



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Detailed Site Investigation for Contamination

Proposed Subdivision
360A Alderson Place, Tralee

Prepared for
Canberra Estates Consortium No 4 Pty Ltd

Project 46162.12
August 2018

Integrated Practical Solutions





Douglas Partners

Geotechnics | Environment | Groundwater

Document History

Document details

Project No	46162.12	Document No	R.001.Rev1
Document title	Report on Detailed Site Investigation for Contamination Proposed Subdivision		
Site address	360A Alderson Place, Tralee		
Report prepared for	Canberra Estates Consortium No 4 Pty Ltd		
File name	46162.12.R.001.Rev1		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Peter Storey	Dean Woods	July 2018
Revision 1	Peter Storey	Dean Woods	August 2018

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Jason Burgess, Canberra Estates Consortium No 4 Pty Ltd
Revision 1	1	0	Jason Burgess, Canberra Estates Consortium No 4 Pty Ltd

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

Signature		Date
Author	Peter Storey	August 2018
Reviewer	Dean Woods	August 2018



FS 604853

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 2, 73 Sheppard Street
Hume ACT 2620
PO Box 1487
Fyshwick ACT 2609
Phone (02) 6260 2788
Fax (02) 6260 1147

Executive Summary

This report presents the results of a detailed site investigation for contamination (DSI) undertaken for a proposed subdivision at 360A Alderson Place, Tralee. The investigation was commissioned in an email dated 25 May 2018 by Jason Burgess of Canberra Estates Consortium No 4 Pty Ltd and was undertaken in accordance with Douglas Partners' proposal CAN180102 dated 7 May 2018.

DP understands that the site is to be subdivided and rezoned to the following zones:

- RE2: Community playing fields; and
- IN2: Industrial

The objectives of the proposed works include:

- Review site history information for the site;
- Undertake soil sampling at the site with interpretation of soil laboratory results; and
- Advise on any contamination and the need, or otherwise, for on-going site investigations and/or remediation.

The site comprises a large irregular shaped area and is approximately 54 hectares in size. An area in the central western portion of the site was used as a race track. An oval race track, earthen embankment and buildings are present in this area. A gravel road is present running along the southern boundary of the site. The remaining area of the site is grassed and scattered with trees. The maximum north-south dimensions and east-west dimensions are approximately 550 m and 1.2 km, respectively.

The site is generally flat and slopes down gently towards the north to northwest and the surface level of the site ranges from approximately 590 m AHD in the east of the site to 580 m AHD in the west of the site. The regional topography slopes down towards the north-west with the Tralee Hills present to the south-east of the site.

The site is bounded by rural properties to the north and south, low density residential properties to the east and commercial and industrial properties to the west.

The site history review indicated that the site had primarily been used for livestock grazing prior to development of the Speedway race track in 1970. The race track was operational from 1970 to approximately 1997. Anecdotal information and the results of the site inspection indicated an area of hummocky land was present in the north of the site that may have been associated with the dumping of waste material associated with the speedway operation. In addition, buildings located in the north-east corner of the site appeared in the early 1990s and were associated with potential sand or gravel extraction. The overall potential for contamination is considered to be moderate, with localised areas of more elevated contamination potentials.

The table below outlines the justification behind the identification of areas of environmental concern (AECs) and the environmental contaminants of concern (associated with each AEC).

AEC Description	Justification	Potential Contaminants of Concern	Comments
AEC 1: Fill embankments with filling of unknown origin	Potential importation or use of filling of unknown origin. Possible contamination from burial of unknown wastes.	TRH, BTEX, PAH, Metals, OCP/OPP, PCB, Asbestos	Generally comprising the fill embankment surrounding the main speedway race track. DP considers the likelihood for contaminants to be present to be moderate to high. Soil media potentially affected.
AEC 2: Main Race Track	Potential spills and leaks from motor race vehicle during operation of the speedway	TRH, BTEX, PAH and Metals	Race track was in operation for approximately 30 years. There is potential for accumulation of hydrocarbon contamination from spills and leaks from race vehicles. DP considers the likelihood for contaminants to be present to be moderate. Soil and groundwater media potentially affected.
AEC 3: Race Track pits area	Potential spills and leaks from motor race vehicle during operation of the speedway.	TRH, BTEX, PAH and Metals	The pits area to the east of the main race track was used to maintain vehicles prior to racing. There is the potential for accumulation of hydrocarbon contamination resulting from spills and leaks. DP considers the likelihood for contaminants to be present to be moderate. Soil and groundwater media potentially affected.
AEC 4: Hazardous Building Material	Hazardous building material associated with race track buildings.	Asbestos, Lead, PCBs	Potential asbestos containing material and lead paint used in construction of on-site buildings. DP considers the likelihood for contaminants to be present to be moderate to high in localised areas surrounding buildings. Soil media potential affected.
AEC 5: Toilet Blocks and Soakaways	Potential biological pathogens associated with drainage of toilet blocks.	E coli, Salmonella and Faecal coliforms	Several toilet blocks were present across the site. Site inspection indicated that these discharged to soakaways. There is the potential for biological pathogens to be present. DP considers the likelihood for contaminants to be present to be low to moderate. Soil and groundwater media potentially affected.

AEC Description	Justification	Potential Contaminants of Concern	Comments
AEC 6: Historic on-site landfill	Anecdotal information indicates that waste from race track operation was buried on site.	TRH, BTEX, PAH, Metals, OCP/OPP, PCB, Asbestos	Anecdotal information from the current site owners indicates that waste material from speedway events were buried on site. DP considers the likelihood for contaminants to be present to be moderate to high. Soil and groundwater media potentially affected.
AEC 7: Potential sand /gravel extraction	Historical aerial photographs indicate the possible extraction of sand and or gravel in the north-east corner of the site. Possible machinery associated with this activity may have been present.	TRH, BTEX, PAH, Metals, PCB	Potential machinery associated with any extraction may have been powered by fuel oils. Storage and use of fuel oils may have resulted in leaks and spills and the accumulation of hydrocarbon contamination. DP considers the likelihood for contaminants to be present to be low Soil and groundwater media potentially affected.
AEC 8: Potential historical use of pesticides	Prior to development of the speedway, the site was used for grazing. Pesticides may have been applied to livestock.	OCP/OCP, metals	No obvious sheep dip sites were observed during the site inspection, however there is potential for pesticides to have been used at the site. DP considers the likelihood for accumulation of significant quantities of pesticides to be low. Soil media potentially affected

The AECs were identified on the basis of the available site information, site inspection and limited subsurface investigation. Based on the findings of the assessment, including limited sampling and testing to date, the potential for gross contamination to be present within the site is considered to be low, with localised areas of more elevated contamination potential.

It is recommended that prior to the commencement of construction activities, further intrusive-based investigation be carried out to further characterise each of the identified AECs. The recommendations for further works are summarised in the Table below. The further works aim to confirm the suitability of the site for the proposed end-uses (commercial/industrial and recreational).

AEC	Description	Recommendations for further work
AEC 1	Fill Embankment	The results of the sampling of the fill embankment indicate that gross contamination was not present within the filling. DP understands the filling may be re-used on site. DP considers the filling may be suitable for on-site reuse subject to further investigation and the implementation of an unexpected finds protocol.
AEC 2	Use of hydrocarbon fuel in race track area.	No further investigation required but it would be prudent to include this area in the unexpected finds protocol.

AEC 3	Spills and leaks of fuels in pits area	
AEC 4	Hazardous building materials	A pre-demolition hazardous materials survey is recommended for buildings and former buildings in the race track area and should be undertaken by a licensed asbestos assessor. Identified hazardous building materials should be removed by a licensed asbestos removalist and validation of the removal should be completed by a licensed asbestos assessor
AEC 5	Toilet blocks and soakaways	No further investigation required except for a hazardous building materials survey.
AEC 6	Former landfill area	The results of the sampling of the former landfill identified the presence of anthropogenic waste, including asbestos containing material. DP recommends the area is excavated and stockpiled on site prior to undertaking a waste classification assessment in order to dispose the material off-site to a suitably licensed waste disposal facility.
AEC 7	Potential sand and /or gravel extraction	No further investigation required.
AEC 8	Potential former Pesticide use	No further investigation required

Based on the assessment undertaken to date, it is considered that the site is likely to be suitable for the proposed development, following further investigation and remediation detailed in the Table above.

In addition, DP recommends that a construction environmental management plan (CEMP), incorporating an unexpected finds protocol be implement during the development works at the site.

Table of Contents

	Page
1. Introduction.....	1
2. Scope of Works	1
3. Site Identification and Description	2
3.1 Site Identification	2
3.2 Site Layout and Description	3
4. Soil Landscape, Regional Geology and Hydrogeology	3
4.1 Soil Landscape	3
4.2 Regional Geology	4
4.3 Hydrogeology	4
4.4 Groundwater Bore Search	4
5. Site History	4
5.1 Regulatory Notice Search under the CLM and POEO Acts	4
5.2 Historical Title Search	5
5.3 Historical Aerial Photography	5
5.4 Additional Historical Information	8
6. Site Inspection	8
7. Proposed Development	9
8. Potential for Contamination	9
9. Conceptual Site Model	11
9.1 Potential Receptors	12
9.1.1 Human Health Receptors	12
9.1.1 Environmental Receptors	12
9.2 Potential Pathways	12
9.3 Summary of Potential Complete Pathways	12
10. Sampling and Analysis Plan and Methodology	14
10.1 Data Quality Objectives	14
10.2 Sampling Rationale	16
10.2.1 Motor Vehicle Speedway	16
10.2.2 Former Landfill	16
10.2.3 Former Toilet Blocks	16
10.2.4 Former Agricultural Use	17
10.3 Methods and Sampling Locations	17

10.4	Soil Sampling Procedure	17
10.5	Analytical Rationale	18
11.	Quality Assurance and Quality Control	18
12.	Site Assessment Criteria	18
12.1	Health Investigation and Screening Levels	19
12.2	Ecological Investigation Levels	21
12.3	Ecological Screening Levels – Petroleum Hydrocarbons	22
12.4	Management Limits – Petroleum Hydrocarbons	23
12.5	Asbestos in Soil	24
13.	Results of the Investigation	25
13.1	Subsurface Conditions	25
13.1.1	Race Track Embankment	25
13.1.2	Former Race Track Area	25
13.1.3	Former Race Track Pits Area	25
13.1.4	Former Landfill Area	25
13.1.5	General Areas of the Site	26
13.2	Field Screening Observations	26
13.3	Contamination Observations	26
13.3.1	Field Sieve Screening for Asbestos	26
13.4	Analytical Results	27
13.5	Assessment of Laboratory Results	27
13.5.1	Motor Vehicle Speedway Area	27
13.5.2	Former Landfill Area	27
13.5.3	Former Toilet Block Areas	27
13.5.4	Agricultural Areas	27
14.	Revised Conceptual Site Model	28
15.	Conclusions and Recommendations	29
16.	References	30
17.	Limitations	31

APPENDICES

Appendix A:	About This Report
Appendix B:	Drawings
Appendix C:	Site History Searches
Appendix D:	Historical Aerial Photographs
Appendix E:	Site Photographs
Appendix F:	Test Pit Logs
Appendix G:	Data Quality Assessment
Appendix H:	Laboratory Certificates of Analysis and Chain of Custody Documentation
Appendix I:	Ecological Investigation Level Calculation Sheet Output
Appendix J:	Tables

Report on Detailed Site Investigation for Contamination Proposed Subdivision 360A Alderson Place, Tralee

1. Introduction

This report presents the results of a detailed site investigation for contamination for contamination (DSI) undertaken for a proposed subdivision at 360A Alderson Place, Tralee. The investigation was commissioned in an email dated 25 May 2018 by Jason Burgess of Canberra Estates Consortium No 4 Pty Ltd (CEC) and was undertaken in accordance with Douglas Partners' proposal CAN180102 dated 7 May 2018.

DP understands that the site is to be subdivided and rezoned to the following zones:

- RE2: Community playing fields; and
- IN2: Industrial

The site is approximately 54 hectares in size and has formerly been used for agricultural uses and a motor vehicle race track. Anecdotal information indicates that a possible former landfill is also located in the northern part of the site. DP further understands that remediation of asbestos contamination has occurred on part of the site adjacent to the southern boundary. CEC therefore, require a site contamination assessment to inform any further remediation works that may be necessary prior to development.

The objectives of the proposed investigation include:

- Review site history information for the site;
- Undertake soil sampling at the site with interpretation of soil laboratory results; and
- Advise on any contamination and the need, or otherwise, for on-going site investigations and/or remediation.

This report must be read in conjunction with the notes *About this Report* which are included in Appendix A.

2. Scope of Works

The following scope of works was conducted to meet the project objectives:

- Preparation of a list of Potential Areas of Environmental Concern (PAEC) through investigation of the site by the following methods:
 - o A desk study of available topographical, geological and hydrogeological maps;
 - o A search through the Contaminated Land Register for notices issued under the CLM Act;
 - o A search of the groundwater bore database;
 - o A review of available historical aerial photography;

- o A review of historical land titles with respect to the Deposited Plan to identify previous site owners. The names and occupations of site owners may assist in the identification of potentially contaminating activities;
 - o Review of existing environmental reports available for the site; and
- Site inspection by an environmental scientist;
- Formulation of a preliminary conceptual site model (CSM) based on the site history review and inspection;
- Subsurface investigation with sampling and laboratory testing for the contaminants of concern as outlined Sections 10 and 11;
- Revision of the CSM based on the results of the limited subsurface investigation and laboratory testing; and
- Preparation of this report presenting the findings of the DSI, identification of potential sources of contamination, and an assessment of the need for further investigations and/or management.

The works documented in this report were undertaken with reference to the following guidance:

National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure (1999, as amended 2013) (Ref 1); and

NSW Office of Environment and Heritage (OEH) (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (Ref 2).

3. Site Identification and Description

3.1 Site Identification

Site information is summarised in Table 1 below:

Table 1: Site Identification Details

Item	Details
Site Owner/ Occupiers	The Village Building Company Limited
Site Address	360A Alderson Place, North Tralee
Registered Lot and Plan (see Drawing 1, Appendix B)	The site is comprised of the following registered lot parcels: • Lot 6, DP239080; • Lot 3, DP239080; and • Lot 1, DP313299
Current land use	Stock grazing
Current Zoning	DM: Deferred Matter (extract of Queanbeyan-Palerang Regional Council Local Environment Plan 2009 is presented in Appendix C).
Council	Queanbeyan-Palerang Regional Council
Approximate Site Area	54 hectares
Proposed future land-use	Commercial/Industrial development and recreational – playing fields

Item		Details
Proposed future zoning		RE2: Community Playing Fields, and IN2: Industrial
Surrounding Land Use	North:	Jerrabomberra Creek with open agricultural land beyond
	South:	Open agricultural land, grazing
	East:	Low Density Residential properties
	West:	Commercial/Industrial properties

3.2 Site Layout and Description

The site comprises a large irregular shaped area and is approximately 54 hectares in size. An area in the central western portion of the site was previously used as a race track. An oval race track, earthen embankment and buildings are present in this area. A gravel road is present running along the southern boundary of the site. The remaining area of the site is grassed and scattered with trees. The maximum north-south dimensions and east-west dimensions are approximately 550 m and 1.2 km, respectively.

The site is generally flat and slopes down gently towards the north to northwest and the surface level of the site ranges from approximately 590 m AHD in the east of the site to 580 m AHD in the west of the site. The regional topography slopes down towards the north-west with the Tralee Hills present to the south-east of the site.

The site is bounded by rural properties to the north and south, low density residential properties to the east and commercial and industrial properties to the west.

Drawing 1, Appendix B present the site location and an aerial view of the current site features.

4. Soil Landscape, Regional Geology and Hydrogeology

4.1 Soil Landscape

Reference to the 1:100 000 'Canberra Soil Landscape' Series Sheet 8727 (Ref 3) indicated that the site is mapped as being on the Williamsdale Soil Group.

The Williamsdale Soil Group is characterised by undulating rises, alluvial fans and valley flats on Silurian Volcanics of the Canberra Formation. Generally, little or no rock outcrops occur within this soil group. Soils are moderately deep, well drained podzolic soils, red and brown earths on upper rises and fan elements and moderately to very deep, poorly to imperfectly drained, solodic soils on lower rises and fan elements. This soil group is limited by its erodible and dispersible nature, its acidity, potential for seasonal water-logging and localised flooding hazard.

4.2 Regional Geology

Reference to the Canberra 1:100 000 Geological Series Sheet (Ref 4) indicates that the site is underlain by geological rock units of the Laidlaw Volcanics of late Silurian age.

The Laidlaw Volcanics typically comprise rhyodacitic ignimbrite with minor volcaniclastic and argillaceous sedimentary rocks.

4.3 Hydrogeology

The 1:100,000 map 'Hydrogeology of the Australian Capital Territory and Environs' (Ref 5) indicates that the site is underlain by geological units of late Silurian aged. These typically include: dacitic, rhyodacitic, ignimbrite, bedded tuffs, minor shale, sandstone, limestone and ashstone and are typically fractured, high yielding where minor limestone beds, major fold closures, major geologic contacts, individual ash-flows and interbedded sediments appear. The mapped water quality is indicated to be good with total dissolved solids of less than 500 mg/L and yield is mapped at less than 0.5 L/s.

It is anticipated that groundwater flow direction in the area will follow the regional topography and flow towards the north to north west.

4.4 Groundwater Bore Search

A search of the groundwater bore database was conducted through the NSW Department of Primary Industries. Based on the database there are two groundwater abstraction bores registered within a 1.5 km radial search area of the site. Further information was available through the database for the bore as shown in Appendix C and summarised in Table 2.

Table 2: Groundwater Bores Attribute Data

Groundwater Bore Number	Date Installed	Distance to site (m)	Private/Public	Groundwater Usage	Depth (m)	Depth to standing water level (m)	Yield (L/s)
GW043846	1/10/69	835 m S	Private	Irrigation	40.50	17.6	0.51
GW043847	1/08/69	1,020 m S	Private	Stock, Domestic	37.70	12.10	0.07

5. Site History

5.1 Regulatory Notice Search under the CLM and POEO Acts

A search on 5 June 2018 for Statutory Notices issued under the *Contaminated Land Management Act 1997* and *Protection of the Environment Operation Act 1997* (POEO) available on the NSW Environment Protection Authority (EPA) website indicated that there have been no notices issued on the subject Lots.

An extract of the "List of NSW Contaminated Sites Notified to EPA" is presented in Appendix C.

5.2 Historical Title Search

Historical title records were reviewed to identify any previous land owners and/or site uses that may indicate a potential for contamination. Information of current and previous owners is presented in Table 3. The historical title search results are presented in Appendix C.

Table 3: Summary of Historical Titles

Date of Acquisition and term held	Registered Proprietor(s) & Occupations	Inferred Land Use
19.12.1924 (1924 to 1925)	James Patrick Heaton (Grazier)	Agricultural
01.04.1925 (1925 to 1936)	Amy Gwendoline Halloran (Married Woman)	Agricultural
01.07.1936 (1936 to 1954)	John Morrison (Grazier)	Agricultural
31.03.1954 (1954 to 1993)	John Walsh Morrison (Catholic Priest) Bernard Lawrence Morrison (Grazier) (Application by Transmission not investigated)	Agricultural
04.03.1993 (1993 to 1999)	Bernard Lawrence Morrison (Grazier)	Unknown
18.06.1999 (1999 to 1999)	Sandra Anne Walsh Graeme Farquhar Finlayson (Executors of the Will of Bernard Lawrence Morrison)	Unknown
18.10.1999 (1999 to 2002)	Therese Mary Hansen John Bernard Morrison Lucille Margaret Wilmot Sandra Anne Walsh	Unknown
13.06.2002 (Part) (2002 to 2003)	The Village Building Co. Limited	Unknown
02.04.2014 (2014 to Date)	The Village Building Co. Limited	Unknown

No significant potential sources of contamination were identified based on a review of the inferred site ownership records.

5.3 Historical Aerial Photography

Five historical aerial photographs available from the ACT Planning and Land Authority and two satellite images obtained from Google Earth were reviewed (refer to Aerial Photograph Plates D1 to D8 presented in Appendix D).

The photographs and image were examined for signs of potential areas of environmental concern such as planting patterns, previous structures which may have subsequently been removed, existing

structures, stripped soil or areas of filling or disturbance or other signs of potentially contaminating activities. Findings of the review are summarised Table 4.

Table 4: Summary of Historical Aerial Photography Review

Aerial Photograph	On-site Conditions	Surrounding Area
1951 Photograph Run 9-5118	The site appeared to be unimproved open land open covered by grass and sporadic trees. Two small structures appeared to be present in the central part of the site, one of which may have been a homestead. Several track crossed the site. It is possible that hay production was occurring in the north-eastern corner of the site. Creek lines were present aligned south-east to north-west crossing the central portion of the site of the site.	The surrounding area was unimproved open grassland and several farm dams were present. Jerrabomberra Creek was present immediately to the north of the site. An unsealed track was present to the south of the site. A railway line was present to the west of the site.
1961 Photograph Sortie 23-120	Largely unchanged from the previous aerial photograph. A farm dam was present in the south west corner of the site.	Largely unchanged from the previous aerial photograph.
1973 Photograph Run 73C14-128	The western part of the site had been developed as a race track arena consisting of an oval-shaped vehicle track and earthen embankment. The race track appeared to be unsealed. Two buildings were present on the western side of the race track and one building was present on the eastern side of the race track. Access tracks were present leading from the north-west corner of the site to the race track area. An excavation was present immediately to the east of the possible homestead located in the central part of the site. The eastern part of the site was largely unchanged.	Largely unchanged from the previous aerial photograph. Farm dams and drainage channels had been cut into the agricultural land to the south of the site.
1983 Photograph Run 21-123	An additional race track had been constructed to the east of the original race track. The new race track area appeared to be unsealed.	The construction of commercial and industrial properties to the west of the site had been undertaken.

Aerial Photograph	On-site Conditions	Surrounding Area
	The area to the east of the original race track appeared to have been developed as an un-sealed car park and additional buildings had been constructed in this area. A disturbed area of ground was visible to the north-east of the original race track, adjacent to Jerrabomberra Creek The excavation to the east of the homestead building had been in-filled. The second building visible on the 1951 aerial photograph was no longer present. Several tracks crossed the site, a track crossed the site along the northern site boundary to a building located in the north-east corner of the site	
1990 Photograph Run 21-792	Largely unchanged from the previous photo. Two additional small buildings were present to the west of the race track. Several small stockpiles were present in the west of the site. The car parking area to the east of the original race track had been enlarged and the second race track appeared to be un-used. Buildings had been constructed in the north-east corner of the site, where bare earth was present and it appeared the banks of Jerrabomberra Creek had been excavated	Additional construction of commercial and industrial properties to the west of the site had been undertaken. A lake had been constructed to the east of the site.
1995 Photograph Run 21-64	Largely unchanged from the previous aerial photograph.	Largely unchanged from the previous photo. Some additional buildings had been developed in the north-east corner of the site.
1998 Photograph Run 8-92	Largely unchanged from the previous aerial photograph. Some of the buildings associated with the race track were no longer present.	Residential properties had been developed to the east of the site.
2005 GoogleEarth Satellite Image	The race track area of the site appeared to be disused and some of the buildings appeared to have been demolished. The buildings in the north-east corner of	Largely unchanged from the previous aerial photograph.

Aerial Photograph	On-site Conditions	Surrounding Area
	the site were no longer present.	
2018 GoogleEarth Satellite Image	Largely unchanged from the previous aerial photograph. A dirt road had been constructed along the southern boundary of the site.	Largely unchanged from the previous aerial photograph.

5.4 Additional Historical Information

An internet search for the 'Tralee Speedway' conducted on 2 July 2018 indicated the following information:

- The Tralee Speedway was constructed during 1970 and opened in May 1970;
- The speedway consisted of an oval track with a surrounding earthen embankment. The race track had a dirt surface and was 410 m in length;
- A large building was located adjacent to the west of the track. It is understood that the building contained a canteen and control tower for race track operations;
- A 'pits area' was located to the east of the track where cars were prepared for racing;
- Between 1974 and 1977 it is understood that the race track was sealed with bitumen. Following 1977, it is understood that the surface of the race track was returned to dirt and a second race track, approximately half a mile in length was built to the east of the main race track; and
- The speedway ceased operations in 1997.

6. Site Inspection

A site inspection was undertaken on 4 June 2018 by an experienced environmental scientist. The inspection was undertaken to check and identify (where possible) the likely presence, or otherwise, of potential sources of contamination. Reference was made to the site history review, in order to identify and comment on additional potential sources of contamination which were encountered or observed. Drawing 1, Appendix B, and site photographs, Appendix E, shows the layout of the site.

The following observations were made during the site inspection:

- The site is a large, relatively flat block of land that is mainly grassed that was un-used at the time of the site inspection;
- A race track was present in the central part of the site. The race track was oval shape and unsealed. Surrounding the race track was a large earthen embankment. The embankment was approximately 5 m to 6 m in height at its highest point and approximately 30 m wide;
- Two buildings were present to the west of the race track, a small square building and a larger rectangular building. The two buildings were in a state of disrepair and broken pieces of compressed cement sheeting were observed on the ground surface in the vicinity of both buildings;
- A concrete slab was located to the west of the two buildings indicating the former presence of another building. Building and demolition rubble was noted on the ground surface in this area;

- A soakaway was observed between the two buildings. The soakaway was constructed from a section of concrete pipe. Two drainage pipes were observed to enter the soakaway;
- A large concrete slab was present on the western side of the racetrack. Stockpiles of building and demolition rubble were present adjacent to the concrete slab;
- A stockpile of demolition rubble was present on the southern part of the earthen embankment. The stockpile contained timber and pieces of compressed cement sheeting;
- Immediately to the west of the race track was an area of hard standing surfaced with bitumen. Four concrete slabs were present in were present in this area. In addition, in the north western part of this area, stockpiles of building and demolition rubble were present;
- The remains of a toilet block building were present to the south of the hard standing area. A soakaway was observed associated with the toilet block building remains;
- An area of hummocky ground was present to the north-east of the race track area. Anthropogenic waste materials including metal, concrete and car parts were observed protruding from the ground surface. Information from the site owner's representative indicated that this area may have been used as a small landfill area associated with the speedway operation;
- The remains of an old homestead building were present to the south of the area of hummocky ground. What appeared to be a soakaway was present to the south of the homestead;
- A gravel road was present running along adjacent to the southern boundary of the site.
- A further toilet block was located to the south of the gravel road. The toilet block was constructed from cinder blocks and was in a state of disrepair. A soakaway was located to the north-west of the toilet block;
- Areas of disturbed ground were present adjacent to the western boundary of the site. Bare earth was present at the surface and anthropogenic material including concrete was observed, suggesting the presence of filling; and
- No potential sheep or cattle tick dip facilities were observed during the site inspection.

Selected site photographs from the site inspection visit are presented in Appendix E.

7. Proposed Development

DP understands that the proposed development will include the subdivision of the site for commercial/industrial and recreational use. Detailed development plans were not available at the time of writing this report, however, it is understood that the recreational use will include the development of playing fields. It is understood that at this time, there are no plans for residential development at the site.

8. Potential for Contamination

The site history review indicated that the site had primarily been used for livestock grazing prior to development of the Speedway race track in 1970. The race track was operational from 1970 to approximately 1997. Anecdotal information and the results of the site inspection indicated an area of

hummocky land was present in the north of the site that may have been associated with the dumping of waste material associated with the speedway operation. In addition, buildings located in the north-east corner of the site appeared in the early 1990s and were associated with potential sand or gravel extraction. The overall potential for contamination is considered to be moderate, with localised areas of high contamination potential.

Table 5 outlines the justification behind the identification of areas of environmental concern (AECs) and the environmental contaminants of concern (associated with each AEC). Due to the varying potential for environmental impact associated with different contamination sources, intrusive sampling should be undertaken targeting all potential AECs.

Table 5: Summary of Identified Areas of Environmental Concern

AEC Description	Justification	Potential Contaminants of Concern	Comments
AEC 1: Fill embankments with filling of unknown origin	Potential importation or use of filling of unknown origin. Possible contamination from burial of unknown wastes.	TRH, BTEX, PAH, Metals, OCP/OPP, PCB, Asbestos	Generally comprising the fill embankment surrounding the main speedway race track. DP considers the likelihood for contaminants to be present to be moderate to high. Soil media potentially affected
AEC 2: Main Race Track	Potential spills and leaks from motor race vehicle during operation of the speedway.	TRH, BTEX, PAH and Metals	Race track was in operation for approximately 30 years. There is potential for accumulation of hydrocarbon contamination from spills and leaks from race vehicles. DP considers the likelihood for contaminants to be present to be moderate. Soil and groundwater media potentially affected.
AEC 3: Race Track pits area	Potential spills and leaks from motor race vehicle during operation of the speedway.	TRH, BTEX, PAH and Metals	The pits area to the east of the main race track was used to maintain vehicles prior to racing. There is the potential for accumulation of hydrocarbon contamination resulting from spills and leaks. DP considers the likelihood for contaminants to be present to be moderate. Soil and groundwater media potentially affected.
AEC 4: Hazardous Building Material	Hazardous building material associated with race track buildings.	Asbestos, Lead, PCBs	Potential asbestos containing material and lead paint used in construction of on-site buildings. DP considers the likelihood for contaminants to be present to be moderate to high in localised areas surrounding buildings. Soil media potential affected

AEC Description	Justification	Potential Contaminants of Concern	Comments
AEC 5: Toilet Blocks and Soakaways	Potential biological pathogens associated with drainage of toilet blocks	E coli, Salmonella and Faecal coliforms	Several toilet blocks were present across the site. Site inspection indicated that these discharged to soakaways. There is the potential for biological pathogens to be present. DP considers the likelihood for contaminants to be present to be low to moderate. Soil and groundwater media potentially affected.
AEC 6: Historic on-site landfill	Anecdotal information indicates that waste from race track operation was buried on site.	TRH, BTEX, PAH, Metals, OCP/OPP, PCB, Asbestos	Anecdotal information from the current site owners indicates that waste material from speedway events were buried on site. DP considers the likelihood for contaminants to be present to be moderate to high. Soil and groundwater media potentially affected.
AEC 7: Potential sand /gravel extraction	Historical aerial photographs indicate the possible extraction of sand and or gravel in the north-east corner of the site. Possible machinery associated with this activity may have been present.	TRH, BTEX, PAH, Metals, PCB	Potential machinery associated with any extraction may have been powered by fuel oils. Storage and use of fuel oils may have resulted in leaks and spills and the accumulation of hydrocarbon contamination. DP considers the likelihood for contaminants to be present to be low. Soil and groundwater media potentially affected.
AEC 8: Potential historical use of pesticides	Prior to development of the speedway, the site was used for grazing. Pesticides may have been applied to livestock.	OCP/OCP, metals	No obvious sheep dip sites were observed during the site inspection, however there is potential for pesticides to have been used at the site. DP considers the likelihood for accumulation of significant quantities of pesticides to be low. Soil media potentially affected.

9. Conceptual Site Model

Based on Section 8, the potential contamination sources are as follows:

- S1 – Fill embankments
- S2 – Use of hydrocarbon fuel in race track area
- S3 – Spills and leaks of hydrocarbon fuels in pit area
- S4 – Hazardous Building Materials
- S5 – Toilet blocks and soakaways

- S6 – Filling in former landfill area
- S7 – Potential sand and/or gravel extraction
- S8 – Potential historical use of pesticides

9.1 Potential Receptors

9.1.1 Human Health Receptors

Potential human health receptors include the following:

- R1 – Current users (general public)
- R2 – Construction and maintenance workers
- R3 – Future users (commercial workers and general public in recreational areas)
- R4 – Land users in adjacent areas

9.1.1 Environmental Receptors

Potential Environmental Receptors include the following:

- R5 – Groundwater
- R6 – Surface water (Jerrabomberra Creek)
- R7 – Ecological receptors

9.2 Potential Pathways

Potential pathways for contamination present include the following:

- P1 – Incidental ingestion and dermal contact of soil and dust particulates
- P2 – Indoor inhalation of vapours
- P3 – Outdoor inhalation of dust particulates
- P4 – Outdoor inhalation of vapours
- P5 – Surface water run-off
- P6 – Leaching of contaminants and vertical migration into groundwater
- P7 – Lateral migration of groundwater providing base-flow to watercourses
- P8 – Direct contact with ecological receptors

9.3 Summary of Potential Complete Pathways

A 'source–pathway–receptor' approach has been used to assess the potential risks of harm being caused to human, water or environmental receptors from contamination sources on or in the vicinity of the site, via transport pathways (potential complete pathways). The possible pathways between the above sources (S1 to S3) and receptors (R1 to R6) are provided below in Table 6.

Table 6: Summary of Potentially Complete Pathways

Source	Receptor	Transport Pathway	Comments
S1 – Fill Embankment	R2	P1, P3 and P4	The unknown origin of the filling within the embankment surrounding the racetrack presents a risk to human health receptors. An intrusive investigation is required to assess possible contamination within the filling. As the site is currently disused, no current users of the site were identified. If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary. Investigation of soils is required to assess the risk to ecological receptors.
	R3	P1, P2, P3 and P4	
	R5	P6 and P7	
	R6	P5 and P7	
	R7	P8	
S2 – Use of hydrocarbon fuel in race track area S3 – Spills and leaks of fuels in pits area	R2	P1, P3 and P4	Leaks and spills of hydrocarbons were possible during the operation of the speedway. Intrusive investigation is required to assess possible site contamination. If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary. Intrusive investigation of soils is required to assess the risk to ecological receptors.
	R3	P1, P2, P3 and P4	
	R5	P6 and P7	
	R6	P5 and P7	
	R7	P8	
S4 – Hazardous building materials	R2	P3	Intrusive investigation is required to establish the extent of hazardous building materials in filling materials present at the site.
	R3	P3	
S5 – Toilet blocks and soakaways	R2	P1	An intrusive investigation is required to assess possible site contamination. If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary. Intrusive investigation of soils is required to assess the risk to ecological receptors.
	R3	P1	
	R5	P6 and P7	
	R7	P8	
S6 – Former landfill area	R2	P1, P3 and P4	The former landfill area was confirmed to contain waste material during the site inspection. An intrusive investigation is required to assess possible site contamination. If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary. Intrusive investigation of soils is required to assess the risk to ecological receptors.
	R3	P1, P2, P3 and P4	
	R5	P6 and P7	
	R6	P5 and P7	
	R7	P8	
S7 – Potential sand and/or gravel extraction	R2	P1, P3 and P4	An intrusive investigation is required to assess possible site contamination. If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary.
	R3	P1, P2, P3 and P4	
	R5	P6 and P7	

Source	Receptor	Transport Pathway	Comments
	R6	P5 and P7	be necessary.
	R7	P8	Intrusive investigation of soils is required to assess the risk to ecological receptors.
S8 – Potential historical use of pesticides	R2	P1, P3	An intrusive investigation is required to assess possible site contamination.
	R3	P1, P3	
	R5	P6 and P7	If soil contamination is identified, assessment of groundwater and identified surface water receptors may be necessary.
	R6	P5 and P7	
	R7	P8	Intrusive investigation of soils is required to assess the risk to ecological receptors.

10. Sampling and Analysis Plan and Methodology

10.1 Data Quality Objectives

Data qualitative objectives (DQOs) are qualitative and quantitative statements that specify of data required for the assessment and have been derived from the CSM. The DQO process is a seven-step iterative planning approach that is used to define the type, quantity and quality of data needed to inform decisions relating to the environmental condition of a site. DQOs for this assessment were developed in accordance with the seven-step DQO process specified in NEPM (Schedule B2, Appendix B) and are summarised in Table 7 below.

Table 7: DQOs for the project

Problem	Uncertainty exists as to whether contamination exists at the site
Identify the Decision/ Goal	Does soil contamination exist from previous site uses? Are there any signs of elevated soil contamination within the site? Does the site, or is the site likely to, present a risk of harm to human health or the environment? Are there any significant contamination issues that could restrict the proposed development? Does the site require further investigation, remediation and/or validation to render the site suitable for the proposed use? Is there any contamination requiring the site to be listed on list of contaminated sites notified to the NSW EPA?
Information Inputs	Historical information regarding past land uses and features Site operations and observation details Soil profile information obtained through the sampling phase Chemical analysis data for soil samples analysed Assessment of analytical data against applicable site assessment criteria

Study Boundaries	The physical site boundary is shown on Drawing 1, Appendix B and forms the boundary of this investigation. The temporal boundary of this assessment is limited to the time at which the assessment was conducted.
Decision Rules	Information obtained in this investigation is to be used to make an assessment of contamination issues likely to impact on the proposed development. In assessing analytical data against screening levels for ecological and/or human health risk, site conditions can be stated to be acceptable if either: • All results are below the relevant screening level; OR • Individual concentrations of analytes (non-volatile) are less than 250% of the relevant screening level; and • The 95% upper confidence limit (UCL) of mean concentrations of a data set for samples of like material is below the relevant screening level; and • The standard deviation of the population is <50% of the relevant screening level. Statistical analysis needs only be conducted where analytical results for a contaminant of concern are recorded above, but less than 250% of the relevant screening level. Laboratory results are accepted and considered suitable for this assessment under the following conditions: • All laboratories are accredited by National Association of Testing Authorities (NATA) for all analyses to be performed; • All practical quantitation limits (PQLs), or laboratory limits of reporting (LORs) set by the laboratories fall below the adopted assessment criteria; • Reported concentrations of analytes in the replicate and/or split sample pairs are within accepted limits; and • Quality assurance/quality control (QA/QC) protocols and results reported by the laboratories comply with the requirements of NEPM (Schedule B3).
Performance Criteria	Analyte selection was based on available site history information, observed site activities, site features, and field observations during sampling. The potential for contaminants to be present other than those analysed is considered to be low. Assessment criteria adopted from the guidelines stated in Section 12 incorporate risk probabilities. Acceptable limits for laboratory QA/QC parameters are based on those stated by the laboratory and those stated in NEPM (Schedule B3).
Optimise design	Locate sampling points to target potential sources of contamination. Procedures for collection of environmental samples were developed prior to fieldwork with reference to NEPM, AS4482.1, AS4482.2, and current good industry practice. Use of NATA accredited analytical laboratories to conduct sample analyses.

10.2 Sampling Rationale

The site area is understood to be approximately 54 hectares. For the purposes of this investigation, the site was split into smaller areas for investigation as recommended by the NSW EPA Sampling Density Guidelines (NSW EPA, 1995).

The site was divided into three zones for more effective sampling of the site. The division of the site was based on the past uses of the site identified during the desktop site history review. The site was divided into the following smaller areas:

- The motor vehicle speedway area in the central south of the site;
- The former landfill in the north of the site;
- Former toilet blocks; and
- Areas of the site used for agricultural purposes.

The following sampling rationales were developed for each of the above areas.

10.2.1 Motor Vehicle Speedway

The motor vehicle racing track is approximately 4 ha in size and comprises the former race track surface, a large fill embankment, a race track pits area and former buildings that are in various states of disrepair, with the majority only retaining the concrete slab. DP excavated 42 test pits across this area to target the following PAEC:

- Nineteen test pits (Pits 1 to 15, Pits 31 to 33 and Pit 50) were excavated within the fill embankment surrounding the main race track (AEC 1). Pits 1 to 10, 31 to 33 and 50 were excavated from the top of the fill embankment. Pits 11 to 15 were excavated into the northern slope of the northern side of the embankment;
- Six test pits (Pits 16 to 21) were excavated within the main race track (AEC 2);
- Nine test pits (Pits 22 to 30) were excavated within the race track pits area to the east of the main race track (AEC 3) and
- Eight test pits (Pits 34 to 40 and Pit 49) were excavated in the vicinity of building footprints (AEC 4)

10.2.2 Former Landfill

The former possible landfill in the north of the site is approximately 3,000 m² in size and is understood to comprise an area where waste from racing events was dumped and then covered with soil. DP excavated 10 test pits (Pits 51 to 60) across this area to target the AEC (AEC 6)

10.2.3 Former Toilet Blocks

Eight test pits (Pits 41 to 48) were excavated to investigate the former toilet blocks and soakaways (AEC5).

10.2.4 Former Agricultural Use

The site is understood to have been used for grazing purposes prior to development of the motor speedway. DP excavated 20 test pits (Pits 61 to 80) across the site to assess for contaminants associated with agricultural use. This also included 3 test pits (Pits 63 to 65) located within the north-east corner of the site to assess potential contamination associated with the possible extraction of sand and/or gravel.

10.3 Methods and Sampling Locations

The fieldwork comprised the excavation of 80 test pits (Pits 1 to 80) to a maximum depth of 3.2 m below ground level (bgl) using a Kobelco mini-excavator fitted with a 450 mm bucket. Samples were collected directly from pit walls or directly from the centre of the excavator bucket at regular intervals during the excavation process. All test locations were selected for the collection of soil samples.

Fieldwork was undertaken between on 18 June and 26 June 2018 by suitably qualified environmental scientists who undertook the following:

- Marking out the test locations;
- Logging of the subsurface profile; and
- Collection of samples to assist in strata identification and for laboratory testing purposes.

A calibrated photo-ionisation detector (PID) was used during the fieldwork to screen the collected soil samples to assess whether volatile organic compounds were present. The approximate test locations are shown on Drawing 1 in Appendix B. Sampling depths are shown on the test pit logs in Appendix F.

10.4 Soil Sampling Procedure

All sample locations were checked for underground services by a review of dial before you dig (DBYD) plans and by a services locator.

All sampling data was recorded on DP test pit logs with essential information included on the chain-of-custody sheets. The general sampling procedure adopted for the collection of environmental samples is summarised below:

- The use of disposable gloves for each sampling event;
- Transfer of samples into laboratory-prepared glass jars, and capping immediately;
- Collection of replicate soil samples in zip-lock plastic bags at each depth for PID screening;
- Collection of replicate samples for QA/QC purposes;
- Labelling of sample containers with individual and unique identification, including project number, sample location and sample depth;
- Placement of the sample jars and replicate sample bags into a cooled, insulated and sealed container for transport to the laboratory;
- Selected soil samples within the filling were subjected to field screening for asbestos following the procedure described within the WA DOH guidelines; and

- Use of chain of custody (COC) documentation so that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

Samples for environmental purposes were generally collected from the near surface, and at regular depth intervals or changes in strata within each test pit.

Soil samples were collected from the centre of the excavator bucket. Care was taken whilst collecting the samples to remove any extraneous material on the outside of the bucket.

EnviroLab Services Pty Ltd (EnviroLab) (NATA accreditation number: 2901) was used for the analysis of soil samples. The laboratory is required to carry out routine in-house QC procedures.

Field replicates were recovered and analysed by intra-laboratory analysis for a limited suite of contaminants with reference to standard industry practice and guidelines. The comparative results are outlined in Appendix G together with other QA/QC evaluations of the assessment, COC documentation (Field and Laboratory) and sample receipt information.

10.5 Analytical Rationale

The analytical scheme was designed to obtain an indication of the presence of a broad range of contaminants of potential concern (COPC) that may be attributable to past and present activities and features that may reasonably be expected to have occurred within the site as identified in the CSM (see Section 9).

Selected primary soil samples were analysed for the various COPC namely metals (As, Cd, Cr, Cu, Pb, Hg, Mn, Ni, Zn), TRH, BTEX, PAH, PCB, OCP, OPP, phenols and asbestos.

Laboratory analytical methods are as stated in the certificate of analysis in Appendix H.

11. Quality Assurance and Quality Control

Quality assurance (QA) and quality control (QC) measures were implemented throughout the investigation. This was achieved by defining the data quality objectives (DQOs, Table 7) for the project based on the CSM prior to the commencement of field investigations. All QA/QC information was then evaluated against the DQOs and is summarised in Appendix G.

12. Site Assessment Criteria

The site is proposed to be subdivided and developed into commercial/industrial land use and recreational use in the form of playing fields. The site has therefore been assessed against criteria for public open space and commercial/industrial land use settings.

The Site Assessment Criteria (SAC) applied in the current investigation are informed by the CSM (refer to Section 9) which identified human and environmental receptors to potential contamination on the site. Analytical results were assessed (as a Tier 1 assessment) against the SAC comprising the

investigation and screening levels of Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC, 2013) (Ref 4). The NEPC guidelines are endorsed by the NSW EPA.

The investigation and screening levels are applicable to generic land use settings and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. Rather, they establish concentrations above which further appropriate investigation (e.g. Tier 2 assessment) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario.

12.1 Health Investigation and Screening Levels

The Health Investigation Levels (HIL) and Health Screening Levels (HSL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants.

HILs are applicable to assessing health risk arising via all relevant pathways of exposure for a range of metals and organic substances. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface for recreational/open space land use. A depth of 1 m below the surface has been adopted for this investigation for a recreational land use.

HSLs are applicable to selected petroleum compounds and fractions to assess the risk to human health via inhalation. HSL have been developed for different land uses, soil types and depths to contamination.

The generic HIL and HSL are considered to be appropriate for the assessment of contamination at the site. Given the proposed land use, the adopted HIL and HSL are:

- HIL-C/HSL-C – Recreational includes public open space such as parks, playgrounds, playing field (e.g. ovals), secondary schools and unpaved footpaths; and
- HIL-D/HSL-D Commercial/Industrial land use.

In addition, the HSL adopted are predicated on the inputs summarised in Table 8.

Table 8: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Soil vapour intrusion (inhalation)	Potential exposure pathways include vapour intrusion through concrete slabs from potentially contaminated filling beneath the slab. There is also the risk of soil vapours during any excavation of potentially contaminated filling.
Soil Type	Silt	A mixture of gravel, sand, silt and clay was encountered during the intrusive investigation (Section 13). Silt has been adopted as an initial conservative screen.
Depth to contamination	0 m to <2 m	A conservative approach has been adopted for this DSI. A depth of 1 m bgl has been adopted in the

Variable	Input	Rationale
		areas where filling was encountered.

The adopted soil HIL and HSL for the potential contaminants of concern are presented in Table 9.

Table 9: Health Investigation and Screening Levels (HIL and HSL) in mg/kg unless otherwise indicated

Contaminants		HIL-C	HSL-C	HIL-D	HSL-D
			0 m to <1m		0 m to <1m
Metals	Arsenic	300	NC	3,000	NC
	Cadmium	90	NC	900	NC
	Chromium (VI)	300	NC	3,600	NC
	Copper	17,000	NC	240,000	NC
	Lead	600	NC	1,500	NC
	Mercury (inorganic)	80	NC	730	NC
	Nickel	1,200	NC	6,000	NC
	Zinc	30,000	NC	400,000	NC
PAH	Benzo(a)pyrene TEQ ¹	3	NC	40	NC
	Naphthalene	NC	NL	NC	NL
	Total PAH	300	NC	4,000	NC
TRH	C6 – C10 (less BTEX) [F1]	NC	NL	NC	260
	>C10-C16 (less Naphthalene) [F2]	NC	NL	NC	NL
	>C16-C34 [F3]	NC	NC	NC	NC
	>C34-C40 [F4]	NC	NC	NC	NC
BTEX	Benzene	NC	NL	NC	3
	Toluene	NC	NL	NC	NL
	Ethylbenzene	NC	NL	NC	NL
	Xylenes	NC	NL	NC	230
Phenol	Phenol	40,000	NC	240,000	NC
OCP	Aldrin + Dieldrin	10	NC	45	NC
	Chlordane	70	NC	530	NC
	DDT+DDE+DDD	400	NC	3,600	NC
	Endosulfan	340	NC	2,000	NC

Contaminants	HIL-C	HSL-C	HIL-D	HSL-D
		0 m to <1m		0 m to <1m
Endrin	20	NC	100	NC
Heptachlor	10	NC	50	NC
HCB	10	NC	80	NC
Methoxychlor	400	NC	2,500	NC
OPP				
Chlorpyrifos	250	NC	2,000	NC
PCB²	1	NC	7	NC

Notes:

- 1 sum of carcinogenic PAH
- 2 non dioxin-like PCBs only
- 3 NC – No Criteria
- 4 NL – Not Limiting

12.2 Ecological Investigation Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

$$\text{EIL} = \text{ABC} + \text{ACL}$$

The ABC is determined through direct measurement at an appropriate reference site or through the use of methods defined by Olszowy et al *Trace element concentrations in soils from rural and urban areas of Australia*, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy, 1995) or Hamon et al, *Geochemical indices allow estimation of heavy metal background concentrations in soils*, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. An *Interactive (Excel) Calculation Spreadsheet* may be used for calculating site-specific EIL for these contaminants, and has been provided in the ASC NEPM Toolbox available on the SCEW (Standing Council on Environment and Water) website (<http://www.scew.gov.au/node/941>).

The adopted EIL, derived from the *Interactive (Excel) Calculation Spreadsheet* are shown in the following Table 10. The following site specific data and assumptions have been used to determine the EILs:

- A protection level of 80% for urban residential and public open space land uses has been adopted;
- The EILs will apply to the top 2 m of the soil profile;
- Given the likely source of soil contaminants (i.e. historical filling, golf course maintenance) the contamination is considered as "aged" (>2 years);
- ABCs have been derived using the *Interactive (Excel) Calculation Spreadsheet* using input parameters of NSW for the State in which the site is closest to, and high for traffic volumes. No background concentration is assumed for lead (conservative);
- Based on average pH, CEC and clay content values for soils collected across the site, the following values have been used for the soil profile: pH = 8.7, CEC = 21.4 cmol_c/kg and clay content = 19%. The Calculation Spreadsheets are included in Appendix I.

Table 10: Ecological Investigation Levels (EIL) in mg/kg

Analyte		EIL	Comments
Metals	Arsenic	100	Adopted pH of 8.7, CEC of 21.4 cmol _c /kg and clay content 19%
	Copper	230	
	Nickel	280	
	Chromium III	410	
	Lead	1100	
	Zinc	810	
PAH	Naphthalene	170	
OCP	DDT	180	

12.3 Ecological Screening Levels – Petroleum Hydrocarbons

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL.

ESL have been derived in NEPC (2013) for petroleum fractions F1 to F4 as well as BTEX and Benzo(a)pyrene. Site specific data and assumptions as summarised in Table 11 have been used to determine the ESL. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 12.

Table 11: Inputs to the derivation of ESL

Variable	Input	Rationale
Depth of ESL application	Top 2 m of the soil profile	The top 2 m depth below ground level corresponds to the root zone and habitation zone of many species.

Land use	Public open space	It has been assumed for this site contamination assessment that the activities on site will be public open space land uses.
Soil Texture	Fine	The approach adopted for this investigation is based on the sand, silt and clay soils encountered during the investigation

Table 12: Ecological Screening Levels (ESL) in mg/kg

Analyte		ESL	Comments
TRH	C6 – C10 (less BTEX) [F1]	180*	*All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16 (less Naphthalene) [F2]	120*	
	>C16-C34 [F3]	1,300	
	>C34-C40 [F4]	5,600	
BTEX	Benzene	65	
	Toluene	105	
	Ethylbenzene	125	
	Xylenes	45	
PAH	Benzo(a)pyrene	0.7	

12.4 Management Limits – Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. Management Limits have been derived in NEPC (2013) for the same four petroleum fractions as the HSL (F1 to F4). The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown in the following Table 13. The following site specific data and assumptions have been used to determine the Management Limits:

- The Management Limits will apply to any depth within the soil profile;
- The Management Limits for residential, parkland and public open space apply;
- A mixture of sand, silt and clay was encountered during the DSI (Section 13). Silt (fine) has been adopted as an initial conservative screen.

Table 13: Management Limits in mg/kg

Analyte		Management Limit
TRH	C ₆ – C ₁₀ (F1) #	800
	>C ₁₀ -C ₁₆ (F2) #	1,000

Analyte		Management Limit
	>C ₁₆ -C ₃₄ (F3)	3,500
	>C ₃₄ -C ₄₀ (F4)	10,000

Separate management limits for BTEX and naphthalene are not available hence these have not been subtracted from the relevant fractions to obtain F1 and F2

12.5 Asbestos in Soil

Bonded asbestos-containing material (ACM) is the most common form of asbestos contamination across Australia, generally arising from:

- Inadequate removal and disposal practices during demolition of buildings containing asbestos products;
- Widespread dumping of asbestos products and asbestos containing filling on vacant land and development sites; and
- Commonly occurring in historical filling containing unsorted demolition materials.

Mining, manufacturing or distribution of asbestos products may result in sites being contaminated by friable asbestos including free fibres. Severe weathering or damage to bonded ACM may also result in the formation of friable asbestos comprising fibrous asbestos (FA) and/or asbestos fines (AF).

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

On the basis that several land uses will be present within the final development, and in accordance with Table 1, Schedule B1, NEPC (Ref 4), asbestos HSL for applicable land use settings have been included to assess the contamination risk posed by asbestos.

Table 14: Health Screening Levels for Asbestos Contamination in Soil (% w/w)

Form of Asbestos	HSL-C	HSL-D
	Public Open Space	Commercial / industrial
Bonded ACM	0.02 %	0.05 %
FA and AF	0.001 %	0.001 %
All Forms of Asbestos	No visible asbestos for surface soil	

13. Results of the Investigation

13.1 Subsurface Conditions

Details of the subsurface conditions encountered during the field work are included on the logs, refer Appendix F, which must be read in conjunction with the included explanatory notes that define classification methods and terms used to describe the soils and rocks. In summary, the pits encountered variable subsurface conditions underlying the site with the succession of strata broadly summarised as follows for each of the main site areas:

13.1.1 Race Track Embankment

- **FILLING:** generally moist to dry silty sand, clayey sand and silty clay encountered in all pits within the race track embankment to a maximum depth of 3.2 m. It should be noted, pits situated on top of the embankment were not able to fully penetrate the depth of the embankment due to height of the embankment and restrictions on the reach of the excavator. Minor anthropogenic material including metal and plastic was encountered in Pits 2, 6, 31 and 32; and
- **SANDY CLAY/SANDY SILT:** moist to dry, orange brown to brown sandy clay and sandy silt in pits 11 to 15, 31 to 33 to depths of 1.6 m to 3.2 m bgl which were terminated in this strata.

13.1.2 Former Race Track Area

- **FILLING:** generally moist to dry, brown to orange brown gravelly sand, sandy silt, silty clay or sand clay, cemented in places, with well graded gravel, encountered in Pits 16 to 21 to depth of between 0.4 m to 1.3 m bgl; and
- **SANDY CLAY/SILTY CLAY:** moist to dry, brown to orange brown and mottle grey with varying sand and silt content with trace gravel, encountered in Pits 16 to 21 to depths of 1.6 m to 2.7 m bgl.

13.1.3 Former Race Track Pits Area

- **ASPHALT:** black asphalt cement with a maximum thickness of 0.01 m encountered in Pits 25 and 28;
- **TOPSOIL FILLING:** moist to dry brown, sandy silt and silty sand encountered in Pits 21, 23, 24, 26, 27 to depths of between 0.02 m and 0.15 m bgl;
- **FILLING:** generally moist to dry, brown to orange brown sandy clay, silty sand or gravelly sand, , encountered in Pits 22 to 30 to depths of between 0.2 m to 1.6 m bgl. Minor anthropogenic content including bitumen, metal, concrete and plastic were observed; and
- **SILTY CLAY/SANDY CLAY:** moist to dry, brown to orange brown and mottled grey with varying sand and silt content with trace gravel, encountered in Pits 22 to 30 to depths of between 1.2 m and 2.5 m bgl.

13.1.4 Former Landfill Area

- **FILLING:** generally moist to dry, brown to dark brown silty sand or sandy silts, encountered in Pits 50 to 53, 56 and 56 to depths of between 0.9 m to 2.1 m bgl. Waste material content including

food packaging, glass, metal, cloth, drink cans, bitumen, metal, concrete, tyres, car parts, oil barrel and plastic were observed. Corrugated compressed cement sheet fragments were observed in Pit 57; and

- **SILTY CLAY/SANDY CLAY:** moist to dry, brown to orange brown and mottle grey with varying sand and silt content with trace gravel, encountered in Pits 51 to 60 to depths of between 1.0 m and 2.3 m bgl.

13.1.5 General Areas of the Site

- **FILLING:** generally moist to brown to orange brown silty and sandy clay, silty sand or sandy silt, encountered in Pits 41 to 48, 63, 65, 70 and 76 to 80 to depths of between 0.1 m to 2.1 m bgl. Minor anthropogenic content including bitumen, metal, concrete and brick was observed in Pits 44, 46, 47 and 80;
- **TOPSOIL:** moist brown silty clay with some rootlets encountered in Pits 34 to 40, 60 to 62, 64, 66 to 69 and 71 to 73 to depths of between 0.02 m to 0.2 m bgl;
- **SILTY SAND/CLAYEY SAND:** light brown/grey to orange brown silty clay or sandy clay encountered in Pits 34 to 40, 61, 70 and 71 to depths of between 1.5 m and 2.5 m bgl; and
- **SILTY CLAY/SANDY CLAY:** light brown/grey to orange brown silty clay or sandy clay encountered in Pits 41 to 49, 62 to 69 and 72 to 80.

13.2 Field Screening Observations

The results of the PID screening are included on the test pit logs (Appendix F). The screening tests indicated that the subsurface conditions were generally absent of volatile organic compounds with recorded values generally less than 5 ppmV.

13.3 Contamination Observations

13.3.1 Field Sieve Screening for Asbestos

Samples (10 L) for on-site sieving for the assessment of asbestos were collected from pits where filling was present. The results of the on-site sieving analysis reported fragments of potential ACM in good condition were identified the following pits:

- Pit 57 1.0 m to 1.1 m bgl – two fragments of ACM in good condition were identified. The fragments were approximately 70 mm to 80 mm in length and weighed 42.3 g; and
- Pit 57 2.0 m to 2.1 m bgl – three fragments of ACM were identified. The fragments were in good condition and ranged in size from approximately 40 mm to 200 mm in length and weighed 223.50 g.

The fragments were collected and submitted for laboratory analysis for asbestos.

The results of the field sieve screening are presented in Table J1 in Appendix J.

13.4 Analytical Results

A summary of the results of the laboratory analysis undertaken on the soil and surface water samples are presented in Tables J2 to J5 in Appendix J along with the laboratory certificates.

13.5 Assessment of Laboratory Results

13.5.1 Motor Vehicle Speedway Area

All soil results for TRH, BTEX, PAH, OPP, OPP and PCB were below the laboratory's practical quantitation limit (PQL) and therefore below the site assessment criteria (SAC).

Soil results for metals were generally above the laboratory PQL with the exception of arsenic, cadmium and mercury which were below the laboratory PQL. All soil results for metals were below the SAC.

Soil results for asbestos reported that the laboratory analysis did not record the present of asbestos, including FA/AF.

13.5.2 Former Landfill Area

All soil results for TRH, BTEX, PAH, OPP, OPP and PCB were below the laboratory's practical quantitation limit (PQL) and therefore below the site assessment criteria (SAC).

Soil results for metals were generally above the laboratory PQL with the exception of arsenic, cadmium and mercury which were below the laboratory PQL. All soil results for metals were below the SAC.

Soil results for asbestos reported that the laboratory analysis of the fragments of potential ACM collected from Pit 57 at 1.0 m to 1.1 m and 2.0 m to 2.1 m bgl contained amosite, chrysotile and crocidolite asbestos fibres. The concentration of asbestos in soil for these two samples was 0.046 % and 0.224 %, respectively. The concentration of asbestos in the sample from Pit 57 2.0 m to 2.1 m bgl was above the investigation level for commercial/industrial land use and the concentration of asbestos in both samples was above the investigation level for parks and public open spaces.

13.5.3 Former Toilet Block Areas

All soil results for E. Coli, Salmonella and faecal coliforms were below the laboratory PQL.

13.5.4 Agricultural Areas

All soil results for TRH, BTEX, PAH, OPP, OPP and PCB were below the laboratory's PQL and therefore below the site assessment criteria (SAC).

Soil results for metals were generally above the laboratory PQL with the exception of arsenic, cadmium and mercury which were below the laboratory PQL. All soil results for metals were below the SAC.

Soil results for asbestos reported that the laboratory analysis did not record the present of asbestos, including FA/AF.

14. Revised Conceptual Site Model

The preliminary CSM in Section 9 has been updated to incorporate the findings of this PSI. The updated CSM is presented in Table 15 below

Table 15: Revised Summary of Potentially Complete Pathways

Source	Receptor	Transport Pathway	Comments
S1 – Fill Embankment	R2	P1, P3 and P4	The results of the sampling of the fill embankment encountered filling comprising silty sand, clayey sand and silty clay with only trace inert anthropogenic inclusions noted.
	R3	P1, P2, P3 and P3	
	R5	P6 and P7	
	R6	P5 and P7	The laboratory analytical results indicate that gross contamination of the filling was not present within the areas of the site where samples were obtained. However, it should be noted that there is the potential for anthropogenic material to be present in areas of the embankment that were not sampled. Therefore it is considered that this pathway remains potentially complete.
	R7	P8	
S2 – Use of hydrocarbon fuel in race track area S3 – Spills and leaks of fuels in pits area	R2	P1, P3 and P4	The results of the limited sampling did not identify the presence of gross hydrocarbon contamination associated with the use of hydrocarbon fuels in the race track and pits areas.
	R3	P1, P2, P3 and P3	
	R5	P6 and P7	
	R6	P5 and P7	Therefore it is considered that this pathway is not complete.
	R7	P8	
S4 – Hazardous building materials	R2	P3	Hazardous building materials (ACM) were identified in buildings associated with the Speedway race track and it is considered that the pathway remains potentially complete. DP recommends that a hazardous materials survey be undertaken prior to demolition of the buildings. Results of the intrusive sampling in the vicinity of the buildings did not identify hazardous building materials present in the filling. However, it was not possible to obtain samples directly beneath the building slab footprint.
	R3	P3	
S5 – Toilet blocks and	R2	P1	The results of the limited sampling did not identify the presence of gross biological contamination associated
	R3	P1	

Source	Receptor	Transport Pathway	Comments
soakaways	R5	P6 and P7	with the former toilet blocks and soakaway areas.
	R7	P8	Therefore it is considered that this pathway is incomplete.
S6 – Former landfill area	R2	P1, P3 and P4	The former landfill area was confirmed to contain waste material during the intrusive investigation. Furthermore, ACM was confirmed to be present in Pit 57 at a concentration above the adopted investigation levels.
	R3	P1, P2, P3 and P3	
	R5	P6 and P7	
	R6	P5 and P7	Results of laboratory analysis of soil samples did not indicate chemical contaminants of concern above the adopted investigation levels.
	R7	P8	Due to the presence of asbestos and other waste materials, it is considered that this pathway remains potentially complete.
S7 – Potential sand and /or gravel extraction	R2	P1, P3 and P4	The results of the sampling did not identify the presence of gross contamination associated with the potential sand and/or gravel extraction that may have occurred in the north-east corner of the site. It is considered that this pollutant pathway is not complete.
	R3	P1, P2, P3 and P3	
	R5	P6 and P7	
	R6	P5 and P7	
	R7	P8	
S8 – Potential historical use of pesticides	R2	P1, P3	The results of the sampling did not identify the presence of gross contamination associated with the potential historical application pesticides that may have occurred at the site. It is considered that this pollutant pathway is not complete.
	R3	P1, P3	
	R5	P6 and P7	
	R6	P5 and P7	
	R7	P8	

15. Conclusions and Recommendations

The AECs were identified on the basis of the available site information, site inspection and limited subsurface investigation. Based on the findings of the assessment, including limited sampling and testing to date, the potential for gross contamination to be present within the site is considered to be low, with localised areas of more elevated contamination potential.

It is recommended that prior to the commencement of construction activities, further intrusive-based investigation be carried out to further characterise each of the identified AECs. The recommendations for further works are summarised in Table 16 below. The further works aim to confirm the suitability of the site for the proposed end-uses (commercial/industrial and recreational).

Table 16: Recommendations for Further Works

AEC	Description	Recommendations for further work
AEC 1	Fill Embankment	The results of the sampling of the fill embankment indicate that gross contamination was not present within the filling. DP understands the filling may be re-used on site. DP considers the filling may be suitable for on-site reuse subject to further investigation and the implementation of an unexpected finds protocol.
AEC 2	Use of hydrocarbon fuel in race track area	No further investigation required but it would be prudent to include this area in the unexpected finds protocol.
AEC 3	Spills and leaks of fuels in pits area	
AEC 4	Hazardous building materials	A pre-demolition hazardous materials survey is recommended for buildings and former buildings in the race track area and should be undertaken by a licensed asbestos assessor. Identified hazardous building materials should be removed by a licensed asbestos removalist and validation of the removal should be completed by a licensed asbestos assessor.
AEC 5	Toilet blocks and soakaways	No further investigation required except for a hazardous building materials survey
AEC 6	Former landfill area	The results of the sampling of the former landfill identified the presence of anthropogenic waste, including asbestos containing material. DP recommends the area is excavated and stockpiled on site prior to undertaking a waste classification assessment in order to dispose the material off-site to a suitably licensed waste disposal facility.
AEC 7	Potential sand and /or gravel extraction	No further investigation required
AEC 8	Potential former Pesticide use	No further investigation required

Based on the assessment undertaken to date, it is considered that the site is likely to be suitable for the proposed development, following further investigation and remediation detailed in Table 16 above.

In addition, DP recommends that a construction environmental management plan (CEMP), incorporating an unexpected finds protocol be implement during the development works at the site.

16. References

1. National Environment Protection Council (NEPC) (1999), National Environment Protection (Assessment of Site Contamination) Measure, Schedule A and Schedule B1 to B9, (1999 – amended 2013).

2. NSW Office of Environment and Heritage (OEH) (2011) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.
3. NSW Department of Land and Water Conservation (2000): *Canberra Soil Landscape Series Sheet 8727* 1:100 000 scale map.
4. Bureau of Mineral Resources (1992): *Geology of Canberra Geological Series Sheet 8727*, 1:100 000 scale map.
5. Bureau of Mineral Resources, Geology and Geophysics (1984): *Hydrogeology of the Australian Capital Territory and Environs* 1:100,000 scale map.

17. Limitations

Douglas Partners (DP) has prepared this report for this project at 360A Alderson Place, North Tralee in accordance with DP's proposal CAN180102 dated 7 May 2018 and acceptance received from Jason Burgess of Canberra Estates Consortium No 4 Pty Ltd dated 6 June 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Canberra Estates Consortium No 4 Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

Asbestos has been detected by observation and laboratory analysis in filling materials within the investigation area (Former landfill area). Building demolition materials, such as concrete, brick, tile, also observed which are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos. Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to vegetation preventing visual inspection and reasonable access. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations

or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report