and hills. • Residual soil profiles were observed in the sides of the gullies which comprised pale brown and grey sandy silt overlying orange brown clayey sand/sandy clays. • With the exception of farm dams, isolated uncontrolled filling, some minor filling/modification to drainage lines, and of the existing structures across the site, the remainder of the site is generally undisturbed. • No 'filling' was reported within the test pits completed in the Site with the exception of TP026 and TP060 which was typically topsoil's and/or reworked natural soils to 0.35m and 0.60m depth respectively. • No free groundwater was observed in any test pits during excavation with the exception of TP089 (within

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	• Coppins Creek). However the pits were backfilled immediately following excavation. • Development constraints were listed in the report from a geotechnical perspective such as water logging, unsuitable soils and erosion. • The preliminary geotechnical site investigation indicated that the majority of the Site is suitable from a geotechnical perspective for residential development. No unexpected finds were encountered within Area B.
Milsearch (April 2015) Post Activity Report, Molonglo Stage 3 Urban Development: Geophysical Survey and Remediation of Unexploded Ordnance (V3 final draft)	Milsearch completed a geophysical survey and remediation of Unexploded Ordnance across a 195 hectare investigation and remediation area within the Molonglo Stage 3 Future Urban Area. The 195 hectare area was previously identified through a UXO Contamination and Remediation Assessment of 265 hectares of the Molonglo Stage 3 Future Urban Area previously completed by Milsearch (May 2014). Milsearch state that the survey task was a 100% geophysical UXO survey followed by remediation. Grassed areas were slashed prior to survey to allow access and to increase the accuracy of the survey. The following survey methods were utilised: • TM7 Survey – Utilisation of a quad and pedestrian carried Telemag TM7 multi-sensor magnetometer system over the majority of the Site. A Geometrics G858 Magnetometer System and/or UPEX 740M 1 metre coil metal detector was used over areas of rocky terrain where TM7 survey was unsuitable; • Analogue creek search - Survey of 3.93ha of Deep Creek and tributaries using a Foerster 4.032 Magnetometer; and • Laneway survey - A Geonics EM61 High Power Time Domain Metal Detector was utilised to survey laneways and along fence lines. Due to access and other restrictions, the survey excluded the following areas: • Several mounds covering 1.29ha within a re-contoured/quarried area present in the horse paddock centred on Block M15; • Coppins Crossing Road and other lanes/tracks; • Existing dwellings and other structures, including stockyards and a barn, within Blocks O15, P15 and N14; • Fence lines; • Trees and areas of dense vegetation; and • Flooded farm dams. Anomalies identified during the survey were subsequently investigated and finds removed using a combination of hand and mechanical excavation. A range of unexploded ordnance (UXO) and Exploded Ordnance Waste (EOW) consistent with the firing of 15 Pounder (Pdr) and 18 Pdr guns was found across the investigation and remediated which comprised: • Shell 15 and 18 Pounder HE; • Inert canister shells; • Ogives from the canister shell; • Fragmentation from HE and canister shell; • Ignition (flash) tubes from canister shells; and • Fuze adaptor rings. All identified UXO and EOW was collected by the Department of Defence (DoD) for appropriate disposal. The conclusions and recommendations of the Geophysical Survey and Remediation of Unexploded Ordnance, by Milsearch were as follows: • It is the opinion of Milsearch Pty Ltd that, within the limitation of the UXO search equipment and methodology applied, that the area, excluding those areas detailed as exceptions and limitations, is free of live UXO/EO of a size equal to or greater than a 15 Pdr projectile at a depth of 0.61m depth or shallower; • **It was recommended that, when possible, subsequent investigation should be carried out within the following areas:** - South-west from the external search boundary, towards the Molonglo River from the vicinity of Blocks C11 and D11, due to the number of fragmentation finds in close proximity to the external search boundary in this direction; - The seven remaining anomalies within the flooded dam in the extreme east of the Site;

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	- Areas of blackberry and other bushes within the protected Pink Tail Worm habitat; and - During removal of existing fence lines, soil mounds, large trees, dwellings and other structures across the Site.
WSP Environmental (May 2016) Stage 2 Detailed Site Investigation Molonglo Valley Stage 3 (Area B)	The scope of works were as follows: • Site investigation works undertaken between 16 April and 14 May 2015. Supplementary fieldwork including the installation of four groundwater monitoring wells was completed on 5 and 6 August 2015. • Test pits encountered variable subsurface conditions generally associated with the undulating topography across the site. Soils across the site were typically characterised as gravelly and sandy clays, with a covering of topsoil and shallow weathered, low strength bedrock (dactite). High strength bedrock was encountered at shallow depths near elevated areas across the site. Fill with inclusions of anthropogenic wastes was encountered at: - WSP_AEC7 (farm dam): B-TP014, brick fragments and glass. - WSP_AEC8 (farmhouse): B-TP017, B-TP019 and B-TP020 pieces of plastic, likely incineration, rusted metals. - WSP_AEC10 (sludge ponds): Test pits undertaken within the AEC. - WSP_AEC12 (kangaroo burial pit): Test pits undertaken within the AEC. - WSP_AEC18 (livestock plunge dip): B-TP094, fragments of brick. - RobA_AEC5 (AFP training area): Test pits undertaken within the AEC. - UFP1 (former sewer construction vehicle maintenance depot): B-TP300 to B-TP321. • Areas that contained fill or reworked natural soil included most dam embankments and around structures such as farmhouses and agricultural sheds and structures. The reworked natural soil did not include anthropogenic or buildings waste.. • No confirmed asbestos containing materials (bonded fibre cement fragments or similar) were observed during the Site work in any of the test pits, boreholes or surface sampling locations. • Selected samples from each location were submitted for laboratory analysis. Samples were predominantly selected from the surface or fill material, which was identified as having the greatest potential for contamination. - WSP_AEC10 (Sludge Ponds) and WSP_AEC18 (livestock plunge dip) reported chemical results in soil above the adopted Site criteria. It should be noted however, the Sludge Ponds area future development zoning will be NUZ4 River Corridor, the soils requiring remediation may only require burial and / or landscape works such as pushing the embankments over and re-compacting. Off-site disposal may not be required and decisions on this should be confirmed with the Site owner, Territory and Municipal Services (TAMS), and a remedial action plan (RAP) and civil earthworks design be prepared to ensure the former Sludge Ponds are geotechnically stable and pond sediments buried. - A total of 78 soil samples were analysed for the explosives residue suite that included HMX, RDX and nitro-glycerine. All explosives residue laboratory results for soils were below the LOR (non-detect) at all sampling locations with the exception of B-TP186 0.1 located within the AFP Training Area (RobA_AEC5). This sample had a trace concentration of 0.2 mg/kg for RDX with an adopted screening criteria for residential land use of 6.1 mg/kg. - No bonded asbestos containing material or friable asbestos was detected in bulk samples (500g) nor during sieving of the 10L samples for sample analysis. No asbestos fines (AF) or fibrous asbestos (FA) were identified above the laboratory detection limit in any of the samples analysed. No exceedances of adopted criteria for asbestos were reported. • No filling was reported within the test pits completed for the Preliminary Geotechnical Investigation (Douglas Partners, April 2015) with the exception of TP026 and TP060 which was typically topsoil and/or reworked natural soil to 0.35m and 0.60m depth respectively. Although the Douglas Partners investigation was completed for geotechnical purposes, no deep fill with obvious anthropogenic waste or inclusions was observed or reported. • The two remedial areas and estimated volumes of material are provided below. WSP reported that for WSP_AEC10 (Sludge Ponds) soils may only require burial and / or

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	landscape works such as pushing the embankments over and compacting, not necessarily excavation and offsite waste disposal. **Remedial Area 1 (RA1):** WSP_AEC10 (Sludge Ponds): - Heavy metals, microbiological and TRH C_{10}-C_{36} impacted soils / sediments from former sewerage works. - Preliminary volume estimate: 20,000m^3 (40,000m^2 of area with an average depth of 0.5m). Using a conservative bulking factor of 1.8, this equates to 36,000 tonnes. - Material could potentially remain on the Site and a civil earthworks design solution be implemented to push over the embankments and cap the bottom sediments with 1.0 - 2.0 m of reworked natural soils. **Remedial Area 2 (RA2):** WSP_AEC18 (Livestock Plunge Dip): - Arsenic impacted soil from previous plunge dip use and surrounding area. - Preliminary volume estimate: 100m^3 (200m^2 of area with an average depth of 0.5m). - Using a conservative bulking factor of 1.8, this equates to 180 tonnes. • Based on the available Site history, SAQP, visual and olfactory observations, the concentrations of contaminants of concern and the findings of this Stage 2 DSI, WSP concluded that the Site can be made suitable for future urban use and open space along the Molonglo River riparian corridor subject to preparation of a RAP (or administrative control) for the Sludge Ponds (WSP_AEC10) and remediation of the livestock plunge dip (WSP_AEC18). • The following actions will need to be addressed prior to and during the proposed future development works to ensure remedial works are completed and any unexpected finds are managed according to best environmental practice: - No interim management measures are considered to be required for the sludge ponds (WSP_AEC10) as the site has restricted public access, is securely fenced and is only accessed occasionally by the AFP for training. - For the livestock plunge dip (WSP_AEC18) on the Killenia property with arsenic in surface soils, the current leaseholder should be informed and if not in use (for livestock) the immediate area cordoned off. If in use for livestock / farming, the leaseholder should ensure that surface soils immediately around the dip are not handled without wearing protective clothing (i.e. gloves) and hands should be washed to minimise the potential for ingestion of arsenic in soil; - Prepare a remedial action plan (RAP) for livestock plunge dip (WSP_AEC18) that discusses the remediation goals and objectives, methodology and validation procedures; - Prepare a RAP and, if required, civil earthworks design for WSP_AEC10 (Sludge Ponds) to cap the bottom sediments with 1.0 - 2.0 m of reworked natural soils and ensure long term geotechnical stability; - Undertake future earthworks and development works with consideration of the Environmental Management Plan (EMP); - Carry out segregation or offsite disposal as waste for the areas identified with anthropogenic wastes / fill from an aesthetic contamination perspective; - Ensure the recommendations in the UXO Milsearch (April 2015) *Post Activity Report* are undertaken as part of future works prior to development and earthworks at the Site, including additional surveys of specific areas such as along metal fence lines, farm buildings and stockpiles / fill mounds; - Tracing and removal of any asbestos containing materials such as potential *in situ* piping and potential other utility services installed across the Site; and - Ensure that any earthworks is carried out under the provision of an Unexpected Findings Protocol (UFP) that identifies any potential soil or water contamination during development. This may also require the need for a 'watching brief' to be undertaken during bulk earthworks to ensure any minor contamination issues are identified and dealt with by suitably qualified and experienced environmental consultants. This may include segregation of unexpected finds, chemical characterisation and assessment for reuse on the Site or offsite disposal as a waste.
WSP | PB (22 September 2016) Letter Report on Investigation of soils	The objective of the soil investigation was to determine the contaminant concentrations around and within the Sheep Dip associated with the Glenloch property, which has anecdotally been disused for several decades.

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around the Glenloch Property Sheep Dip located within Molonglo Valley Stage 3 Future Urban Area (Area B), Block No. 6	WSP completed 10 test pits across the general area of the AEC (Rob_AEC22 – Glenloch Sheep Dip) during the Stage 2 DSI. One groundwater monitoring well was installed in August 2015 to assess depth to groundwater and potential for contaminant impact from the Sheep Dip. Groundwater was not encountered within the well to a depth of 10.0 m below ground level, and no samples could be collected. Results of the soil analytical results from the 10 test pits reported concentrations of contaminants of concern below the laboratory limits of reporting, and below the respective adopted site criteria. As the sampling completed by WSP during the Stage 2 DSI did not target the concrete Sheep Dip, further sampling was required. Nine additional sample locations were completed by WSP on 15 August 2016. The samples were collected in a systematic grid around the Sheep Dip. Sampling within the Dip was not possible, however WSP reported that the material within the concrete lined Dip appeared to be mainly organic material from the surrounding pine trees. Samples were submitted for laboratory analysis for heavy metals and OCPs, with selected samples also submitted for leachate testing (TCLP and ASLP). Sixteen samples were submitted for analysis, with all results reported below the adopted HIL A criteria, with the exception of arsenic. Arsenic was present in the majority of samples collected from around the Sheep Dip, with concentrations exceeding the human health criteria of 100 mg/kg. No OCPs and specifically no DDT was identified which correlates with the non-use of the Sheep Dip for several decades and the short half-life of DDT being approximately 3 to 10 years. Comparison of arsenic in soil concentrations to the Environment ACT (June 2000) ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste criteria indicates that the soils are classified as a mixture of Solid and Industrial waste. WSP reported that the soils immediately around the Sheep Dip (~2.5m) appear to have the higher waste classification (Industrial). Concentrations of arsenic within soils around the Sheep Dip are above the adopted human health site criteria and will require management and / or remediation prior to the future urban uses being applied to the Site. The remedial works proposed to be outlined in the remedial action plan (RAP) prepared for the Molonglo Valley Stage 3 (Area B) area.
WSP | PB (8 February 2017) Unexpected Finds Management Plan Contaminated Land and Unexploded Ordnance (UXO) / Exploded Ordnance (EOW), within Molonglo Valley Stage 3 (Future Urban Area)	WSP prepared an Unexpected Finds Management Plan (UFMP) for the entirety of the Molonglo Valley Stage 3 (MV3) future urban area (covering Area A and Area B audit areas). The UFMP has been prepared to manage risks of encountering potentially contaminated land, unexploded ordnance (UXO) and exploded ordnance waste (EOW) during future earthworks and construction activities. Several UXO investigation surveys and remediation of UXO/EOW have been undertaken within MV3 (as reported by Milsearch 2013, 2014, 2015). The Molonglo Valley was historically used for the training of artillery soldiers from 1915 until the mid-1920s, with two known projectiles used (15pd and 18pd Artillery Projectiles). The Department of Defence (DoD) has reportedly taken reasonable steps to locate and remove all explosive ordnance waste and unexploded ordnance from Molonglo Valley. There is however a possibility that future users of the site may encounter explosive waste or unexploded ordnance (principally within Area B of MV3 and not Area A). The objectives of the UFMP are to: • Manage potential unexpected finds of contamination (if any); • Mitigate human health and environmental risks (if any) associated with the find; and • Provide guidance to obtain adequate management advice and allow validation (where required). With regards to potential for UXO and EOW within MV3, the UFMP requires the following: • Familiarise members of the contractor's workforce, including subcontractor and other personnel requiring access to the MV3 (Area A and Area B) worksites, with the unexploded ordnance hazards associated with that site; • Provide actions on discovery of UXO and EOW; • Ensure any UXO or EOW finds are handled appropriately; and • Provide guidance to obtain adequate management advice and contact details for ACT Police and Department of Defence to assess the find and clear the area.
WSP | PB (13 February 2017)	WSP prepared a Remedial Action Plan (RAP) in relation to remedial areas located within the Molonglo Valley Stage 3 (MV3) Area B Future Urban Area (FUA).

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Remedial Action Plan Molonglo Valley Stage 3 (Area B)	This RAP covers three remedial areas identified as WSP_AEC10 (Former Sludge Ponds), WSP_AEC18 (Former Livestock Plunge Dip and Yards) and RobC_AEC22 (Glenloch Sheep Dip). The contaminants of concern for each remedial area is provided below: • **WSP_AEC10 (Former Sludge Ponds):** Heavy metals, microbiological (Faecal Coliforms and E. Coli) and TRH C10-C36 impacted soils / bottom sediments from former sewage treatment works. • **WSP_AEC18 (Former Livestock Plunge Dip and Yards):** Arsenic impacted soils from previous livestock plunge dip use and immediately surrounding yard area. • **RobC_AEC22 (Glenloch Sheep Dip):** Arsenic impacted soils from previous sheep plunge dip use and immediately surrounding area. The purpose of the RAP is to minimise contamination risks associated with potential hazards identified specifically relating to soil contamination issues and to demonstrate that the remedial areas can be made suitable for their future landuse. The RAP outlines the proposed remediation goals, strategy and methodology for each of the remedial areas. Remedial area WSP_AEC10 (Former Sludge Ponds) is currently managed by Territory and Municipal Services (TAMS) and remedial works may be undertaken by TAMS or another party in the future. LDA and TAMS may need to adopt a long term site management outcome and determine which agency will implement the remedial tasks and any future long term environmental management (such as an EMP, if required). Remedial area WSP_AEC18 (Former Livestock Plunge Dip and Yards) is currently leased for farming and agistment practices and managed by LDA. Remedial area RobC_AEC22 (Glenloch Sheep Dip) is currently leased for farming and agistment practices and managed by LDA. The preferred soil remediation strategy will be dependent on the future urban area planning, design and construction framework and timing within the Molonglo Valley Stage 3 area. LDA and TAMS (for the former Sludge Ponds) will need to assess the most practical way to ensure that the remedial works can be implemented to ensure a suitable outcome. Therefore, the future development works in Molonglo Valley Stage 3 may determine at a future date the most suitable outcome from the combination of remedial options listed in the RAP. A series of remedial options have been discussed in the RAP with consideration of the remedial objectives, sustainability, time and cost implications. The preferred remedial strategy for WSP_AEC10 (Former Sludge Ponds) is Civil Earthworks Design, Capping and Containment and Management with an EMP. The principal reason for this option is the costs involved when compared to offsite disposal as waste, the ability for a suitable capping and containment measure to be put in place and the likely end land use (being Public Open Space within the river corridor zone). The preferred remedial strategy for WSP_AEC18 (Former Livestock Plunge Dip and Yards) is a mixture of excavation and offsite disposal, characterisation and beneficial reuse in suitable landforms / zoning. The two options are considered the most suitable due to the relatively small volume of impacted soil, the likelihood of large scale earthworks machinery being available to excavate, load and cart to another location within MV3 and the lower costs involved for beneficial reuse. Both options are considered suitable, however due to the requirement for additional soil characterisation (for leachability potential), the disposal off site option has been included as a contingency or if ACT EPA approval for beneficial reuse as fill is not forthcoming. The preferred remedial strategy for RobC_AEC22 (Glenloch Sheep Dip) is a mixture of excavation and offsite disposal, characterisation and beneficial reuse in suitable landforms / zoning. The two options are considered the most suitable due to the relatively small volume of impacted soil, the likelihood of large scale earthworks machinery being available to excavate, load and cart to another location within MV3 and the reduced costs involved for beneficial reuse. Soil immediately around the concrete dip bath (~2.0m east and west) are not suitable for Open Space reuse due to high arsenic concentrations (>300 mg/kg). This soil will require offsite disposal with remaining soils potentially suitable for beneficial reuse based on total concentrations or arsenic and leachable concentrations. The remediation works would include locating suitable area(s) within MV3 with a zoning less sensitive than low density residential with access to soil. Areas that could be considered for beneficial reuse within MV3 (subject to ACT EPA approvals) include: • WSP_AEC10 (Former Sludge Ponds) remedial area, taking into account potential for ecological significance of the area, ecological communities and capping depth to the final landform design surface.

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	• Within land zoned under a commercial land use. • Within roadways and internal roads as compacted subgrade. • Within roadway / noise embankment structures. • Other areas that are considered suitable within the land zoning and approval processes and that do not have a risk of human health or environmental impacts. The Auditor considered that the strategy presented in the RAP demonstrates that the site can be made suitable for the proposed future urban area land uses.

3.2 Auditor Discussion

The Auditor considers the works completed, followed an iterative process collecting information to characterise the contamination with assessment against criteria applicable for mixed use development comprising urban residential, urban open space including recreation and nature reserve along the Molonglo River corridor with limited core commercial and transport services.

The Auditor considers that the areas of concern have been adequately identified, and that the remedial options proposed are practical to enable the site to be made suitable for the proposed Future Urban Area redevelopment. This is evaluated further in the following SAR chapters.

All other information pertaining to Area A is not relevant to the current SAR and is covered under a separate Audit.

4. Evaluation of Conceptual Site Model

4.1 Site Condition

The site condition prior to the commencement of the works described in this SAR is summarised in this section. This information has been sourced from the reports listed in Section 1.4 which were prepared covering Molonglo Valley 3 (MV3) Areas A and B collectively.

Table 4.1: General Site Condition

Title	Details
Topography and Drainage:	The overall MV3 site area is noted to range from gently undulating to rolling with slope angles between 5° and 15°. The elevation ranges from 630 to 530, dropping further steeply to Molonglo River. The nearest surface water receptor is Molonglo River located along the western and southern boundaries of the Site. The Molonglo River flows in a north-westerly direction, discharging in the Murrumbidgee River, which is the most significant river system in the region. Coppins Creek is situated on the northern boundary of the site. There are at least four drains and associated feeder channels used to control surface water flow which receive runoff from up-gradient areas noted onsite.
Boundary Condition:	The Auditor noted that there were no structures located along the boundaries of the site.
Visible Signs of Contamination:	Potentially contaminated areas noted within the MV3 Area B study area included: • Coppins Crossing Sludge ponds (4) associated with the former sewerage treatment plant (WSP_AEC10); • Livestock Plunge Dip (WSP_AEC18); • Localised dump areas in the creek beds with car wrecks, metals, household rubbish and potentially other waste materials;
Visible Signs of Plant Stress:	No visible signs of distressed vegetation was noted onsite, with the exception of Blackberry pest control
Presence of Drums, Wastes and Fill Materials:	WSP identified the following specific features within Area B: • Localised dump areas in the creek beds with car wrecks, metals, household rubbish and potentially other waste materials; • Burial locations of kangaroo carcasses / livestock dumps; • Filled area containing household and construction waste; and • Potential presence of unexploded shells / EOW associated with historic use of the site as an artillery range.
Odours:	Organic odour were observed in several drainage lines during WSP's January 2015 site visit.
Condition of Buildings & Roads:	Roads/tracks within the site were generally noted to be unsealed.
Quality of Surface Water:	Surface water quality observations were as follows: • Agricultural dams onsite, dam water observed to be turbid. • Surface water in creeks onsite – water quality observation not outlined. • Molonglo river water quality – water quality observation not outlined. • Ponded surface water within drainage lines in lower parts of the local catchment near Molonglo River. Sampling of surface waters was conducted with results provided in sections below.
Flood Potential:	The Molonglo River is adjacent to the site, and is known to flood during high rainfall events, however, no information pertaining to flood potential to the Molonglo Valley was provided.

Title	Details
Relevant Local Sensitive Environments:	Sensitive receptors and environments identified were: • The Molonglo River riparian areas along the western and southern boundary of the site • Molonglo River water quality and freshwater aquatic species downgradient from the site. • Endangered ecological species such as the pink tail worm lizard and Rainbow bee-eater located in the rocky bluffs and riparian areas of Area B. • Kama Reserve ecological communities to the west of Area B.

4.2 Site History & Records

The site history and review of government records is summarised in this section. Previous assessment reports have been completed for the entire MV3 study area (Area A and Area B combined). As a result, the historical assessment described below includes information relevant to both Areas A and B. This information has been sourced from the reports listed in Section 1.4:

Table 4.2: Site Land use and Historical Records

Title	Details
Previous Land Use & Chronological List:	• 1944: The site was under agricultural use. • 1968: Northern and central portion of site (80%) remained under agricultural use, a forestry plantation was developed on the southernmost portion of the site. • 1985: Continued agricultural landuse in the central to northern portion. Forestry plantation to the south had expanded northwards towards the centre of the site. Four sludge ponds were constructed in Block 10 with trunk sewer pipelines constructed across the site. • 1998: No major changes observed. • 2009: Plantation of the southern portion (Area A to the south of the site) was impacted by the 2001 and 2003 bushfires, with majority of the forested areas cleared. The remainder of the site was noted to be under agricultural landuse.
Land Titles:	The land is owned by the ACT government which permits access/use of the land via: • Privately leased land – Blocks 4, 5, and 41 (private individual) • Unleased land with grazing access – Blocks 12, 13, 14, 15, 16, 42, 43, part of 46 and part of 72 • Former pine plantation - part of 46 • Infrastructure Corridors - Blocks 38, 39, 40 • Molonglo River + banks - Part of 46 • Coppins Crossing Sludge Ponds – Block 10
EPA Records:	An Environment Protection Authority (EPA) Contaminated land Search was conducted, and the following applicable records were noted: • Block 10 – Molonglo Valley (formerly Clock 1570 Belconnen). Records held by the Environment Protection Authority (EPA) indicated the following: - The block is recorded on the EPA's contaminated sites management database and geographic information system; - EPA records indicate the presence of a number of disused sewage treatments ponds; - Sewage treatment plants are listed as activities associated with land contamination which may pose a risk to human health and the environment; - Blocks which contain sewage treatment plants would be considered potentially contaminated and would be subject to assessment and an audit should it be developed into the future. • Block 16 – Molonglo Valley (formerly 181 Belconnen). Records held by the Environment Protection Authority (EPA) indicated the following:

Title	Details
	- Sheep dip sites have been identified within the site. - Areas impacted by sheep dip and associated rural activities are considered potentially contaminated and would be subject to assessment and an audit should a change in land use or redevelopment of the site be proposed.
WorkCover Dangerous Goods Licenses/ USTs/ ASTs:	No WorkCover records are associated with the site.
Summary of Aerial Photographs (on site and adjacent sites):	• 1944: Northern portion of the site was under agricultural use with a network of tracks noticeable in southernmost portion the site. Coppins Crossing Road had been constructed. Surrounding land use primarily was agricultural landuse, Molonglo River to the south and west, and Weston Creek Sewage Treatment Plant in Area B. • 1968: Northern portion of site remained under agricultural use, a forestry plantation was developed on the southernmost portion of the site. Tracks constructed towards Block 10 sludge ponds. A large building was constructed at the eastern side of Coppins Crossing Road. 15ha of land across 400 Coppins Crossing Road re-contoured with stockpiles noticeable. No change to surrounding landuse. • 1985: No change to the northern portion of the site (still agricultural). 4 sludge ponds constructed in Block 10 with trunk sewer pipelines constructed across the site. Building constructed at 400 Coppins Crossing Road had been demolished. New building constructed on Block 13 with sheds constructed on Blocks 5 and 13. Surrounding landuse - Tuggeranong Parkway constructed to the east and William Hovell Drive to the north of the site. • 1998: No major changes to the site landuse with signs of excavations/re-contouring in the north-eastern portion of Block 46. No major changes to surrounding landuse. • 2009: No major changes in Area B site area. Plantation to the south of the site (Area A) impacted by 2001 and 2003 bushfires, with majority of the forested area cleared.
Description of Manufacturing / Industrial Processes and Location:	Majority of the MV3 Area B site was historically used for agricultural purposes. The former Weston Creek Sewage Treatment Plant (WCSTP) was constructed in 1925, decommissioned in 1977, and demolished between 1977 and 1979. The WCSTP contained several sludge ponds utilised in the processing of the waste water. The Sludge ponds (four) were located within Block 10, and received waste sludge from the Sewerage Treatment Plant between 1970 and 1978. The sludge ponds are potential sources of nitrogen, phosphorus, faecal coliforms and heavy metals. Part of the former WCSTP has been and continues to be used by AFP as an explosives detonation training compound.
Inventory of Chemicals and Wastes and their Location:	WSP did not provide an inventory of chemicals used, nor their location. However, the site has been used since the 1940s for agriculture and the storage of chemicals associated with such use may include pesticides/herbicides, sheep and cattle dipping chemicals, fertilizers in close proximity to such activities.
Product Spill and Loss History:	Nil reported
Discharges to Land, Air & Water:	Discharges to land and water may include agricultural dams, excavated areas, localized oil staining from oil drums, stockpiles, agricultural chemical use, uncontrolled fill material for construction, and uncontrolled surface and groundwater discharges to Molonglo River. No discharges to air were identified.
Complaint History:	Nil reported
Sewer & Service Plans:	No services and sewer plans were available for the site.
Local Site Knowledge:	Relevant anecdotal information reported by Consultants indicated the following: • Territory and Municipal Services Directorate Nature District - No major filling has occurred. Minor filling (probably with clean materials) associated with filling gullies. Mainly close to the tar road (Coppins Crossing Road);

Title	Details
	- Spraying is done on a regular basis for herbaceous weed control, targeted against blueberry bushes. Products that are used: 2.4D Amine, Dicamba, Roundup (glyfosate), Grazon (picloram, tryclopir), Brushoff (metsulfuron methyl) - Dry sludge ponds in Block 10 caught fire in the 2003 bushfires, white ash from the fire dispersed to distances of approximately 500m. - Around 1970 the north east corner of Block 46 was used as a pipe lay down area for the concrete lined steel pipes of the trunk sewer. - In the southern point of Block 46, a pine plantation was present until the 2001 and 2003 bushfires. Currently blueberry bushes have taken over and the area is therefore regularly sprayed for weed control. • Forestry and Roads with ACT Parks - Former quarry (use in the 1970s) located along the eastern boundary of the site, near the north-western corner of the Arboretum, to provide rock for upgrading works to William Hovell Drive.
Permits, Licenses and Approvals:	See above. Nil identified for current site use.

4.3 Geology, Hydrogeology and Hydrology

The geology, hydrogeology and hydrology is summarised in this section. This information has been sourced from the reports listed in Section 1.4.

Table 4.3 Subsurface Conditions

Title	Details
Geology Map Conditions:	The Canberra 1:100,000 Geological Series Sheet (1992) indicates the site is underlain by Silurian Volcanics which generally comprise Dacites and Ignimbrites with minor tuff and ash stone occurrences.
Soil Map Conditions:	The weathered soils within this Silurian formation are characterized by clay. The Silurian sequence is well fractured and contains low salinity water capable of producing stock and domestic water supplies at depths ranging from 25m to 60m below grade.
Acid Sulfate Soils:	The area is considered to have no known occurrence of acid sulfate soil (ASS).
Salinity:	It is not considered likely that the site would be significantly impacted by saline soils based on the regional geology, hydrology, and soils.
Soil Classification Method:	Not outlined.
Ground Conditions Summary from borehole records:	Surface perched water tables will periodically occur in the relatively thin soil cover on top of the volcanics, leading to local water logging after heavy rainfall. The potential for significant perched groundwater systems was considered low due to the limited thickness of the soil and weathered rock cover on the Silurian sequence (up to several metres) and the low permeability of the clay based subsoil. Alluvium aquifers were not considered to be a substantial storage of water as alluvium sediment volume and thickness is likely to be low and confined to the lower reaches of the Molonglo River channel which appeared to be dominated by bed rock controlled fluvial geomorphology.
Location of Fill Material:	Fill material identified across the site: • Imported fill material used to construct agricultural dams • Fill material found at mouth of a gully • Fill material to construct two concrete driveways onsite • Fill material to construct drainage and underground sewage pipelines across the site.
Regional Hydrogeology:	Based on WSP (2012), the Silurian sequence underlying the site is well fractured and contains low salinity water capable of producing stock and domestic water supplies at depths ranging from 25 to 60 metres below grade. Based on the 1:100 000 Hydrogeology

Title	Details
	Map of the ACT and Environs (Evans and Moffat, 1984), Coffey (2005) report that aquifer yields are generally less than 0.5 L/s.
Summary of Monitoring Wells:	A search of privately managed water abstraction bores and groundwater monitoring wells with ACT ESDD Environment Protection and Water Regulation shows that there are no registered bores within the site boundary.
Depth to Groundwater:	Based on geology, topography and the information from the Hydrogeology Map, groundwater levels in the area are generally deeper than several tens of metres below ground level. Based on the wells installed by WSP in August 2015, regional groundwater is considered likely to be located within the underlying dactite bedrock (>10m bgl) within primary fractures throughout the rock mass. Some perched water is likely to occur down hydraulic gradient of permanent surface water dams and ponds such as the Sludge Ponds (WSP_AEC10) with shallower groundwater present at monitoring wells BMW01 and B-MW02 (~6.0 to 8.5m bgl).
Direction and Rate of Groundwater Flow:	Regional groundwater flow is expected to be towards the Molonglo River.
Use of Water Abstraction:	No registered groundwater bores for water abstraction were found for the site.
Nearest Water Body:	Molonglo River is located along the western and southern boundary of the site.
Direction of Surface Water Run Off:	Surface water is channelled through drainage and associated feeder channels onsite which drain towards Molonglo River. The presence of agricultural dams serves to collect up-surface water runoff as well.
Background Water Quality:	Surface Water Quality is discussed in Section 7.10 as surface water samples were collected.
Preferential Water Courses:	Coppins Creek, Deep Creek and Molonglo River.
Summary of Local Meteorology:	The Bureau of Meteorology (BoM) characterised the regional meteorology for Canberra as a relatively dry, continental climate with warm to hot summers and cool to cold winters

4.4 Contaminants and Media

WSP (2012, 2016) had identified the following potentially contaminating activities and contaminants of concern associated with past and present activities for Area B. WSP's SAQP considered findings from other consultants' investigations. Given the size of the site, the areas of concern are notated as AECs and their locations are provided in WSP Figures included in Appendix A.

Table 4.4 Summary of AECs, Potentially Contaminating Activities and Contaminants of Concern for Area B - SOILS

Area	Activity	Potential Contaminants
WSP (2012) Phase 1 ESA		
WSP_AEC 1 to WSP_AEC 7 (excluding 6)	Agricultural dams with potential to act as a sink for any contamination runoff	Heavy metals (As, Cd, Cr, Cu, Pb, Ni, Hg, Zn); Organochlorine Pesticides (OCPs); Organophosphorus pesticides (OPPs); Total Recoverable Hydrocarbons (TRH); Polycyclic Aromatic Hydrocarbons (PAHs); Polychlorinated Biphenyls (PCBs); Phenol; Nutrients (phosphate, ammonia, nitrate), RDX/HMX (explosive residues)
WSP_AEC 8	Homestead with associated sheds and stockyards. The homestead may be associated with building materials such as asbestos and lead paint and there may be current or historic	Heavy metals, OCPs, OPPS, TRH, PAH, Asbestos

Area	Activity	Potential Contaminants
	storage of small quantities of farm chemicals.	
WSP_AEC9	Localised dumped rubbish in an excavated area	Heavy metals, OCPs, OPPs, TRH, PAHs, PCBs, BTEX (benzene, toluene, ethylbenzene, xylene), phenols, asbestos
WSP_AEC10	Sludge Ponds located on Block 10 which received sludge from the former Weston Creek Sewerage Treatment Plant between 1970 and 1978	Heavy metals, OCPs, OPPs, TRH, PAHs, PCBs, phenols, asbestos, faecal coliforms, nutrients, RDX/HMX, viruses and bacteria.
WSP_AEC11	Localised suspected asbestos containing materials (ACM) were identified in a small area (5m x 1m x 1m) near the Sludge Ponds (AEC10)	Asbestos
WSP_AEC12	Kangaroo carcass burial area	Heavy metals, OCPs, TRH, PAH, nutrients
WSP_AEC13	Hay shed with various stockpiles including steel barrels, tyres, wood, plastic	Heavy metals, OCPs, OPPs, TRH, PAH
WSP_AEC14	Occupied homestead with associated diesel storage shed and stockyards	Heavy metals, OCPs, OPPs, Triazine Herbicides, TRH, PAHs, BTEX, PCBs, phenols, asbestos.
WSP_AEC15	Barrel with petroleum product and localised staining (<1 m^2) from leakage and burning.	TRH, PAH, BTEX
WSP_AEC16	Disused old shed and livestock holding yards	Heavy metals, OCPs, OPPs, TRH, PAHs, BTEX, asbestos
WSP_AEC17	Derelict sheep dip spray with holding pen	Heavy metals, OCPs, OPPs
WSP_AEC18	Derelict sheep dip, adjacent to disused shed (AEC16)	Heavy metals, OCPs
WSP_AEC19	Cattle spray dip.	Heavy metals, OCPs, OPPs
WSP_AEC20	Abandoned car bodies in creek bed.	Heavy metals, OCPs, OPPs, TRH, PAHs, BTEX, PCBs, phenols, asbestos
WSP_AEC21	Scrap metal in multiple locations in the creek (barrels, steel, containers etc.)	Heavy metals, TRH, PAH
WSP_AEC23	Former building structure as identified in 1968 aerial photograph (no longer present)	Heavy metals, OCPs, TRH, PAH, PCB, phenols, asbestos
WSP_AEC26	Shed with corrugated steel roof and wooden columns.	Heavy metals, OCPs, TRH, PAH, PCB
WSP_AEC27	Location of a former pioneer's house (exact location not known).	Heavy metals, OCPs, TRH, PAH, PCB, asbestos
WSP_AEC28	Rubbish dump area	Heavy metals, TRH, PAH, asbestos
WSP_AEC30	Unexploded Ordnance (UXO) and exploded ordnance waste (EOW) remediation area.	Heavy metals, RDX/HMX
WSP_AEC 31 (diffuse)	Herbicide and pesticide usage from current and historical land use: grazing land, nature conservation and forestry.	Heavy metals; OCPs, OPPs, Triazine Herbicides.
WSP_AEC 33 (diffuse)	Stockpiles and isolated occurrences of burnt timber, likely resulting from bushfires.	Heavy metals; TRH; PAHs.

Area	Activity	Potential Contaminants
Sewer Construction Depot (1970s) – UFP1	Former sewer construction vehicle / truck workshop area noted in a 1975 aerial photo of the site. Included buried waste such as metal parts and associated vehicle maintenance	Heavy metals, TRH, PAH, OCP, PCB
Robson (2014) Phase 1 ESA		
RobA_AEC5	Explosive detonation and training by AFP	Heavy metals, TRH, PAH, asbestos, perfluorinated compounds (PFC)
RobA_AEC7 and RobA_AEC8	Two concrete spill points	Heavy metals, OCP, OPP, PAH, PCB, phenol, faecal coliforms, nutrients
RobA_AEC9 to RobA_AEC12	Four drains used to control surface water runoff from up-gradient land uses.	Heavy metals, OCP, OPP, TRH, PAH, BTEX, RDX/HMX, Nutrients
RobC_AEC10	Dam, potentially receiving runoff from William Hovell Drive.	Heavy metals, OCP, OPP, RDX/HMX, Nutrients
RobC_AEC11 to RobC_AEC13	Dam, potentially receiving runoff from Bindubi Street	Heavy metals, OCP, OPP, TRH, PAH, BTEX, nutrients
RobC_AEC22	Sheep plunge dip, 'Glenloch' property area	Heavy metals, OCP, OPP, TRH
RobC_AEC23	Glenloch property homestead and shed area Glenloch sheep plunge dip and shearing shed area.	Heavy metals, OCP, OPP, Triazine Herbicides, TRH, PAH, PCB, BTEX, PCB, Phenols, Faecal Coliforms, Nutrients, asbestos
RobC_AEC24	Former orchard area, Glenloch property area	Heavy metals, OCP, OPP, Triazine Herbicides
RobC_AEC25 and RobC_AEC26	Two small farm sheds	Heavy metals, OCP, TRH
RobC_AEC27	Livestock loading ramp	Heavy metals, OCP, TRH
RobC_AEC32	Dam, potentially receiving runoff from William Hovell Drive	Heavy metals, OCP, OPP, TRH, PAH, BTEX
RobC_AEC33	Dam, potentially receiving runoff from William Hovell Drive, plus the	Heavy metals, OCP, OPP, TRH, PAH, BTEX, Faecal coliforms, nutrients
RobC_AEC34 to RobC_AEC43 (excluding 37)	Ten (10) dams, potentially used for agricultural / grazing purposes. (AEC37 is located outside the defined Area B boundary)	Heavy metals, OCP, OPP, TRH, PAH, BTEX, Faecal Coliforms, nutrients
RobC_AEC44	Dam, potentially receiving runoff from William Hovell Drive	Heavy metals, OCP, OPP, TRH, PAH, BTEX
RobC_AEC45	18 lb QF Gun Firing Point (1920/1921 Practice)	Heavy metals, PAH, RDX/HMX
RobC_AEC46	18 lb QF Gun Firing Point (1920/1921 Practice)	Heavy metals, PAH, RDX/HMX
WSP (2014)		
Molonglo River Water	South western portion of Area B Boundary within River channel	Dissolved heavy metals, OCP, TRH, PAH, Faecal Coliforms, nutrients
Molonglo River Sediment	South western portion of Area B Boundary within River channel	Heavy metals, OCP, TRH, PAH, Faecal coliforms, nutrients

Table 4.5 Summary of AECs, Potentially Contaminating Activities and Contaminants of Concern for Area B – GROUNDWATER

Area	Activity	Potential Contaminants
WSP (2012) Phase 1 ESA		
WSP_AEC 18 (Groundwater)	Spray Sheep Dip, with holding pen	Dissolved heavy metals, OCP, OPP, TRH, PAH, Faecal coliforms, nutrients
RobC_AEC22 (Groundwater)	Sheep plunge dip, Glenloch property	Heavy metals, OCPs, OPPS

WSP reported that OPPs will have degraded relatively quickly after application in Area B. However, pesticide spraying has occurred in grazing and Molonglo River areas (WSP, 2012) and therefore WSP considered it prudent to allow for OPPs analysis.

Consideration of the relative risk for each AEC was also assessed (based on previous reports and the detailed site walkover conducted by WSP and Site Auditor) in confirming the DSI programme.

WSP considered the contaminants of potential concern (COPC) in the following media:

- Soil
- Sediment
- Groundwater
- Surface Water

4.5 Auditor Discussion

The information required by OEH (2011), in regard to site condition and history, geology, hydrology and hydrogeology, has been provided, and is consistent with the Auditor's understanding of the site. Those items not provided were noted in Auditor Interim Advices, and responded to by WSP in updating and revising the reports (notably the SAQP). Where items were not addressed, their omission is not considered to affect the conclusions of this SAR.

The Auditor concurs with WSP that the COPC and potentially impacted media as identified above are appropriate for the Areas of Environmental Concern (AECs) for assessment at Area B and are appropriate for the purposes of this SAR.

5. Sampling and Analysis Plan

This section provides details on the sampling and analysis plan and associated methodologies adopted by WSP for the detailed investigation works conducted at the site. This information has been sourced from the WSP SAQP (December 2014). It should be noted that the SAQP covered both Area A and B.

Table 5.1: Sampling and Analysis Plan

Sampling Item	EPA Guidelines	Auditor Comments
Data Quality Objectives (DQOs)	"Data Quality Objectives: Outline of the DQO Process" in Appendix IV of the DEC (2006) Guidelines for the NSW Site Auditor Scheme.	The 7 step DQOs by WSP (2014) are summarised as follows: • Step 1: To determine (i) the nature, extent and concentration of contamination in soil, (ii) the likely source of identified contamination, (iii) risk to human health and/or the environment, and (iv) site suitability for residential landuse or whether remediation is required to render the site suitable for such use. • Step 2: Decisions are (a) does contamination pose an unacceptable liability or risk to human health and/or environment for its proposed use? (b) are contaminants within the adopted site criteria levels? (c) is surface water quality in dams and Molonglo River suitable based on comparison to criteria adopted? (d) are there any aesthetic issues which need to be addressed? (e) are local background concentrations exceeding the site criteria adequately reported in site assessment reports? (f) is the site management strategy appropriate? (g) are evidence of, or potential for, migration of contaminants from the site adequately addressed and reported? If so (h) what is the risk priority and what measures can be adopted to mitigate or manage risk? (i) what is the likely source and what activities (current/historic) would have contributed to the identified contamination? • Step 3: Key inputs are concentrations of CoPC in soil collected in the study area, the pathways for contaminant movement (underlying geological and hydrogeological conditions) and the location of sensitive receptors. • Step 4: The vertical extent of the study boundary will be a minimum of 0.25m into residual natural soils, or 0.5m below the extent of observable contamination (whichever is greater). The vertical boundary may be limited by excavation refusal. The temporal boundaries of the study will be limited to those dates that the investigation/site works is undertaken. • Step 5: Decision rules are meeting NEPM (2013) criteria; not being asbestos contaminated; materials suitable for use; and waste classification. • Step 6: Decision error limits based on AS4482.1-1995 for number of samples to make a decision. • Step 7: Design to identify a resource-effective data collection approach for generating data to meet the project objectives. The Auditor considers the DQOs to be appropriate to characterise site conditions and whether additional investigation or remediation is required.
Sampling Pattern Rationale	The EPA (1995) Sampling Design Guidelines (Section 2.3) provides details on judgmental, random, systematic and stratified sampling pattern.	The sampling strategy is a combination of targeted, bulk sampling (for asbestos) and broad grid-based assessment that meets the needs of both: • NSW EPA (1995) Sampling Design Guidelines.

Sampling Item	EPA Guidelines	Auditor Comments
		• National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) – NEPM ASC, 2013. Soil samples were collected from test pits completed in a combination of targeted and grid-based locations. Twenty thee sediment samples were collected from farm dams, and two samples were collected from the Molonglo River for laboratory analysis. Surface water samples were collected from the Molonglo River, and well as farm dams for laboratory analysis. Groundwater samples were collected wells across the site. The Auditor considers the sampling pattern to be appropriate for to the COPC and AECs identified, and with consideration of findings from all the previous studies and site conditions.
Sampling Density Rationale:	NSW EPA (1995) Sampling Design Guidelines	The sampling density and coverage (vertical and horizontal) was designed to ensure a sufficiently large dataset was collected to enable calculation of 95%UCLavg (if required) and/or characterisation of the material being assessed. The Auditor considers that the sampling density rationale was appropriate to meet the objectives of the investigation.
Locations Shown on Site Plan:	The OEH (2011) Guidelines for Consultants reporting on Contaminated Sites requires that sampling locations are shown on a site plan.	The locations are shown on WSP Figures in Appendix A. The Auditor considers this requirement has been met.
Sampling Depths	The OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites requires information on the depths of samples that were collected. NEPM (2013) Schedule B2.	Test pits were excavated to a maximum depth of 3.0 – 5.0m below ground level, or to the top of competent rock, top of refusal on fill inclusions or as judged safe by the field scientist/engineer in the field based on lithology encountered. The Auditor considers that the sampling depths appropriate to meet the objectives of the investigation.
Selection of Samples for Analysis:	The OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites. NEPM (2013) Schedule B2	Soil samples were collected from nominal depths of 0-0.1m, 0.25m, 0.5m, 1.0m, 2.0m and +2.5m. A minimum of one soil sample per location collected and analysed for the main contaminants of concern to allow sufficient vertical delineation of contaminant impact. Samples selected for analysis based on field observations and screening targeting surface soils (uncontrolled filling, asbestos debris, sinks, spraying of chemicals) within the soil/fill profile. The Auditor considers that the selection of samples for analysis was appropriate to meet the objectives of the investigation.
Sample Splitting Techniques and Statement of QA/QC Sample Frequencies	NEPM (2013) Schedule B3 DEC (2006) Guidelines for the NSW Site Auditor Scheme OEH (2011) Guidelines for Consultants Reporting on Contaminated Sites	Analysis for asbestos fibres (AS 4964 – 2004) in soil bulk samples. Duplicate and triplicate quality control samples obtained at the rate of one in twenty samples. The Auditor considers that the sample splitting techniques were appropriate for the purposes of this SAR. The QA/QC sampling frequencies for the investigations generally comply with NEPM (2013) requirements.
Analytical Methods:	DEC (2006) Guidelines for the NSW Site Auditor Scheme	Laboratory analysis of asbestos completed at a NATA accredited laboratory in accordance with the Australian Standard method for the Qualitative Identification of Asbestos in Bulk Samples (AS4964-2004) and enHealth (2005) using phase-contrasted microscopy or polarised-light microscopy with a detection limit of 0.1 g/kg. Other parameters analysed by NATA accredited analytical methods.

Sampling Item	EPA Guidelines	Auditor Comments
		The Auditor considers the analytical methods to be appropriate for the purposes of the investigation and detection reporting acceptable for the criteria adopted.
Sample Container Selection:	NEPM (2013) Schedule B2 and B3	All samples collected in laboratory prepared containers. The Auditor considers the sample container selection to be appropriate for the investigation.
Sampling Devices / Techniques	NEPM (2013) Schedule B2 and B3 NSW DEC (2007) Groundwater Guidelines	Gloves were used for sample collection and renewed between each sample location, decontaminated hand tools may be used. The Auditor considers the sampling techniques adopted to be appropriate for the COPC and to achieve the DQOs.
Decontamination Procedures:	Australian Standard AS4482.1 – 2005 NEPM (2013) Schedule B2 and B3	Decontamination of hand tools used involved washing between each sampling location using phosphate-free detergent, followed by rinsing with clean water. The Auditor considers the decontamination procedures to be appropriate for the purposes of the investigation.
Sample Handling and Preservation Procedures:	NEPM (2013) Schedule B3 AS4482.1 and AS 4482.2	Each sample labelled using a unique identifier, comprising site name, sample location number, sample type and sample depth. Samples stored at cool temperatures during transport and forwarded to NATA accredited laboratories. The Auditor considers the procedures appropriate for the COPC.
Field Calibration and Screening Protocols	NEPM (2013) B2	Field screening (visual, olfactory and PID) used to select the particular samples for laboratory analysis. A visual evaluation of the presence of ACM fragments also conducted. Equipment used (PID, water quality meter) for onsite measurements were calibrated prior use. The Auditor considers the field calibration and screening protocols to be appropriate for the investigation.
Groundwater Monitoring Well Installation	NEPM (2013) Schedule B2 NSW DEC (2007)	Four groundwater monitoring wells were installed onsite as part of the WSP assessment, with groundwater expected to be located within the fractured volcanics underlying the majority of the Area B (>10m below ground level). The wells were installed at the Sludge Ponds (WSP_AEC10) (two wells, one shallow and one deep), and at the livestock plunge dips (WSP_AEC18 and RobC_AEC22). The Auditor considers this appropriate given the AECs, COPC and future landuse.
Groundwater Monitoring Well Development & Sampling	NEPM (2013) Schedule B2 NSW DEC (2007)	Newly installed monitoring wells MW01S, MW02D and MW03D were gauged as dry and unable to be sampled. Groundwater samples were collected from 4 historical monitoring wells located across the site, and the newly installed well MW01D on 16 April and 11 August 2015. Prior to sampling a water level interface probe was used to record standing water level. The wells were then purged using a low flow micro purge with bladder pump. Where inadequate water column present (B-MW03) a disposable bailer was used to collect the sample. Samples for heavy metals analysis were field filtered and collected in laboratory prepared containers, with appropriate preservation, prior to submission to a NATA accredited laboratory for analysis.

5.1 Auditor Discussion

The information required by OEH (2011) in regard to the sampling and analysis plan and associated methodologies, has been generally provided in the SAQP for the detailed site investigation with the aim of characterising the site. The Auditor considers the SAQP adopted to be appropriate given the conceptual model for the site. It is noted that the SAQP provided for sampling of river water quality from point sources along the Molonglo River.

The Auditor notes that 3 of the 4 wells installed by WSP during this assessment were not able to be sampled due to insufficient sample recovery (dry wells). Samples were collected from one of the wells, as well as historical wells remaining in place from the former AECOM assessment at the site. The Auditor considered that the supporting information regarding soil quality in the areas of where the dry wells were installed, combined with former land uses in these areas and depth of attempted sampling, achieved sufficient characterisation to meet the objectives of the WSP investigation.

Further comments on WSP's reports were provided in the Interim Advice correspondence presented in Appendix B.

The NSW EPA (2006) requires that an Auditor must comment on each of the following:

- The Auditor confirms that WSP (2014) included a general statement of the predetermined DQOs for field and laboratory procedures (including quantitative DQOs).
- The Auditor confirms that WSP (2014) included a plan to achieve pre-determined DQOs; and
- The Auditor confirms that WSP (2014) included procedures to be undertaken if the data did not meet the expected DQOs.

6. Evaluation of Site Criteria

6.1 Assessment Criteria for Soil

The soil assessment criteria adopted were appropriate for the most sensitive landuse for the future development of Area B, by adopting criteria for low density residential and open space/recreational for both the protection of human health and the environment. Criteria was adopted from the following guidelines:

- National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) for Health Based Investigation Levels (HILs) and Health Screening levels (HSLs) for the majority of contaminants in soil, in particular, Table(s) 1A(1) – (5) from Schedule B1.
- National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) for Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for the majority of contaminants in soil, in particular, Table(s) 1B(1) – (7) from Schedule B1.

Specifically, the site assessment criteria used were:

- NEPM, 2013: HIL A – Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools. Residential/Soil HSLs (0 m to <1 m sand).
- NEPM, 2013: HIL C – Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site-specific assessment may be more appropriate. Recreational/Soil HSLs (0 m to <1 m sand)
- NEPM, 2013: Management Limits (Coarse) Residential/Open Space (0 m to <1 m sand)
- NEPM 2013: EILs/ESLs - Urban Residential, Surface Soils (0.0 – 0.2m depth)
- NEPM 2013: EILs/ESLs - Urban Residential, Sub Soils (>0.2 – 2.5m depth)

Where Australian published human health criteria are not available for target compounds, the level of detection (or non-detect at the laboratory method limit) was used as the tier 1 screening tool. For explosives residues analytical results, screening level criteria were derived from the United States Environmental Protection Agency (2015) Regional Screening Levels for Chemical Contaminants at Superfund Sites Region 3, 6, 9, Regional Screening Table.

Where individual sample values exceeded the adopted criteria, the site may still be considered suitable for residential and open space land use if the following conditions are met:

- The 95% UCL value is less than the criteria;
- The standard deviation does not exceed 50% of the adopted criteria value; and
- The values are less than 250% of the criteria.

WSP assessment also considered leaching potential (TCLP and ASLP) on select samples (where required). This provides data to determine risk of contaminant migration via infiltration and groundwater transport for reuse of soils on the site.

With respect to asbestos in soil, the NEPM 2013 Health Screening Levels (HSLs) for residential with garden accessible soils and recreational / open space were adopted. These criteria include concentrations for bonded and friable asbestos in soil, which are based on scenario-specific likely exposure levels and are adopted from the WA Department of Health (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia. The guidelines (adopted in NEPM, 2013) also require that no visible asbestos containing materials or fragments are present at the ground surface.

Soil aesthetic criteria is based on the amended NEPM, 2013 (Schedule B1, Section 3.6) which provides circumstances whereby assessment of aesthetics may be required as part of site suitability assessment. There are no specific numeric aesthetic guidelines and professional judgement is considered applicable based on a `balanced approach' when considering whether various inclusions within fill materials warrant remediation or management for aesthetic reasons. The main aesthetics issues include stained or discoloured soil, large volumes of inert refuse, unsightly or malodourous soils, leachate production, hydrocarbons sheens and chemical residues.

6.2 Assessment Criteria for Groundwater

Groundwater samples were compared against the following guidelines for specified analyses and physiochemical parameters:

- ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, Canberra:
    - Fresh Water Quality (95% Protection Levels) for 'slightly to moderately disturbed systems'.
- For explosive residues, screening level criteria were derived from the United States Environmental Protection Agency (2015) *Regional Screening Levels for Chemical Contaminants at Superfund Sites Region 3, 6, 9*. The criteria adopted were as a screening tool only, as the levels are for "tap water".
- Consideration or vapour intrusion of volatile contaminants from contaminated groundwater to the indoor air environment has not generally been made as there is an expectation that no volatile petroleum hydrocarbons would be present at the site.
- For perfluorinated compounds (PFCs) no Australian criteria for groundwater has been adopted and WSP assessed results based on concentration and risk to nearby receiving waters / receptors.

6.3 Other Assessment Criteria

Surface water sampled was compared against the following guidelines for specified analyses and physiochemical parameters:

- ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, Canberra:
    - Fresh Water Quality (95% Protection Levels) for 'slightly to moderately disturbed systems'.
- NHMRC National Health and Medical Research Council (2008) Guidelines for Managing Risk in Recreation Waters.

In the absence of total arsenic and chromium guidelines, the more conservative arsenic (V) and chromium (VI) speciated criteria have been adopted.

River sediment sample results were compared to the Interim sediment quality guidelines (ISQG) in the Australian and New Zealand guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000). The ISQG have limitations relating to the availability of appropriate

ecotoxicology data and the small number of species on which they are based. However, were used as an initial tier 1 screening criteria. The ISQG provide criterion for a common metal, metalloid and organometallic contaminants and organics, principally PAHs and organochlorine pesticides (OCPs).

6.4 Waste Classification

Leachate results allowed for the classification of waste for disposal which was completed in accordance with the Environment ACT (June 2000) ACT's Environmental Standards: Assessment & Classification of Liquid & Non-liquid Wastes.

6.5 Auditor Discussion

The Auditor considers that the adopted criteria were appropriate for the contaminants of concern, the environmental setting for the site and the proposed future land use.

7. Assessment of Investigation Results

The results for the soil investigation completed in Area B by WSP (2016) are summarised below. Refer to Appendix A and C for sample locations and analytical result summary tables respectively.

7.1 Soil Analytical Results

Soil Analytical results were compared to the adopted Site criteria for soils for each AEC. This included assessment against both Human Health (HILs and HSLs) as well as ecological (EILs/EILs) screening levels.

All AEC locations were samples in accordance with the Auditor endorsed SAQP. The results reported were all below the laboratory limits of reporting (LOR) for both HIL / EIL, with the following exceptions:

Table 7.1: Soil Analytical Results – Area B DSI (WSP)

AEC	Test Pit	Depth (m)	CoC	Reported concentration (mg/kg)	Threshold criteria (mg/kg)
WSP_AEC 8	B-TP017	0.1	TRH (C16-C34)	420	ESL (course) criterion 300
WSP_AEC 10 former Sludge ponds	B-TP035, B-TP036, B-TP040, B-TP051, B-TP053, B-TP054, B-TP058	0.1-0.2,	Cadmium	20 - 26	HIL-A (20)
	B-TP035, B-TP036, B-TP037, B-TP038, B-TP039, B-TP040, B-TP044, B-TP045, B-TP046, B-TP051, B-TP051, B-TP053, B-TP054, B-TP057, B-TP058	0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.3-0.4, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.2-0.3	Chromium	100 - 160	HIL-A (100)
	B-TP035, B-TP036, B-TP037, B-TP038, B-TP039, B-TP040, B-TP044, B-TP045, B-TP046, B-TP051, B-TP051, B-TP053, B-TP054, B-TP057, B-TP058	0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.3-0.4, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.2-0.3	Lead	340 - 430	HIL-A (300)
	B-TP057	0.7-0.8	Manganese	11,000	HIL-A (3,800)
	B-TP035, B-TP036,	0.1-0.2, 0.1-0.2,	Copper	930 - 2600	EIL (307-311)

	B-TP037, B-TP038, B-TP039, B-TP040, B-TP041, B-TP044, B-TP045, B-TP046, B-TP049, B-TP050 B-TP051, B-TP051, B-TP052, B-TP053, B-TP054, B-TP055, B-TP056, B-TP057, B-TP057, B-TP058, B-TB058	0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.3-0.4, 0.9-1.0, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.7-0.8, 0.2-0.3, 0.4-0.5			
	B-TP035, B-TP036, B-TP037, B-TP038, B-TP039, B-TP040, B-TP041, B-TP044, B-TP045, B-TP046, B-TP051, B-TP051, B-TP052, B-TP053, B-TP054, B-TP055, B-TP056, B-TP057, B-TP057, B-TP058, B-TB058	0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.3-0.4, 0.9-1.0, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.7-0.8, 0.2-0.3, 0.4-0.5	Nickel	42 - 93	EIL (42-189)
	B-TP035, B-TP036, B-TP037, B-TP038, B-TP039, B-TP040, B-TP041, B-TP044, B-TP045, B-TP046, B-TP049, B-TP050 B-TP051, B-TP051, B-TP052, B-TP053, B-TP054, B-TP055, B-TP056, B-TP057, B-TP057, B-TP058, B-TB058	0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.3-0.4, 0.9-1.0, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.1-0.2, 0.7-0.8, 0.2-0.3, 0.4-0.5	Zinc	470 - 5000	EIL (273-451)
	B-TP037, B-TP051,	0.1-0.2, 0.3-0.4,	>C16-C34	710 - 9400	ESL (course) criterion 300

	B-TP057, B-TP058	0.7-0.8, 0.4-0.5			
	B-TP051, B-TP057, B-TP058	0.3-0.4, 0.7-0.8, 0.4-0.5	>C10-C16	140 - 510	ESL (course) criterion 120
	B-TP051, B-TP057, B-TP058	0.3-0.4, 0.7-0.8, 0.4-0.5	F2 C10-C16	140 - 510	HSL A/B 110 mg/kg
WSP_AEC 15	TP088	0.1-0.2	TRH (F2 C10-C16)	910	HSL A/B (110)
WSP_AEC 18 Livestock dip	B-TP093	0.1-0.2	Arsenic	170	HIL-A (100)
	B-TP093	0.5-0.6	Arsenic	390	HIL-C (300)
	B-TP094	0.1-0.2	Arsenic	260	HIL-A (100)
	B-TP094	0.5-0.6	Arsenic	210	HIL-A (100)
	B-TP094	1.2-1.3	Arsenic	110	HIL-A (100)
	B-TP095	0.1-0.2	Arsenic	140	HIL-A (100)
	B-TP095	0.5-0.6	Arsenic	300	HIL-A (100)
	B-TP095	1-1.1	Arsenic	350	HIL-C (300)
	W-MW02D	0.1-0.2	Arsenic	100	HIL-A (100)
	W-MW02D	0.25-0.35	Arsenic	140	HIL-A (100)
	W-MW02D	0.5-0.6	Arsenic	450	HIL-C (300)
	W-SB02	0.25-0.35	Arsenic	350	HIL-C (300)
	W-SB03	0.1-0.2	Arsenic	100	HIL-A (100)
	W-SB04	0.1-0.2	Arsenic	140	HIL-A (100)
	W-SB05	0.5-0.6	Arsenic	220	HIL-A (100)

In summary, WSP_AEC10 (Sludge Ponds) and WSP_AEC18 (livestock plunge dip) reported chemical results in soil above the adopted Site criteria.

WSP_AEC10 (Sludge Ponds) chemical results indicate that the upper 0.5 to 1.5m (variable depths) of soil contain heavy metals above adopted criteria with concentrations decreasing with depth. The majority of these results were within the reworked natural soils of the sludge ponds with deeper soils (either natural or reworked) below the adopted Site criteria.

A portion of the TRH fractions are considered likely (through review of soil sample descriptions – 'light, airy, spongy silt, often dark brown') to be related to organic matter such as plant derived matter, fats and lipids and sludge residues from settlement. However, silica gel clean-up to define hydrocarbon sources was not scheduled by WSP as part of the analysis suite. WSP however stated that hydrocarbons may be used in the AFP Training activities (RobA_AEC5) within the Sludge Ponds fenced area.

WSP_AEC15 relates to a small (<2m^2) oil stain at B-TP088 with TRH above the adopted HSL and ESL criteria. The natural soils underlying the surface did not indicate any deeper hydrocarbon impact and the small surface stain is considered to be a low risk as it is not widespread and limited to the upper 0.3m of soil.

WSP_AEC8 relates to B-TP017 to the north of the farmhouse with TRH above the adopted ESL criteria. The natural soils underlying the surface did not indicate any deeper hydrocarbon impact and is considered to be a low risk as it is not widespread and limited to the upper 0.2m of soil (fill).

Metal concentration (lead and cadmium) above HIL A criteria (residential) at the Sludge Ponds (WSP_AEC10) along with copper, nickel and zinc for EILs. Samples exceed the HIL A (residential) criteria for arsenic at the livestock plunge dip (WSP_AEC18) along with zinc for EILs.

The Glenloch Sheep Dip (AEC22) was further investigated by WSP on 15 August 2016 to verify soil impact immediately around the concrete dip bath.

A "Letter Report on Investigation of soils around the Glenloch Property Sheep Dip located within Molonglo Valley Stage 3 Future Urban Area ("Area B"), Block No. 6" (WSP, September 2016) was prepared and provided to LDA and the Site Auditor.

The results of the Glenloch additional assessment reported all samples below the adopted site criteria, (HIL / EIL), with the following exceptions:

Table 7.2: Soil Analytical Results – Glenloch Additional Assessment (WSP)

AEC	Test Pit	Depth (m)	CoC	Reported concentration (mg/kg)	Threshold criteria (mg/kg)
WSP_AEC22 Glenloch sheep dip	BH3	0.1	Arsenic	150	HIL A (100)
	BH3	0.5	Arsenic	190	HIL A (100)
	BH4	0.1	Arsenic	320	HIL-C (300)
	BH4	0.5	Arsenic	160	HIL A (100)
	BH5	0.1	Arsenic	1300	HIL-B (500)
	BH5	0.5	Arsenic	990	HIL-B (500)
	BH6	0.1	Arsenic	280	HIL A (100)
	BH7	0.1	Arsenic	100	HIL A (100)
	BH8	0.1	Arsenic	160	HIL A (100)
	BH8	0.5	Arsenic	290	HIL A (100)
	BH9	0.1	Arsenic	130	HIL A (100)

Arsenic has been reported in the majority of samples collected from the Sheep Dip above the residential (with garden accessible soils) human health criterion of 100 mg/kg. The results for arsenic ranged between 4 and 1,300 mg/kg with the highest concentrations on either side of the Sheep Dip (BH4 and BH5). These higher results are consistent with the Sheep Dip bottom sediments being placed on either side of the dip structure which historically occurred when in use. Samples from both the surface soils (0.0-0.1m bgl) and at depth (0.4-0.5m bgl) have results above the adopted criteria.

Further testing was undertaken on four soil samples to assess the leachability of arsenic using TCLP (acidic pH) and ASLP (neutral pH). The results ranged between 1.5 to 0.4 mg/L and were of a similar concentration for both analytical methods. The leachability results indicate that the soils (under laboratory conditions) will leach arsenic under aggressive conditions.

WSP stated that typically, arsenic is strongly bound to the soil particles within the Sheep Dip and immediate surrounds and does not leach into solution *in situ* (NSW DPI, 2014). Transport mechanisms for arsenic in soil are often related to erosion and movement of soil and / or Dip fluids to surrounding areas such as yards.

The Auditor considers that this contaminant behaviour be considered in evaluating the reuse or offsite disposal of impacted soil.

7.2 Microbial Colonies in Soil

Microbiological analysis was completed on soil samples from five locations:

- WSP_AEC 10 - Sludge Ponds;
- UFP1 – Sewer Depot;
- RobA_AEC7 & 8 – Concrete spill points;
- RobC_AEC23 – Glenloch property;
- RobC_AEC33 – Dam;

Concentrations of E.coli and faecal coliforms detected in these samples were between <200 (non-detect) and 160,000 CFU/100g (colony forming units). High results were reported from WSP_AEC10 (Sludge ponds) for E.coli and Faecal Coliforms, and UFPA (Sewer Depot) for Faecal coliforms, however no reported colonies of salmonella or enteric viruses were detected. The remaining samples (Glenloch property, Dam and Concrete spill point) reported marginal colonies of faecal coliforms.

There are currently no endorsed human health and ecological soil guideline criteria available for faecal coliforms, E.Coli, salmonella and Enteric Viruses in Australia. There are however biosolids reuse and disposal criteria that may be applicable to bottom sediments of the Sludge Ponds.

WSP consider that the concentrations of microbial colonies in soil may represent the local nature of the catchment within the Site (excluding the Sludge Ponds / Sewer Depot) and from upstream sources (such as grazing lands). Based on the identified concentrations it is the opinion of WSP that the risk to human health and the environment is considered low for areas outside of WSP_AEC10 (Sludge Ponds).

7.3 Nutrients in Soil

Nutrient concentrations for soils were reported in the following ranges:

- Ammonia - was reported between 0.9 mg/kg and 1,100 mg/kg.
- Nitrate (as N) - was reported between <0.1 (non-detect) mg/kg and 2,400 mg/kg.
- Phosphorus: - was reported between 80 - 37,000 mg/kg.

Typically nutrients in soil data are compared to planting requirements of future specific species of vegetation. The majority of soil samples from farm dams and the kangaroo burial pit (WSP_AEC12) are not considered by WSP to be indicative of severe nutrient build up that may cause stress to ecological receptors. All ammonia, nitrate and phosphorus concentrations outside of the Sludge Ponds were <1,200 mg/kg with the highest results related to the kangaroo burial pit with decomposed organic materials present.

High nutrient values for the majority of Sludge Pond near surface soils and sediments were encountered and typically decrease in concentrations with depth. The concentrated and elevated nutrient loads in Sludge Ponds soils may be managed via future decommissioning and earthworks to address the heavy metal and TRH findings at this location.

7.4 Asbestos in Soil

WSP reported that no bonded asbestos containing material or friable asbestos was detected in bulk samples (500g) or during sieving of the 10L samples at the 76 locations analysed. No asbestos fines (AF) of fibrous asbestos (FA) were identified above the laboratory detection limit in any of the samples analysed. No exceedances of adopted criteria for asbestos were reported.

7.5 Explosive Residues in Soil

A total of 78 soil samples were analysed for explosive residue that included HMX, RDX and nitro-glycerine. WSP reported that all explosives residue results were below the LOR at all sampling locations with the exception of B-TP186 (0.1m), located within the AFP Training Area (RobA_AEC5). This sample had a trace concentration of 0.2 mg/kg for RDX with an adopted screening criteria for residential land use of 6.1 mg/kg. WSP reported that the location was near a small crater hole, likely used for explosive detonation from past training activities.

7.6 Sediment Analytical Results

WSP reported that concentrations of all analytes for the 26 sediment samples collected from farm dams and along the Molonglo River were below the analytical LOR and / or respective adopted Site criteria for Human Health (NEPM, 2013 HIL A and HIL C). All organic analyses were below the LOR and detected concentrations of heavy metals above the LORs but below the adopted criteria are likely to be representative of the naturally occurring background levels in the environment.

7.7 Auditor Discussion on Soil and Sediment Quality

Based on the number of soil and sediment samples analysed, the sampling spread and targeting of the AECs and soil type encountered at the site, the Auditor considers that soil and sediment was adequately characterised when the data set is considered as a whole. Based on the information presented above, the following conclusions regarding soil quality are as follows:

- WSP_AEC10 (Sludge Ponds) and WSP_AEC18 (livestock plunge dip) reported chemical results in soil above the adopted Site criteria which will require remediation.
    - WSP_AEC10 (Sludge Ponds): Heavy metals, microbiological and TRH C_{10}-C_{36} impacted soils / sediments from former sewerage works.
    - WSP_AEC18 (Livestock Plunge Dip): Arsenic impacted soils from previous plunge dip use and immediate area.
- Concentrations of arsenic within soils around the Glenloch Sheep Dip are above the adopted human health Site criteria. The Auditor concurs with WSP that these soils will require management and / or remediation prior to the future urban uses being applied to the Site. The remedial works are documented within the remedial action plan (RAP) prepared for the Molonglo Valley Stage 3 (Area B) area (discussed in later sections in this SAR).
- WSP considered that the Molonglo River sediments and dam sediments, did not indicate severe nutrient build up that may cause stress to ecological receptors. Generally, concentrations of analytes tested for sediment samples were below the laboratory limits of reporting (LORs) and the respective adopted site criteria for human health. Exceedances were noted for heavy metals, principally for zinc, lead and arsenic for ISQG falling within the low and high range with the exception of zinc. Clarification on the exceedances were provided by WSP as follows:
    - Zinc exceedances were not considered significant risk due to the upstream catchment characteristics of Molonglo River and limitations of the ecotoxicology data used to derive the criteria.
    - Exceedance of lead, arsenic and zinc in other sediment samples collected is attributed to be representative of the naturally occurring background levels of heavy metals in the environment.

The Auditor concurs with the general findings and conclusions when considering the data in totality, noting that the LOR for herbicides, OCPs and OPPs were above the assessment criteria for the ISQG. As there are no currently endorsed criteria for faecal coliform in Australia, WSP concluded that the concentrations of faecal coliform may represent the local nature of the catchment within the site and from upstream sources such as grazing lands, leading to the conclusion that the risk to human health and the environment is considered low within the Molonglo River riparian corridor.

The Auditor notes in ANZECC (2000) that for ammonia and other nutrients (such as phosphate and nitrate), there are no specific ISQG, however it is important to identify when these represent a threat to benthic communities.

The current characterisation works and the assessment of sediment quality (combined with surface water quality) was to form an opinion on protecting site conditions from algal or macrophtye blooms. WSP reported some algal blooms at the edges of the dams, however the Auditor notes that these dams are most likely to be removed as part of future development, and therefore not posing a concern to any 'future users' of the dam.

7.8 Soil Aesthetics

WSP reported that no odours, or aesthetic inclusions that would preclude future residential land use.

WSP state that fill soil, including the former sewer construction depot (UFP1) (contained surficial buried vehicle parts), the Sludge Ponds, vehicle parts in drainage/creek lines (WSP_AEC20) and any other filled ground may not be aesthetically suitable but could be managed as part of future earthworks activities. Buried fill, such as WSP_AEC12 (kangaroo burial pit), may require further geotechnical advice regarding future management of heavily reworked and filled ground.

Any identified services made of asbestos materials such as underground pipes would require excavation and offsite disposal to a licensed waste disposal facility. Natural soils were typically orange to light brown sandy and gravelly clays, suitable to remain on site from an aesthetic perspective.

7.9 Preliminary Waste Classification

Soil samples from the Sludge Ponds (WSP_AEC10) and the Livestock Plunge Dip (WSP_AEC18) were collected for analysis and compared to the Environment ACT (June 2000) Environmental Standards: Assessment & Classification of Liquid & Non-liquid Waste. The samples were analysed for heavy metals, TRH, BTEX, PAHs, Phenol, PCBs, OCP and OPP.

Results, when compared to the CT1 criteria for Inert Waste, without TCLP, indicated exceedance to this classification.

TCLP tests were undertaken on 6 samples from WSP_AEC10, to assess the leachability of fill and natural soil for heavy metals. Results indicated that heavy metals were generally not leachable.

Several samples for TPH C^{10}-C^{36} were above the Solid Waste Criteria, such as B_T051 0.3m (10,540 mg/kg). WSP considered that these results were influenced by the organic nature of the soil, however silica gel clean-up was not completed to verify their assumption. WSP considered that further testing (silica gel clean-up) should be completed to assess the actual petroleum hydrocarbon constituents of this material prior to final waste classification. The Auditor notes that TPH was impact was localised, with only 3 of the 29 samples analysed within WSP_AEC10 exceeding the Inert and Solid Waste criteria for TPH.

For WSP_AEC18, WSP classified soils as a mixture of Solid Waste and Industrial Waste without any TCLP data with respect to metals (principally arsenic). WSP concluded that during any future remedial works for arsenic impacted soils, TCLP testing may reduce the waste classification to Inert Waste. TCLP analysis will need to be completed for arsenic, chromium, lead and nickel.

Additional leachate testing was undertaken on selected samples throughout the Site to determine background soil leachability conditions due to the mineralised nature of the geology.

WSP considered that aged biosolids, such as those within the former Sludge Ponds (WSP_AEC10), may be able to be reused under certain circumstances. Based on Table 1 of the *ACT Waste Guidelines* (2000), as the biosolids are significantly aged, the reuse potential cannot be determined through comparison to criteria as it is unknown if and when any biosolids stabilisation has taken place.

Laboratory results discussed indicated that enteric viruses, helminth ova, salmonella are within guidance levels but E. Coli and faecal coliforms were above the 1,000 CFU / 100g (equivalent to 1,000 / MPN). Further guidance is provided in the NSW EPA (2000), *Environmental Guidelines, Use and Disposal of Biosolids Products*. WSP concluded that ACT EPA should be consulted on the appropriate potential reuse prior to soil remediation and earthworks within the Sludge Ponds.

The ACT Waste Guidelines (2000) also provide pre classification of some wastes such as VENM and building and construction demolition wastes (not containing any asbestos). It is considered likely that natural soils can be preliminarily classified as VENM (Inert Waste). Fill material not containing any forms of asbestos where construction and demolition wastes (such as bricks, concrete, paper, plastics, glass, metal and timber) can be segregated can be classified as Inert Waste.

The Auditor anticipates that as bulk earthworks will occur as part of future redevelopment, any surplus material will undergo further testing for either waste classification for offsite disposal or to show the material can be reused onsite in consultation with EPA. This has been addressed in the RAP (WSP, 2017) and as is discussed in Section 10 of this report.

7.10 Surface Water Results

Surface water samples were collected from eighteen locations between 17 April and 15 May 2015. In summary the following results were reported:

- pH measurements ranged between 5.95 (RobC_AEC11) and 8.29 (RobC_AEC35, RobC_AEC42) indicating acidic to slightly alkaline conditions.
- Conductivity of the water sampled ranged between 33.5 µS/cm (RobC_AEC32, RobC_AEC34) and 430.6 µS/cm (WSP_AEC5) indicating typically freshwater conditions.
- The temperature of the surface water ranged between 3.8 (RobC_AEC43) and 20.5 (WSP_AEC7).
- Dissolved oxygen ranged between 1.37 ppm (RobC_AEC11) and 13.42 ppm (RobC_AEC44) indicating oxygenated surface water.
- Redox ORP (oxidation reduction potential) was recorded between 90.9 mV (SW02) and 199.1mV (RobC_AEC11) indicating oxic conditions.

Some minor algae growth was observed at one dam (WSP_AEC5) around the perimeter of the water line. No sheen was observed at any surface water sampling location. No odours or obvious signs of contamination were noted in embankment walls. No visibly distressed vegetation was noted around the dams.

Results for TRH, BTEX, PAHs, pesticides and explosives were all reported below the respective LORs and/or below the adopted Site criteria. There were several exceedances of the ANZECC 2000 *95% Ecosystem Species Protection Levels* criteria for the following samples:

- Copper: WSP_AEC5, WSP_AEC7, WSP_AEC42, RobC_AEC10, RobC_AEC12, RobC_AEC32, RobC_AEC43 and sample B-SW02-MR from Molonglo River. Concentrations ranged between <0.001 and 0.003 mg/L above the criterion of 0.0014 mg/L.
- Zinc: WSP_AEC5, RobC_AEC10, RobC_AEC11, RobC_AEC13, RobC_AEC32 and sample B-SW02-MR from Molonglo River. Concentrations ranged between 0.004 and 0.01 mg/L exceeding the criterion of 0.008 mg/L.

- Ammonia: WSP_AEC5 and WSP_AEC7. Concentrations ranged between <0.005 and 3.5 mg/L (adopted criterion of 0.9 mg/L).

WSP concluded that the elevated copper and zinc levels were a result of the local geology and catchment characteristics. As the concentrations did not exhibit a significant deviation from each other and only marginally exceeded the criteria, it was the opinion of WSP that they do not pose a significant risk to ecological receptors.

Comparison of water quality to the ANZECC 2000 South East Australia Trigger Values identified the following exceedances for an 'upland river' system:

- Phosphorus: The majority of samples (15 out of 16 samples) were above the criteria of 0.02 mg/L with a range of <0.05 to 4.9 mg/L.

Elevated phosphorus levels were considered to be related the local catchments (dams and drainage lines) and upstream catchment for Molonglo River. Some algal blooming was noted in two dams although the bloom was limited to the periphery of the water line.

Based on the number of surface water samples actually analysed, the location of monitoring sampling points and COPC encountered at the site, the Auditor considers that surface water was adequately characterised for Area B with results not showing any gross impact from AECs, rather concentrations of constituents typically associated with the environmental setting and rural use and catchment size for the study area.

7.11 Groundwater Results

WSP obtained physiochemical results during sampling of groundwater wells (B-MW01, B-MW02, B-MW03, B-MW04 -AECOM, 2013 and MW01D - WSP, 2015) as summarised below:

- pH measurements ranged between 4.90 (B-MW02) and 7.98 (B-MW03) indicating acidic to slightly alkaline conditions.
- Conductivity of the water sampled ranged between 379.5 µS/cm (B-MW01) and 1,036 µS/cm (MW01D) indicating typically freshwater conditions.
- The temperature of the groundwater ranged between 13.90 C (MW01D) and 19.20 C (B-MW03).
- Dissolved oxygen ranged between 0.0 ppm (B-MW01 and B-MW02) and 9.81 ppm (MW01D) indicating poorly to well oxygenated groundwater.
- Redox ORP (oxidation reduction potential) was recorded between 21 mV (MW01D) and 147.7 mV (BMW02) indicating oxic conditions.

Based on the wells installed by WSP in August 2015 and those installed by AECOM in 2013, regional groundwater was considered to be located within the underlying dactite bedrock (>10m bgl) within primary fractures throughout the rock mass. Some weathered zones may contain water depending on local and regional rainfall and is likely to be intermittent. Shallow infiltration water is likely to be present in low lying drainage lines and creeks (Deep Creek and Coppins Creek) that flow towards the Molonglo River. Some perched water is likely to occur down hydraulic gradient of permanent surface water dams and ponds such as the Sludge Ponds (WSP_AEC10) with shallower groundwater present at B-MW01 and BMW02 (~6.0 to 8.5m bgl).

The following table summarises the results of the groundwater analytical data for each well sampled.

Table 7.3: Groundwater Analytical Results (WSP 2016)

AEC Reference	Monitoring Well
WSP_AEC10 (Sludge Ponds)	W-MW01S (installed by WSP) • Dry – no analytical results W-MW01D (installed by WSP) • No exceedances of criteria for inorganic and organic analyses completed. • Trace perfluoroctanoate (PFC) present (0.00003 mg/L), slightly above LOR of 0.00002 mg/L B-MW01 (installed by AECOM) • Zinc concentration of 0.019 mg/L (criterion 0.008 mg/L) B-MW02 (installed by AECOM) • Copper concentration of 0.002 mg/L (criterion on 0.0014 mg/L) • Nickel concentration of 0.029 mg/L (criterion on 0.0011 mg/L) • Zinc concentration of 0.019 mg/L (criterion 0.008 mg/L)
WSP_AEC18 (Former Livestock Plunge Dip and Yards)	W-MW02D (installed by WSP) • Dry – no analytical results B-MW03 (installed by AECOM) • Chromium (total) concentration of 0.002 mg/L (criterion 0.001 mg/L) B-MW04 (installed by AECOM) • Copper concentration of 0.002 mg/L (criterion on 0.0014 mg/L) • Nickel concentration of 0.012 mg/L (criterion on 0.0011 mg/L) • Zinc concentration of 0.031 mg/L (criterion 0.008 mg/L)
RobC_AEC22 (Sheep plunge dip, Glenloch property)	W-MW03D (installed by WSP) • Dry – no analytical results

WSP considered that the risks to human health and ecological receptors is low due to the depth of groundwater, field and laboratory results obtained and future use of the Site for low and medium density residential, and some commercial development and open spaces.

7.12 Auditor Discussion on Groundwater Results

Groundwater well installation by WSP focussed on targeted those AECs identified as posing the greatest potential risk to the underlying groundwater given concentrations detected in fill/soil profile: these being WSP_AEC10 (Sludge Ponds), and WSP_AEC18 and RobC_AEC22 (both former plunge dips).

At the time of investigation only some wells produced water. Results did not indicate gross contamination and possibly reflective of background conditions for copper, nickel and zinc. Given the absence of groundwater use (or any registered bores) targeting the depth of groundwater investigated (approx. 10m bgl), no indication of impact to down gradient receptors (surface water bodies), the data suggests that groundwater quality is acceptable. The Auditor notes that for the three AECs targeted, WSP has recommended soil/fill remediation and/or management to ensure the ground is made suitable for the proposed future urban uses. The Auditor agrees with this approach.

7.13 Auditor Discussion on Site Characterisation for Area B

Based on the investigation results, the Auditor considers that the site has been adequately characterised, with appropriately robust review of AECs and targeting COPCs.

The contaminant conceptual site model developed for the site, based on the sampling and analytical results, indicated that contaminants in the soil, sediment and surface water were typically at or below the health based criteria applicable for residential landuse, with garden accessible soils, open space public landuse and ecological receptors with the exception of material associated with former sludge ponds (WSP_AEC10) and former livestock plunge dips (WSP_AEC18 and RobC_AEC22).

The Auditor agrees with WSP that:

- A Remedial Action Plan (RAP) is required to address the soil contamination identified in the three AECs. This is discussed further in Section 10 of the SAR.
- The recommendations outlined in the UXO Milsearch (April 2015) Post Activity Report are undertaken as part of future works prior to development and earthworks at the Site, including additional surveys of specific areas such as along metal fence lines, farm buildings and stockpiles / fill mounds. Requirements have been outlined in Section 8.1 and incorporated into the WSP (2017) Unexpected Finds Management Plan (UFMP) discussed in Section 11.

8. Unexploded Ordnance (UXO)

Several UXO investigation surveys and remediation of UXO have been undertaken within the MV3 area. Principally these have been limited to Area B. All UXO investigation surveys and remediation were undertaken by Milsearch in 2013, 2014 and 2015. The Molonglo Valley was used for the training of artillery soldiers from 1915 until the mid-1920s. Two known projectiles were used (15pd and 18pd artillery projectiles). The Department of Defence has taken reasonable steps to locate and remove all EOW and UXO from Molonglo Valley. There is however a possibility (although slight) that future users of the site may encounter explosive ordnance waste or unexploded ordnance, principally within Area B of MV3, based on the studies undertaken to date.

A detailed UXO assessment survey and remediation has been completed in the Remediation Target Area within Molonglo Stage 3 (Milsearch, 2015). The Remediation Target Area was bounded by the Kama Reserve to the west, Molonglo River to the south and includes a portion of Coppins Crossing Road towards the east. The Remediation Target Area was 198ha in size and comprised predominantly open grasslands which are actively grazed to farmers through arrangements managed by the ACT Parks and Wildlife Service. Terrain comprises undulating hills flatter in the east and becoming somewhat steeper westward. A creek system (Deep Creek) flows from north east towards the south west and eventually into the Molonglo River.

8.1 Further UXO/EOW Recommendations

The limitation and exclusion areas of the Milsearch survey and remediation works include a number of areas that must be re-evaluated prior to construction / redevelopment occurring.

The recommendations from the Milsearch survey and remediation (2015) are provided below:

- In view of the number of fragmentation finds made in close proximity to the external search boundary in the south west, consideration should be given to expanding the remediation boundary westwards into the Molonglo River Valley from the vicinity of Blocks C11 and D11. As land here outside the current search boundary will not be developed but will be accessed by the public as open space – nature reserve etc., full UXO remediation is not warranted. A lesser mitigation treatment to locate surface and very near surface complete UXO items is appropriate, thus reducing the probability of the public coming into contact with accessible UXO items;
- The seven remaining anomalies within the dam in the extreme east of the Site be investigated when the dam bed dries out or is drained;
- At a suitable later stage in the development, existing fence lines should be removed under the direction of a safeguarding EOD technician. The alignment of the fences should then be surveyed with Geometrics G858 magnetometer or equivalent to a width of 12m centred on the original fence-line, then all magnetic anomalies investigated;
- The blackberry and other bushes within the Pink Tail Worm Lizard (PTWL) habitat should be slashed when environmental restrictions are lifted and those areas thus made accessible, be deep searched for UXO using analogue techniques;
- Where necessary during redevelopment, removal of the large trees should include complete excavation of root-balls. Removal of root-balls should be safeguarded by an EOD technician and the root-balls and the holes they have come from, should be searched with magnetometers;
- Following demolition of the house and other buildings on the Site, areas beneath should be surveyed and investigated by magnetometer after their removal. These areas may require

UXO safeguarded mechanical surface scraping to remove domestic detritus, prior to UXO survey; and

- Following removal of the mounds, the ground beneath should be subjected to a UXO magnetometer search.

The Auditor notes that the LDA and the future redevelopment Principal Contractor must ensure that these recommended survey and remediation works have been undertaken and reported prior to construction works occurring within or nearby to these areas.

WSP prepared an Unexpected Finds Management Plan (UFMP) for the MV3 future urban area (WSP, 2017). This is discussed in Section 11 of this SAR. The UFMP has been prepared to manage risks of encountering potential contaminated land, unexploded ordnance (UXO) and exploded ordnance waste (EOW) during future earthworks (including remediation) and construction activities. The UFMP must be implemented for any intrusive works completed within Area B.

8.2 Unexpected Find

WSP reported that during the UXO survey and remediation (Milsearch, 2015) shallow buried metallic objects and wastes were identified. This has been annotated by WSP as UFP1 – Sewer Depot, and was assessed and identified to be part of a former vehicle maintenance depot understood to be used during the construction of the sewer traversing the Site in 1975. This area was investigated by WSP with a series of shallow test pits labelled B-TP300 to B-TP321. Soil samples collected and analysed at the laboratory with results below the laboratory detection limits and / or respective site criteria for all samples submitted, with the exception of faecal coliforms, which reported concentrations consistent with the nature of the catchment.

As discussed in Section 7.8, surficial buried vehicle parts were noted in the fill in UFP1, and may not be suitable aesthetically, and should be addressed as part of future earthworks activities in preparation for the future land use.

The Douglas Partners *Preliminary Geotechnical Investigation* (Douglas Partners, 2015) did not identify an unexpected finds across the Site. Review of geotechnical logs provided in the report did not identify any buried wastes or significant uncontrolled filling.

9. Evaluation of Quality Assurance (QA) and Quality Control (QC)

The NSW EPA (2006) requires that an Auditor must check each of the following requirements:

- The Auditor confirms that the applicability and limitations of field sampling methodology were discussed and addressed in the consultant's reports;
- The Auditor confirms that WSP ensured adequate calibration of field instruments;
- The Auditor confirms that WSP have generally assessed the significance of the field determination of the results compared with the laboratory results and where not compatible, discussed in the report;
- The applicability and limitations of laboratory methodologies were not discussed in the consultant's reports. The Auditor is satisfied however, that NATA accredited methods and laboratories were used;
- The Auditor confirms that the methods used for site investigation were of sufficient precision and accuracy and sensitivity to achieve the assessment of risk;
- The laboratory results met the accuracy criteria specified by the WSP for each performance method; and
- The WSP indicated that the results generally met the criteria specified by the consultant in their DQO with some exceptions.

The Auditor has determined that the above requirements have been met based on the evaluation presented in Appendix E for investigation works conducted at the site.

10. Evaluation of Remedial Action Plan

10.1 Summary of Proposed Remedial Strategy

WSP prepared a Remedial Action Plan (RAP), to address three remedial areas within the MV3 Area B. The RAP (February 2017) was reviewed against the requirements outlined in the NSW DEC (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition) and the NSW OEH (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites. The Auditors comments are summarised in Table 10.1 below.

Table 10.1 Review of Remedial Strategy (WSP, 2017)

Requirement	Consultants' Consideration	Auditor Comment and Recommendation/Questions
Remediation Goal:	The purpose of this RAP is to minimise contamination risks associated with potential hazards identified at the remedial areas specifically relating to soil contamination issues and to demonstrate that the remedial areas can be made suitable for their future landuse and further development. This RAP outlines the proposed remediation goals, strategy and methodology for each of the remedial areas. The objectives of the remedial program are to: • Assess the options for remediation of the three remedial areas considering the future urban area planning and design framework and effective management of the impacted soils. • Reduce potential risks to future users by outlining a methodology to eliminate or reduce the potential for exposure to impacted soil due to chemical concentrations of contaminants above the adopted Site criteria for soils for future land use. • Demonstrate that the Site will be suitable for the respective future land use after the recommended remediation tasks are completed.	Acceptable. Noting that the RAP presents a remedial design that once implemented, will render the site suitable for the proposed residential development. The goals are consistent with the proposed development.
Extent of Remediation Required:	The RAP outlines three remedial areas within MV3 Area B: • WSP_AEC10 (Former Sludge Ponds): Heavy metals, microbiological (Faecal Coliforms and E. Coli) and TRH C10-C36 impacted soils / bottom sediments from former sewage treatment works. Assessment of PFAS may be required at this location. Estimated impacted volume of 20,000 m^3. • WSP_AEC18 (Former Livestock Plunge Dip and Yards): Arsenic impacted soils from previous livestock plunge dip use and immediately surrounding yard area. Estimated impacted volume of 100 m^3. • RobC_AEC22 (Glenloch Sheep Dip): Arsenic impacted soils from previous sheep plunge dip use and immediately surrounding area. Estimated impacted volume of 150 m^3.	Acceptable. **The Auditor notes that the any aesthetic impacts identified during site works must be managed in accordance with the RAP.** **The Auditor further notes that UXO and EOW need to be assessed in accordance with the requirements of the WSP UFMP (2017), prior to the commencement of any intrusive works at the site.**
Discussion of possible remediation options:	A series of remedial options have been discussed in the RAP, with consideration of the remedial objectives, sustainability, time and cost implications. • The preferred remedial strategy for WSP_AEC10 (Former Sludge Ponds) is Civil Earthworks Design, Capping and Containment and management with an EMP (if required). The principal reason for this option is the low to medium	Acceptable. The Auditor notes that the preferred soil remediation strategy will be dependent on the future urban area planning, design and construction framework and timing within

Requirement	Consultants' Consideration	Auditor Comment and Recommendation/Questions
	costs involved when compared to offsite disposal as waste, the ability for a suitable capping and containment measure to be put in place and the likely end land use (Public Open Space recreation within the river corridor zoning). • The preferred remedial strategy for WSP_AEC18 (Former Livestock Plunge Dip and Yards) is a mixture of excavation and offsite disposal and excavation, characterisation and beneficial reuse in Suitable landuse / zoning. The two options are considered the most suitable due to the relatively small volume of impacted soils that require remediation, the likelihood of large scale earthworks machinery being available to excavate, load and cart to another beneficial reuse location within Molonglo Valley Stage 3 and the lower costs involved for beneficial reuse. Both options are considered suitable, however due to the requirement for additional soil characterisation (for leachability), the disposal off site option has been included by WSP as a contingency or if ACT EPA approval for beneficial reuse as filling is not forthcoming. • The preferred remedial strategy for RobC_AEC22 (Glenloch Sheep Dip) is a mixture of excavation and offsite disposal and excavation, characterisation and beneficial reuse in Suitable landuse / zoning. The two options are considered the most suitable due to the relatively small volume of impacted soils that require remediation, the likelihood of large scale earthworks machinery being available to excavate, load and cart to another location within Molonglo Valley Stage 3 and the lower costs involved for beneficial reuse. It is noted that the soil immediately adjacent to the concrete dip bath (~2.0m east and west) is not suitable for 'Public Open Space' reuse due to high arsenic concentrations (>300 mg/kg).	the Molonglo Valley Stage 3 area. The soil remediation options provided considers the site in its entirety, and has therefore adequately addressed the various remediation options available.
Rationale and basis for selected remedial option:	The rationale for the selection of the remedial options are based on sustainability, time and cost implications. The remedial strategy selected for each remedial area has taken into consideration the remediation hierarchy as stated in the NSW DEC (April, 2006) 'Guidelines for the NSW Site Auditor Scheme', which have been adopted for use in the ACT. A preferred hierarchy of options for site clean-up and / or management which is as follows: • On-site treatment of contamination so that contamination is destroyed or the associated hazard is reduced to an acceptable level; or • Off-site treatment of excavated soil, so that contamination is destroyed or reduced to an acceptable level, after which the soil is returned to site. If the above management scenarios cannot be delivered, the following options may be considered: • Removal of the contaminated soil to an approved facility for disposal and where necessary, the disposed material is replaced with appropriate fill material; or • Consolidation and isolation of the soil on site by containment with an appropriately designed barrier.	Acceptable. The Auditor considers that the remedial options proposed as suitable based on the contaminants present at the site, the volume of impacted material identified, and the proposed end land use of the site.

Requirement	Consultants' Consideration	Auditor Comment and Recommendation/Questions
Basis for selected remediation criteria:	As the Site is proposed principally for residential use, the National Environment Protection Measure, as amended (2013), HIL - A criteria for 'low density residential' have been adopted as the Validation Criteria forWSP_AEC18 (Former Livestock Plunge Dip and Yards) and RobC_AEC22 (Glenloch Sheep Dip) remedial areas. As the Site is proposed for public open space (riparian corridor), the National Environment Protection Measure, as amended (2013), HIL - C criteria for 'public open space and recreation' has been adopted as the Validation Criteria for the WSP_AEC10 (Former Sludge Ponds) remedial area. Any imported material from the Molonglo Valley Stage 3 Future Urban Area (Area A and Area B) used for filling of land must be suitable for the proposed future land zoning. Any Virgin Excavated Natural Material (VENM) won from the Molonglo Valley Stage 3 Future Urban Area should be suitable for earthworks. Any soil that is reworked or contains anthropogenic fill will require further assessment prior to reuse. This may occur via an approved beneficial reuse application under the ACT EPA 2014, *Information Sheet 4 – Requirements for the reuse and disposal of contaminated soil in the ACT*. Any soil imported to the Site will be obtained from reputable suppliers and will comprise VENM where appropriate characterisation of the source material has occurred in accordance with the published ACT EPA guidance.	
Proposed testing to validate the site after remediation:	The RAP specifies validation programs for each remedial option proposed (where required). Validation sampling will be completed on an approximate 5 m x 5 m grid across the base of the final excavation for the livestock dips and 20 m x 20 m grid for the former sludge ponds (due to differing lateral footprints). Soil samples will be obtained at 5 m intervals along each excavation wall for the livestock dips and 20 m intervals for the former sludge ponds. For excavations / scrapes greater than 1.0 m depth, two wall samples shall be obtained per location (shallow and deep). Although a grid-based validation sampling plan will be completed, sample locations will also target areas where the dip structures were located and sludge pond bottom sediments and walls. Validation soil samples will be analysed for arsenic (primary contaminant of concern for the remedial areas of the livestock dips). Validation soil samples (if required) will be analysed for heavy metals 8, TRH C10-C36 and microbiological, Faecal Coliforms and E. Coli (primary contaminants of concern for the former sludge ponds), PFAS (if required). Given the deep depth to groundwater at the Site (>10 m BGL), excavations are not anticipated to intercept groundwater inflow that require dewatering.	Acceptable Once the final design of the Future Urban Area has been determined, then the remediation scope and remedial options can be refined to include relevant end land use criteria. **The Auditor further notes that aesthetics are to be assessed in accordance with the requirements of the RAP. These areas are identified in Figure 2 of the RAP.**
Contingency Plan for Remediation:	WSP has included a comprehensive approach on contingency planning and potential unexpected conditions during remedial works, within Section 11 of the RAP.	Acceptable.

Requirement	Consultants' Consideration	Auditor Comment and Recommendation/Questions
Interim site management plan prior to implementation of remediation (health, safety & environment):	No Interim Site Management plant is proposed for the site, however the following measures are stated by WSP which should be implemented: • WSP_AEC10 has restricted public access, is securely fenced and is only accessed occasionally by the Australian Federal Police for training. • For the livestock plunge dips, arsenic is present in surface soils. The current leaseholder should be informed and if the areas not in use (for livestock) the immediate areas should be cordoned off. If in use for livestock / farming, the leaseholder should ensure that surface soils immediately around the dip are not handled without wearing protective clothing (i.e. gloves) and hands should be washed to minimise the potential for ingestion of arsenic in soil.	Acceptable
Site Management Plan for Remediation Works (including stormwater, noise, dust, odour and OHS):	The Site Management Plan (Section 12 of the RAP) specifies the required detail for controls at the site, including; health safety planning and preparations, incident management plans, site access, surface water and soil management, groundwater management, traffic management, noise control, dust control, and odour control measures to be implemented.	Acceptable.
Remediation Schedule and Hours of Operation:	Remediation works will only be permitted during the following hours, and are subject to LDA and TAMS approval: • Monday to Friday: 7:00am to 5:00pm; • Saturdays: 8:00am to 1:00pm.	The Auditor considers that the hours will align with regulators requirements.
Contingency Plans for Incidents:	Specifics included in Section 13.1 of the RAP, including: • Incident reporting requirements; • WH&S plan and contact numbers; and • Relevant emergency contact information.	Acceptable.
Licenses and Approvals:	Section 10 of the RAP presents relevant remedial consents, including: • Provision of the RAP to ACT Planning and Land Authority (ACTPLA) and ACT EPA • Waste Classification approval from ACT EPA • Receipt of all relevant regulatory approvals (development applications if required) for remedial works, vegetation removal, and beneficial reuse / capping strategy.	It is noted that the ACT EPA must endorse the RAP prior to its implementation at the site.
Contact Persons:	To be prepared and included in the WH&S plan, to be prepared at the commencement of the remedial works.	Acceptable
Community Relations (where applicable):	The RAP states that a number of strategies should be implemented to maintain communications during the remedial works program for any surrounding stakeholders. A community relations consultant or the Site Owner should prepare an advisory note setting out in easy to understand language, the extent and need for the remedial works, the persons undertaking the works and contact information for any feedback or complaints. Methodology to be adopted for community engagement and risk communication remediation advice is presented in the	Acceptable

Requirement	Consultants' Consideration	Auditor Comment and Recommendation/Questions
	National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1). Schedule B8, Guideline On Community Engagement and Risk Communication.	
Staged Progress Reporting (where applicable):	No staged reporting was proposed in the RAP.	The remedial works are not proposed to be completed as a staged approach. The Auditor understands that the remedial works will completed as the first task of the bulk earthworks for the subdivision stage of the residential development.
Long Term Site Management Plan:	The RAP requires that a post-remediation Environmental Management Plan (EMP) be prepared to provide clear direction on the management of contaminated soils placed under a capping / containment layer, soils that may be uncapped, and the management of the capping layer itself. The RAP states that should an EMP be required, it is to include: • Be prepared with reference to the ACT EPA (2009) *Environmental Guidelines for Preparation of an Environment Management Plan*, NSW EPA, 2006 Contaminated Sites: *Guidelines for the NSW Site Auditor Scheme* (specifically Sections 3.4.6 and 4.3.3) and the DIPNR, 2004 *Guideline for the Preparation of Environmental Management Plans;* • Define roles and responsibilities associated with the EMP (regulatory and management requirements); • Outline the presence of any impacted materials and containment / capping present on the Site; • Include the pre and post land surveys of the remedial area to indicate depths below ground level and mAHD levels of impacted soils; • Define protocols to maintain cap integrity; • Identify the WH&S requirements and measures required to protect the health of Site workers from the contaminated soil / fill; and • Provide recommendations for work procedures to be implemented during any works undertaken on the Site which entails disturbing contaminated soil within the remedial / capping area footprint or by breaching of the capping layer.	Acceptable. The Auditor notes that the requirement for a long term EMP is dependent on the final design of the Future Urban Area, and the chosen remedial option by LDA / TAMS for the WSP_AEC10 impacted materials. The EMP will be prepared following the outcomes of the Validation program, as completed is accordance with the Validation SAQP.

10.2 Audit Discussion on the RAP

The Auditor considers that the objectives of the RAP (WSP 2017) are to demonstrate that the remedial areas **can be made suitable** for future urban landuses. There remains some uncertainty regarding confirmed future land use zones, as well as site ownership of areas identified as requiring remediation, however it is understood that the remedial process will be managed by the Land Development Agency (LDA), or other appropriate ACT Government agencies.

The RAP (WSP, 13 February 2017) is considered appropriate for the contamination present and the proposed remedial strategy will minimise contamination risks associated with the identified soil contamination within Area B. There are sufficient contingencies outlined in the RAP should contamination be greater than identified.

The Auditor concludes that if the WSP (13 February 2017) RAP as well as the UFMP (8 February 2017) are implemented (including requirement for Validation SAQP once future land use areas are confirmed), the site can be made suitable for the proposed future urban development (mixed residential and open space land use). Both Plans will be attached to the Section B Site Audit Statement.

The proposed remediation activities are considered to have met the relevant requirements of the Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition), namely that they are technically feasible, environmentally justifiable and appear to be consistent with relevant laws, policies and guidelines.

11. Evaluation of Unexpected Finds Management Plan (UFMP)

WSP prepared an Unexpected Finds Management Plan (UFMP) (8 February 2017) for the entire MV3 future urban area (Areas A and B inclusive). The requirement for the UFMP is to manage risks of encountering potential contaminated land, unexploded ordnance (UXO) and exploded ordnance waste (EOW) during future remediation, earthworks and construction activities, although based on the findings of the various contamination and UXO studies completed, the risk of occurrence in Area B is considered higher than for Area A (which is deemed to be low risk).

The Auditor has reviewed the UFMP against the requirements of Section 3.4.5, 3.4.6 and 4.3.3 of the Guidelines for the NSW Site Auditor Scheme (2nd Edition).

A summary of the key considerations is provided in Table 11.1. A copy of the UFMP is attached to the SAS.

Table 11.1: Review of WSP (2017) Unexpected Finds Management Plan (UFMP)

Requirement	UFMP	Auditor Comment
What is the nature and location of potential 'unexpected finds'?	Unexpected finds that may be encountered include any unidentified land contamination or unexploded ordnance or exploded ordnance waste (EOW) within MV3 Area B.	The Auditor agrees with WSP on the potential unexpected finds for which the UFMP addresses, and considers the proposed strategy to manage such finds to be appropriate.
What are the objectives of the UFMP?	The UFMP outlines measures required to manage potential contamination or UXO/EOW finds that have not been identified during previous intrusive assessments at the site.	The objectives as presented in the UFMP are considered to be appropriate for the requirements for currently known site conditions.
How are the contaminants going to be managed?	Table 6.1 of the UFMP provides examples of contaminants that may be encountered during site redevelopment works. Section 7.2 of the UFMP provides a procedure to follow should an unexpected find of potential contamination, UXO or EOW be encountered, including: • stop works, and move to a designated meeting / safe point; • contact person in control of the workplace • assess risk posed to human health and the environment and assess if emergency services should be contacted. • Delineate an exclusion zone. • Follow designated Health and Safety protocols. • Procedures for assessing and remediating / validating / area.	This is considered acceptable.
Who is responsible for the implementation of the UFMP?	The UFMP states that the LDA and the future redevelopment principal contractor must ensure that the UFMP is implemented.	The listed responsibilities and details with regards to the designation of responsibilities are considered acceptable.
Over what timeframe will the UFMP be implemented?	The UFMP shall until redevelopment works are completed.	Acceptable. It is likely that once site bulk earthworks are completed the UFMP becomes void.

Requirement	UFMP	Auditor Comment
Is the UFMP capable of being made legally enforceable?	The UFMP will be appended to the Site Audit Statement (SAS)) which will be recorded by the ACT EPA. The SAS will require implementation of the UFMP as part of future redevelopment works.	Acceptable, noting that the mechanism of enforcement must be made prior to site development.
How will this UFMP be publically notified?	As part of future planning approvals	The UFMP, along with the RAP will be attached to the Section B SAS for Area B and assumed to become a condition of future planning approval.
How is offsite migration of contamination being managed?	Contamination was identified at three AECs however not deemed to be migrating 'offsite'. The UFMP addresses potential unexpected finds associated with fill and historical military use across the greater MV3 future area.	
Does the remaining contamination affect groundwater quality?	Based on the available WSP investigation works (2016) there is no data suggesting that groundwater quality has been impacted, although elevated heavy metal concentrations in soils requiring removal (within AEC18 and RobC_AEC22) require reassessment of leachability potential to ensure if it remains onsite that it does not leach to a condition resulting in impact to surface or ground waters.	
How will the integrity of the cap be maintained in the long term?	Not outlined, and will be subject to final site validation considerations if this remedial approach is adopted in WSP_AEC10 (former sludge ponds). This will be subject to a long term EMP.	
Is there any risk to human health in structures overlying the cap?	If cap and containment strategy is implemented for WSP_AEC10 (former Sludge Ponds) it is the Auditor's understanding that there will be not structures placed on the cap as the area is proposed for Public Open Space Recreation within the river corridor.	

12. Compliance with Regulatory Guidelines

Guidelines currently approved by the ACT EPA for land contamination are listed in Section 1.3 of this SAR. Where relevant, the Auditor has used these in assessing the works conducted by WSP.

WSP's departures from the guidance has been discussed in the preceding sections of this SAR. The Auditor considers that these departures do not detract from the quality of the data set or any associated conclusions made for the objectives of this audit.

The Auditor considers that the work completed by WSP was of sufficient quality to achieve the objectives of the works completed and to assist the Auditor in preparing site audit documentation to form an opinion on site suitability.

13. Assessing Urban Redevelopment Sites

The NSW EPA (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition) describes that in assessing the suitability of a site for an existing or proposed land use in an urban context, Auditors should ensure that the contaminated land consultants have followed the decision process for assessing urban redevelopment sites (Page 50 and 51 of NSW EPA 2006).

For the purposes of this assessment, the proposed land use of the site is a mix of future urban residential, urban open space including recreation and nature reserve along the Molonglo River corridor with limited core commercial and transport services.

The Auditor provides the following comments:

- Departures from the relevant guidelines are listed in the preceding sections of the report. Where departures were noted these have been discussed in the SAR and comment made on any shortcoming or whether it was omitted from further consideration as it did not affect the outcome of the audit. Notwithstanding these departures, the Auditor considers there is sufficient information to enable a conclusion to be made on the suitability of the site for the proposed use.
- NEPM (2013) and OEH (2011) provides guidance on site contamination assessment and reporting requirements. WSP has considered past investigation works, in identifying and targeting source areas and potential contaminants of concern, with the appropriate sampling methodologies as outlined in NEPM (2013). Further the DSI (WSP, 2016) report meets the requirements of OEH (2011) reporting guidelines.
- As required by NEPM (2013), aesthetic inspections were carried out by WSP during the completion of investigation activities, with appropriate record and documentation of findings. Procedures to address any aesthetic issues during future remediation works are outlined in the RAP (WSP, 2017) for areas where fill containing anthropogenic wastes (but not chemically contaminated) were identified (as shown in Figure 2 of RAP).
- The soils have been assessed against the health-based investigation levels for mixed residential and urban open space, including recreational and nature reserve along the Molonglo River. These have comprised the most sensitive human health criteria of HIL A/HSL A as well as the assessment of data against the ecological criteria of EIL/ESL (for urban residential and open space) adopted from NEPM (2013). The surface water criteria comprised the ANZECC (2000) 95% LoP for freshwater. The Auditor is satisfied that the criteria was appropriate for site the environmental setting and future landuse.
- Any issues relating to local area background soil concentrations that exceeded appropriate site soil criteria have been addressed in the investigation report. No anomalous data was identified.
- To the extent practicable, human health impacts of chemical mixtures have been assessed.
- There is no evidence of migration of contaminants either onto or off the site.
- This SAR's objective is to endorse a remedial strategy to confirm the site 'can be made suitable'. The preferred strategies presented in the RAP (WSP, 2017) are considered practical and appropriate for the contamination identified at the site. If the adopted remedial strategy for WSP_AEC10 (former sludge ponds) comprises a cap and containment solution, the area will require a long term environmental management plan (EMP) which must be reviewed and endorsed by a Site Auditor and EPA, be made legally enforceable with public notification of any land use restrictions.

14. Auditor's Assessment of Risk

14.1 Risk to human health, structures and the environment arising from the actual or potential contamination of the land

The site subject to this SAR currently poses unacceptable risk for potential future residential land use. Notably, the following locations contain contaminants of concern which exceed adopted site criteria:

- WSP_AEC10 (Former Sludge Ponds): Heavy metals, microbiological (Faecal Coliforms and E. Coli) and TRH C10-C36 impacted soils / bottom sediments from former sewage treatment works. Estimated impacted volume of 20,000 m^3.
- WSP_AEC18 (Former Livestock Plunge Dip and Yards): Arsenic impacted soils from previous livestock plunge dip use and immediately surrounding yard area. Estimated impacted volume of 100 m^3.
- RobC_AEC22 (Glenloch Sheep Dip): Arsenic impacted soils from previous sheep plunge dip use and immediately surrounding area. Estimated impacted volume of 150 m^3.

The Auditor considers that the risk to human health and the environment will be addressed through the implementation of the RAP (WSP, 2017). Furthermore, aesthetic impacts identified during site redevelopment works will be managed in accordance with the RAP.

The Auditor notes that the Unexpected Finds Management Plan (WSP, 2017) shall be implemented to ensure that any UXO, EOW and/or other unexpected finds are managed during the site remediation and redevelopment works.

14.2 Potential for offsite migration of contamination

Arsenic has been reported above the residential human health criteria (100 mg/kg) in the majority of samples collected adjacent to the Sheep Dip sites. The results for arsenic ranged between 4 and 1,300 mg/kg. Samples from both the surface soils (0.0-0.1m bgl) and at depth (0.4-0.5m bgl) have exceed the adopted criteria.

Leachability results indicated that the soils (under laboratory conditions) will leach arsenic under aggressive conditions. WSP stated that typically, arsenic is strongly bound to the soil particles within the Sheep Dip and immediate surrounds and does not leach into solution *in situ* (NSW DPI, 2014). Transport mechanisms for arsenic in soil are often related to erosion and movement of soil and / or dip fluids to surrounding areas such as yards.

Based on the groundwater wells installed by WSP in August 2015 and those installed by AECOM in 2013, regional groundwater was considered likely to be located within the underlying dactite bedrock (at depths >10m bgl) within primary fractures throughout the rock mass. Some weathered zones may contain water depending on local and regional rainfall and is likely to be intermittent. Shallow infiltration water is likely to be present in low lying drainage lines and creeks (Deep Creek and Coppins Creek) that flow towards the Molonglo River. Some perched water is likely to occur down hydraulic gradient of permanent surface water dams and ponds such as the Sludge Ponds (WSP_AEC10) with shallower groundwater present at B-MW01 and BMW02 (~6.0 to 8.5m bgl).

Of the monitoring wells with recoverable samples, the AECOM wells (B-MW03 and MW04) did not report elevated concentrations of arsenic in ground water, supporting WSP's conclusion that arsenic from the Sheep Dips site is unlikely to migrate into the environment. The factors above provide evidence that groundwater is not at risk from soil conditions and therefore limited migration potential.

14.3 Requirement for any ongoing management of residual contamination

The proposed remediation works may result in contamination remaining within part of the Riparian Corridor (referred to as remediation area WSP_AEC10 former Sludge Ponds). As such, in addition to a validation report confirming the appropriate implementation of the cap and contain remediation works, the area will require a long term environmental management plan (EMP) which must be reviewed and endorsed by a Site Auditor and EPA, be made legally enforceable with public notification of any land use restrictions.

Furthermore, the site is to be managed by the Unexpected Finds Management Plan (WSP, 2017) for all future site re-development works.

15. Site Audit Conclusions

The investigation reports and proposed remediation strategy reviewed are considered to have been completed in general accordance with ACT EPA endorsed land contamination guidelines and the procedures outlined in the ACT EPP (November 2009). Where WSP's work deviated from the guidelines, the Auditor has discussed this within this SAR and is satisfied that these omissions do not affect the conclusions of the Site Audit.

On this basis a Section B Site Audit Statement will be issued certifying that the Auditor considers the site is capable of being made suitable for redevelopment for mixed residential and urban open space, including recreational and nature reserve along the Molonglo River, with limited core commercial and transport services, if the WSP (February 2017) Remedial Action Plan is implemented and subject to the following conditions:

1. Prior to the commencement of any intrusive works (as part of remediation and/or redevelopment activities), the LDA and the appointed Principal Contractor must ensure that the recommended Unexploded Ordnance (UXO) survey and clearance works have been completed and reported prior to construction works occurring within or near these areas. The scope of this requirement is outlined in WSP (8 February 2017) Unexpected Finds Management Plan (UFMP), Contaminated Land and Unexploded Ordnance (UXO) / Exploded Ordnance Waste (EOW), Molonglo Valley Stage 3 (Future Urban Area) (reference WSP-PB_Rpt_UFP_MV3_FINAL).
2. Upon successful completion of the remediation and validation activities in areas outlined in the WSP (2017) RAP, a validation report prepared in accordance with the requirements of OEH 2011 and DEC 2006 must be provided to the Site Auditor for review. A Site Audit Report and Site Audit Statement must be issued confirming that the remediation objectives have been achieved and the land has been rendered suitable for the proposed future uses. The Site Audit Statement and Site Audit Report shall be submitted to the EPA for endorsement prior to the commencement of development works within the audit area.
3. If the adopted remedial strategy within the Riparian corridor at remediation area WSP_AEC10 (former sludge ponds) comprises a cap and containment solution, the area will require a long term environmental management plan (EMP). The EMP must be reviewed and endorsed by a Site Auditor and EPA, be made legally enforceable with public notification of any land use restrictions.

16. Other Relevant Information

This site audit relates only to those matters relevant to the EP Act 1997, which describes that the general object of this Act is to establish a process for the investigation and (where appropriate) remediation of land where contamination presents a significant risk of harm to human health or some other aspect of the environment. Not all environmental issues as stated in the EP Act 1997 have been audited, only soil, surface water, groundwater and odour issues. The SAS and SAR do not seek to provide an opinion regarding other aspects of the environment not related to site contamination, to the suitability of the site in regard to the occupational health and safety legislation, or in regards to the suitability of the engineering design.

By definition, auditing involves the review and critique of Consultants' work, including site histories, site surveys, subsurface investigations, chemical and physical analyses, risk assessments and modelling. Accordingly, the Site Auditor relies on the experience, expertise and integrity of the relevant organisations. The information sources referenced have been used to determine site history and local subsurface conditions. While the Site Auditor has used reasonable care to avoid reliance on data and information that is inaccurate or unsuitable, the Site Auditor is not able to verify the accuracy or completeness of all information and data made available.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Environmental sampling and laboratory analyses were undertaken as part of the investigations reviewed by the Site Auditor, as described herein. Ground conditions between sampling locations may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site which was not identified in the site history.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this site audit are based on the information provided at the time of the investigations.