



Douglas Partners
Geotechnics | Environment | Groundwater

Remediation Action Plan

Proposed Residential Subdivision
Stages 1 and 2, South East Wilton Junction, NSW

Prepared for
Walker Corporation Pty Ltd

Project 92269.02
May 2019

Integrated Practical Solutions



Document History

Document details

Project No.	92269.02	Document No.	R.001.Rev4
Document title	Remediation Action Plan Proposed Residential Subdivision		
Site address	Stages 1 and 2, South East Wilton Junction, NSW		
Report prepared for	Walker Corporation Pty Ltd		
File name	92269.02.R.001.Rev4		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Emily McGinty	J M Nash	19 October 2018
Revision 1	Emily McGinty	Christopher C Kline	4 December 2018
Revision 2	Emily McGinty	Christopher C Kline	10 April 2019
Revision 3	Emily McGinty	Christopher C Kline	30 April 2019
Revision 4	Emily McGinty	Christopher C Kline	7 May 2019

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Walker Corporation Pty Ltd – Mr Oliver Roborgh
Revision 1	1	0	Walker Corporation Pty Ltd – Mr Oliver Roborgh
Revision 2	1	0	Walker Corporation Pty Ltd – Mr Gerry Beasley
Revision 3	1	0	Walker Corporation Pty Ltd – Mr Gerry Beasley
Revision 4	1	0	Walker Corporation Pty Ltd – Mr Gerry Beasley

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		7 May 2019
Reviewer	 p.p. CCK	7 May 2019

Table of Contents

	Page
1. Introduction.....	1
2. Site Background.....	1
2.1 Site Identification and Description	1
2.2 Proposed Development	2
2.3 Regional Geology, Soil Landscapes and Hydrogeology	3
3. Previous Investigations	4
3.1 Interim Audit Report – Melissa Porter.....	5
4. Conceptual Site Model	6
5. Summary of Pre-Earthworks Management Required	6
5.1 Sampling of Dams and Creeks	6
5.2 Summary of Remediation Required.....	7
6. Remediation Acceptance Criteria	7
6.1 Soil	8
6.1.1 Health Investigation and Screening Levels.....	8
6.1.2 Ecological Investigation and Screening Levels.....	9
6.1.3 Management Limits.....	10
6.1.4 Asbestos in Soil.....	10
6.1.5 Waste Classification.....	11
6.2 Surface Water	12
6.3 Sediment.....	13
6.4 Assessment of VENM	13
7. Assessment of Remediation Options	14
7.1 Remediation Goal	14
7.2 Extent of Remediation.....	14
7.3 Remediation Options Assessment.....	14
7.4 Selected Remediation Option	15
8. Remediation Methodology	15
8.1 Overview	15
8.2 Excavate and Dispose of Hydrocarbon Impacted Soil	16
8.3 Delineate and Validate the Excavation//Stockpile Footprints	16
9. Remediation Strategy.....	16
9.1 Site Establishment	16
9.2 Contingency for Unexpected Finds.....	17
9.2.1 Unexpected Finds Containing Asbestos – Additional Requirements	17
9.3 Loading and Transporting of Spoil.....	18
9.4 Waste Management.....	18
9.4.1 Special Area – Management Requirements	18
9.5 Materials for Use in Backfilling and Imported Fill.....	19
9.5.1 Assessment of VENM	19
9.6 Material Tracking Requirements (in/out of site).....	19
9.6.1 Import of VENM.....	19
9.6.2 Offsite Disposal.....	20

10.	Validation Plan	20
10.1	Validation Scope	20
10.1.1	Validation Data Quality Objectives (DQO)	20
10.1.2	Validation of Excavations	22
10.1.3	Validation of Stockpile Footprints	23
10.2	Quality Assurance Plan	23
10.2.1	Sample Collection and Handling	23
10.2.2	Field QA/QC	23
10.2.3	Laboratory QA/QC	23
10.2.4	Achievement of DQO	23
10.3	Validation Reporting	24
11.	Site Management Plan	24
11.1	Site Operations	25
11.2	Environmental Management	25
11.3	Occupational Health and Safety	26
12.	Conclusions	26
13.	Limitations	27

Appendix A: About This Report
 Drawing 1

Remediation Action Plan

Proposed Residential Subdivision

Stages 1 and 2, South East Wilton Junction, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) was engaged by Walker Corporation Pty Ltd ('Walker') to prepare a Remediation Action Plan (RAP) for the proposed residential development of approximately 105 hectares (ha) of land located on Picton Road, Wilton, NSW ('the site')¹. The location of the site is presented on Drawing 1, Appendix A. The site comprises Stages 1 and 2 of the wider South East Wilton Precinct residential subdivision proposed to be developed by Walker.

The RAP has been prepared with reference to NSW Environment Protection Authority (EPA) guidelines under the Contaminated Land Management (CLM) Act 1997, State Environmental Planning Policy *Remediation of Land* 1998 (SEPP 55) and the findings of DP report titled *Report on Detailed Site Investigation, Proposed Residential Subdivision, Stages 1 and 2, Wilton Junction*, reference 92269.00.R.001 Rev. 1, dated 19 April 2018 (DP, 2018 – 'the DSI') and *Detailed Site Investigation Addendum Proposed Drainage Basin, Janderra Lane, Wilton, NSW*, reference 92269.03.R.001.Rev1, dated April 2019 (DP, 2019 – 'the DSI Addendum'). The DSI and DSI Addendum were subject to an interim audit by EPA Accredited² Auditor Melissa Porter of Senversa who subsequently endorsed the DSI and DSI Addendum subject to considerations requiring incorporation within the RAP; these considerations are detailed in Section 3.1 of this report.

Impacted soils associated with fuel/oil storage and timber power poles were identified during the DSI as requiring remediation to render the site suitable for the proposed development, from a contamination perspective. This RAP documents the remediation and validation procedures required to resolve the identified remediation works; it is noted that this document is not intended to be used as a specification or as a basis for calculating costs for remediation volumes.

2. Site Background

2.1 Site Identification and Description

The site is roughly rectangular in shape with an approximate area of 101 hectares (ha) and lies within the Local Government Area (LGA) of Wollondilly Shire. At the time of preparation of Rev 0 and Rev 1 versions of this report, the site was registered as eight separate lots, listed below:

- Lot 75 on Deposited Plan (D.P.) 837310;
- Lot 3 on D.P. 702025;
- Lot 51 on D.P. 626650;

¹ Since previous revision of this report, a minor correction to the site boundary has occurred to reflect the inclusion of a temporary basin at the north east portion of the site. The site detailed in this RAP revision includes the original site and additional area for the basin.

² Under the Contaminated Land Management Act, 1997.

- Lot 2 on D.P. 88145;
- Lot 1 on D.P. 445344;
- Lot 51 on D.P. 626650;
- Lot 16 on D.P. 253158; and
- Part Lot 1 on D.P. 744927.

Since the previous revisions of this report was issued the site has been (and is currently) registered as lots 101, 102, part lot 103 in D.P. 1232553 and lot 2 in D.P. 88145 (the latter remains unchanged).

The site layout is presented in Drawing 1 (Appendix A).

The site is bounded to the north by Picton Road, to the north west by Janderra Road, to the west by Emma Lane, to the south by a bushland associated with the designated 'Special Area'³ surrounding the Nepean River.

At the time of the investigation, the site consisted of primarily grass covered pasture fields separated by trees and mixed timber and wire fencing. A total of 13 farm dams were located throughout the site, particularly along drainage lines running along creeks/surface drainage lines running towards the north/north east (in the northern portion of the site), towards the north-west (in the north west portion of the site) and towards the south (in the southern portion of the site). A total of five creeks were noted at the site at the time of the current investigation.

A rural residential property and sheds located in the north eastern corner of the site is understood by DP to be tenanted at the time of reporting and will be subject to a separate contamination investigation once the property is vacated at a later (currently unknown) date. With the exception of a substation located at the site and the tenanted residence, no other structures currently remain at the site.

The site traverses undulating terrain with an overall relief variation of approximately 70 m from the highest part (260 m AHD⁴ in the east) of the site to the lowest (190 m AHD in the west). The site currently appears to be used for a mixture of rural residential and agricultural (pastoral) purposes.

2.2 Proposed Development

Walker proposes to redevelop the site for primarily residential purposes with some open space areas and employment in the north-west corner of the site. A copy of the masterplan is provided in the DSI (DP, 2018).

³ Declared under the WaterNSW Act 2014 and regulated by WaterNSW.

⁴ Australian Height Datum

2.3 Regional Geology, Soil Landscapes and Hydrogeology

Reference to the Geological Survey of New South Wales (1985) map entitled *Wollongong to Port Hacking 1:100,000 Geological Sheet 9029 - 9129* indicates that the site is located on the southernmost extent of the Permo-Triassic Sydney Basin and key shallow lithologies below the site include laminite and dark-grey siltstone of the Wianamatta group (Ashfield Shale) in the northern portion and older coarse-grained quartz sandstone, very minor shale and laminite lenses (Hawkesbury sandstone) in the southern portion.

Reference to the Soil Conservation Service of NSW (1990) map entitled *Soil Landscapes of the Wollongong-Port Hacking 1:100,000* indicates that the site is predominantly underlain by the Blacktown soil landscape (mapping unit bt), characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale, with local relief to 30 m and slopes usually less than 5%. The landscape is generally represented by broad rounded crests and ridges with gently inclined slopes. Yellow, red and brown podzolic soils are characteristic of the area. Characteristics of this soil include moderately reactive, highly plastic subsoil, low fertility and poor drainage soil. Localised deposits of Luddenham soils may occur in the eastern portion of the site which commonly have a high soil erosion hazard, localised impermeability, high plasticity and moderately reactive soils. The site is underlain by the South Creek soil landscape in the south-east portion of the site, characterised by alluvial soils located in floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain. The landscape is generally represented by flat land with incised channels, mainly cleared. Red and yellow podzolic soils are most common on terraces with small areas of structured grey clays.

The site is located at the geological boundary of the Wianamatta shales and the Hawkesbury sandstone. As such the hydrogeology will vary depending on the location within the site. McNally, G. 2005, *Investigation of Urban Salinity – Case Studies from Western Sydney*, 2005 describes some general features of the hydrogeology of Western Sydney which are relevant to the Walker site. The shale terrain of much of Western Sydney is known for saline groundwater, resulting either from the release of connate salt in shales of marine origin or from the accumulation of windblown sea salt. Seasonal groundwater level changes of 1 m to 2 m can occur in a shallow regolith aquifer or a deeper shale aquifer due to natural influences.

Groundwater investigations undertaken by DP in the South West of Sydney and previous studies of areas underlain by the Wianamatta Group indicate that:

- The shales have a very low intrinsic permeability, hence groundwater flow is likely to be dominated by fracture flow with resultant low yields (typically < 1 L/s) in bores; and
- The groundwater in the Wianamatta Group is typically brackish to saline with total dissolved solids (TDS) in the range 4000 mg/L to 5000 mg/L (but with cases of TDS up to 31,750 mg/L being reported). The dominant ions are typically sodium and chloride and the water is generally unsuitable for livestock or irrigation.

The areas underlain by Wianamatta shales are typically associated with low groundwater yields, often representing discontinuous lenses of perched water within the shale. The areas underlain by Hawkesbury sandstone are typically associated with higher groundwater quality (i.e. low salinities) and higher yields. Based on available groundwater bore logs and available information on regional geology (refer to Section 4.1), shale and sandstone is present at shallow depths (< 10 m) below the Wilton area; the older Hawkesbury sandstone is typically exposed in low lying areas, e.g. built up areas and watercourses. Owing to the higher yield potential and general low salinities associated with the Hawkesbury sandstone, groundwater from the Hawkesbury sandstone can be considered generally suitable for irrigation purposes.

Based on site topography and the locality of on and off-site surface water courses, groundwater across much of the site is expected to flow towards the north and north-west. Groundwater in the south western portion of the site is expected to flow towards the south west. No registered groundwater bores were identified within the site or to the south of the site, surrounding the Nepean River.

The following surface water bodies are located at the site:

- Unnamed creek and farm dams in the north west portion of the site draining into the Nepean River 1.2 km west of the site;
- Unnamed creek and two farm dams in the south west portion of the site draining into the Nepean River 380 m south west of the site; and
- Two small unnamed creeks in the northern site draining towards the north into Stringybark Creek, a tributary of Allens Creek and ultimately into the Nepean River (located 5 km north of the site).

Surface water runoff is anticipated to flow towards the west and to a lesser extent towards the north, i.e. following the topography of the site.

3. Previous Investigations

Prior to carrying out the DSI (refer to Section 1), DP prepared report titled *Report on Phase 1 Contamination Assessment, Land Capability Assessment, Wilton Junction, Hume Highway and Picton Road, Wilton*, report reference 73467.00 Rev. 6, dated 18 June 2014 (DP, 2014 – ‘the PCA’). The PCA identified a number of Areas of Environmental Concern (AEC) which were investigated as part of the DSI and subsequently eliminated as an AEC based on the findings of the DSI. The DSI did however identify two areas of the site as requiring remediation, as summarised in Table 1 below.

Table 1: Summary of Remediation Required

Location of Impact	Description	Recommendations (from the DSI)
SS1	Nickel and total recoverable hydrocarbon (TRH) impact likely associated with historical spillage of fuels and oils from drums	Requires remediation and validation. A RAP is to be prepared to document how the remediation works will be carried out.
Timber power poles	TRH impact from historical timber treatment	

3.1 Interim Audit Report – Melissa Porter

The findings of the DSI were subject to an interim audit by NSW EPA accredited auditor Melissa Porter of Senversa Pty Ltd who generally concurred with the findings of the DSI subject to a RAP being prepared for the site which includes the following (see Table 2).

Table 2: Summary of Auditor Comments and Inclusion in this RAP (or otherwise)

Auditor Comment	DP Response (inclusion with this proposal or otherwise)
Inclusion of an Unexpected Finds Protocol (UFP)	A UFP is included with this RAP (refer to Section 9.2).
Provision of a hazardous materials building survey and sampling below the footprints of any buildings demolished or below the footprints of stockpiles of potentially contaminated material not previously sampled	A number of structures at the site were demolished prior to the DSI and the investigation of the footprints included in the scope of the DSI. DP understands the only portion of the site remaining to be demolished is the residence located in the north east portion of the site (Lot 16) which is currently occupied and will be vacated in the next approximately 2 – 3 years. As such, investigation of the associated building footprints of the currently occupied residency should be undertaken as a separate exercise once the residence is vacated.
A detailed waste management strategy to track waste movements around the site and any off-site disposal. The waste management process should be documented in a manner which can be audited in accordance with Section 4.3.7 of the Guidelines for the NSW Site Auditor Scheme (3rd edition)	A waste management strategy is included with the RAP (see Section 9.4).
Provision for sample collection around the on-site dams (of surface water and sediment) and potentially the creeks	A scope and methodology for sampling, analysis and assessment of surface water and sediments for on-site dams and creeks are provided in this RAP (refer to Section 5.1).
Provision for the mitigation of potential impacts on the 'Special Area' to the south of the site, which is currently being regulated by WaterNSW	Preliminary general advice is provided in this RAP (refer to Section 9.4.1).
Consideration of groundwater results in reference to the criteria for irrigation and domestic stock (if groundwater sampling is undertaken)	The RAP includes remediation criteria for groundwater for irrigation and domestic stock for reference (see Section 6), however as agreed with the auditor no groundwater sampling is considered to be warranted at this time.
Completing any additional asbestos analysis using gravimetric analysis	With the exception of the sampling of dams and creeks, no additional asbestos analysis is considered to be warranted at this time. This RAP includes gravimetric analysis for asbestos if any UXF including asbestos are observed during earthworks at the site.
Employing appropriate quality assurance and quality control (QAQC) procedures	The RAP includes a methodology for QAQC procedures (refer to Section 0).

4. Conceptual Site Model

The findings of the DSI have been used to refine the CSM for the proposed development and establish where further investigation or remediation is required. The updated CSM is presented in Table 3 below.

Table 3: Updated Conceptual Site Model

Source	Exposure Pathway	Receptor	Requirement for Additional Data and/or Management
S2: Storage of fuels and oils (SS1) S4: Timber power poles	P1 – Ingestion and dermal contact; P2 – Inhalation of fibres and/or dust and/or vapours	R1 – Construction and maintenance workers. R2 – Future site users following development of the site R3 – Rural residential receptors in surrounding area	A RAP is required to establish how identified contamination sources will be delineated and subsequently remediated and validated
	P3 – Leaching of contaminants and vertical migration into shallow (perched) groundwater P4 – Surface water run-off P5 – Lateral migration of groundwater providing base flow to watercourses	R4 – Surface water bodies	
	P6 – Plant uptake	R6 – Local ecology	

It is noted that the currently occupied rural residential property in the north eastern corner of the site (refer to Section 2.1) will be subject to a contamination investigation at a later (currently unknown) date, once the property is vacated.

5. Summary of Pre-Earthworks Management Required

5.1 Sampling of Dams and Creeks

As detailed in Section 2.1 there are a total of 13 farm dams and five creeks at the site. As requested by the auditor (refer to Section 3.1) surface water and sediment (where present) requires sampling, analysis and assessment using the following methodology:

- One sample of sediment and one sample of surface water shall be collected from each dam and creek. The sediment sample shall be collected using a trowel or hand auger (rinsed with deionized water between sample locations) representative of the top 0.1 - 0.2 m of the sediment profile and the surface water sample shall be collected (by hand) from the top 0.2 m of the water column by hand. Sediment and surface water samples shall be placed into laboratory supplied bottles and jars;

- Taking into consideration access restrictions, safety factors and the relative level of compaction of the material, the sediment shall be sampled by hand, with a backhoe or using a hand auger. Sufficient sediment shall be collected to fill laboratory supplied acid washed jar(s) leaving minimal headspace. A soil log shall be prepared documenting the sediment matrix and any other observations such organic content and any visual/olfactory indicators of contamination (if any);
- Each sample shall be scheduled with a NATA accredited laboratory for the following common contaminants of potential concern (COPC):
 - o Metals;
 - o Total recoverable hydrocarbons (TRH);
 - o Benzene, toluene, ethylbenzene and total xylenes (BTEX);
 - o Polycyclic aromatic hydrocarbons (PAH);
 - o Total phenols;
 - o Organochlorine and organophosphorus pesticides (OC/OP); and
 - o Asbestos (gravimetric analysis).
- Field QA/QC sampling shall be carried out with reference to Section 10.2.2. of this report;
- Review analytical results against criteria presented in Section 6 of this RAP; and
- A RAP addendum may be required for any dam or creek sediments/surface water that exceed the criteria defined in this report.

5.2 Summary of Remediation Required

Based on the findings of the DSI, the extent of remediation required is defined as follows:

- Nickel and hydrocarbon impacted surface soils associated with fuel/oil storage; and
- Hydrocarbon and nickel impacted surface soils associated with timber power poles.

6. Remediation Acceptance Criteria

The remediation works will be validated as meeting an acceptable standard for the proposed land use. The validation will be undertaken based on visual inspection, field screening, sample analysis and review of disposal dockets as discussed in Section 10.

The remediation acceptance criteria (RAC) for the identified COPC are based on the health investigation levels (HIL), health screening levels (HSL), ecological investigation levels (EIL) and ecological screening levels (ESL) for a residential site with plant uptake as presented in Schedule B1, of the National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC 2013) and are consistent with criteria used in the DSI (DP, 2018).

6.1 Soil

6.1.1 Health Investigation and Screening Levels

The generic Health Investigation Levels (HILs) and Health Screening Levels (HSLs) are considered to be appropriate for the assessment of human health risk associated with contamination at the site. The adopted soil HILs and HSLs for the potential contaminants of concern are presented in Table 5, with inputs into their derivation shown in Table 4.

As shown in Table D2 the adopted HSLs are based on a potential vapour intrusion pathway, as identified in the CSM. Although the CSM also identifies a direct contact pathway as well as construction worker receptors, the corresponding HSLs are significantly higher than those for the vapour intrusion pathway and are therefore not drivers for further assessment and/or remediation. As such the direct contact and intrusive maintenance worker HSLs have not been listed.

Table 4: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Inhalation of vapours	Potential exposure pathways
Soil Type	Silt and clay	Dominant soil type in surface soils (silty clays)
Depth to contamination	0 m to <1 m	Potential contamination sources likely to impact surface soils

Table 5: HIL and HSL in mg/kg Unless Otherwise Indicated

Contaminants		HIL- A	Direct Contact - TRH
Metals	Zinc	7400	-
PAH	Benzo(a)pyrene TEQ ¹	3	-
	Total PAH	300	-
	Naphthalene	-	-
TRH	C6 – C10	-	4,400
	>C10-C16	-	3,300
	>C16-C34	-	4,500
	>C34-C40	-	6,300
Phenols	Phenol	3000	-
	Cresols	400	-

Notes:

- 1 Sum of carcinogenic PAH
- 2 Non dioxin-like PCBs only.
- 3 The soil saturation concentration (C_{sat}) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds C_{sat}, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

6.1.2 Ecological Investigation and Screening Levels

Ecological Investigation Levels (EILs) and Added Contaminant Limits (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. The adopted EILs, derived using the *Interactive (Excel) Calculation Spreadsheet* (Standing Council on Environment and Water (SCEW) website (<http://www.scew.gov.au/node/941>)) are shown in the following Table 7, with inputs into their derivation shown on Table 6.

Table 6: Inputs to the Derivation of EILs

Variable	Input	Rationale
Age of contaminants	"Aged" (>2 years)	Given the potential sources of soil contamination are from historic use, the contamination is considered as "aged" (>2 years);
pH	4.6	Refer to the DSI (Section 3)
CEC	3.6 cmolc/kg	Refer to the DSI (Section 3)
Clay content	35 %	Refer to the DSI (Section 3)
Traffic volumes	low	The site is considered to be located within a low traffic area
State/Territory	New South Wales	-

Table 7: EIL in mg/kg

Analyte	EIL
Arsenic	100
Chromium	620
Copper	70
Lead	1,100
Nickel	20
Zinc	100
Naphthalene	170

Ecological Screening Levels (ESLs) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESLs, based on a fine soil type are shown in the following Table 8.

Table 8: ESL in mg/kg

Analyte		ESL ¹	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]	1300	
	>C34-C40 [F4]	5600	
PAH	Benzo(a)pyrene	0.7	

6.1.3 Management Limits

In addition to appropriate consideration and application of the HSLs and ESLs, 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; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

The adopted management limits, based on a fine soil type are shown in the following Table 9.

Table 9: Management Limits in mg/kg

Analyte		Management Limit
TRH	C ₆ – C ₁₀ (F1) [#]	800
	>C ₁₀ -C ₁₆ (F2) [#]	1000
	>C ₁₆ -C ₃₄ (F3)	3500
	>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

6.1.4 Asbestos in Soil

It is noted by DP that the DSI (DP, 2018) did not identify exceedances of asbestos against the adopted SAC. Should unexpected finds be identified at the site including asbestos impact the associated impact shall be remediated using the unexpected finds protocol presented in Section 9.2 of this report and using the following RAC.

NEPC (2013) defines the various asbestos types as follows:

- **Bonded ACM:** Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7 mm x 7 mm sieve.
- **FA:** Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.
- **AF:** Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve.

Health Screening Levels (HSLs) for asbestos in soil, which are based on likely exposure levels for different scenarios, have been adopted in NEPC (2013) from the Western Australian Department of Health (WA DoH) publication *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia 2009* (WA DoH 2009).

On the basis of the proposed land use and in accordance with Table 7, Schedule B1, NEPC (2013) the following asbestos HSLs for residential use have been adopted:

Table 10: Health Screening Levels for Asbestos Contamination in Soil (% w/w)

Form of Asbestos	HSL
Bonded ACM	0.01%
FA and AF	0.001 %
All Forms of Asbestos	No visible asbestos for surface soil

6.1.5 Waste Classification

Any soils requiring offsite disposal will be classified with reference to NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*. Criteria for COPC where available are presented in Table 11 below and include criteria as follows:

- General solid waste (GSW):
 - o Contaminant Threshold value (CT1) for soil analysis without TCLP (leachate) testing; and
 - o Waste classification criterial where TCLP testing is undertaken including soil (Specific Contaminant Concentration – SCC1) and leachate (TCLP1) criteria.
- Restricted solid waste (RSW):
 - o Contaminant Threshold value (CT2) for soil analysis without TCLP (leachate) testing; and
 - o Waste classification criterial where TCLP testing is undertaken including soil (Specific Contaminant Concentration – SCC2) and leachate (TCLP2) criteria.

Table 11: Waste Classification Criteria

Contaminant		GSW			RSW		
		CT1 (mg/kg)	TCLP1 (mg/L)	SCC1 (mg/kg)	CT2 (mg/kg)	TCLP2 (mc/L)	SCC2 (mg/kg)
PAH	Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23
	Total PAH	200	N/A	200	800	N/A	200
TRH	C6 – C9	650	N/A	650	2,600	N/A	2,600
	>C10-C36	10,000	N/A	10,000	40,000	N/A	40,000
Phenols	Phenol (non-halogenated)	288	14.4	518	1,152	57.6	2,073
	Cresols (total)	4,000	200	7,200	16,000	800	28,800

All soils requiring offsite disposal will be inspected by the Environmental Consultant at the time of sampling to confirm the material description and whether the material type is consistent with conditions observed during the DSI. The waste classification will incorporate suitably representative samples from the DSI (DP, 2018), where possible as well as additional samples suitably representative of the material being disposed collected by the Environmental Consultant with reference to NSW EPA (2014) guidelines. If suitably representative sample analytical results from the DSI cannot be referred to for the waste classification, additional analysis may be required and such additional analysis will be compared to the relevant criteria presented in NSW EPA (2014).

6.2 Surface Water

Surface water shall be assessed in the first instance against Default Guideline Values (DGV) for 99% level of species protection (where defined) as presented in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) and summarised in Table 12 below.

Table 12: Adopted Surface Water RAC

COPC	Guideline Value (adopted RAC) µg/L
Arsenic	0.8
Cadmium	0.06
Chromium	3.3
Copper	1
Lead	1
Mercury	0.06
Nickel	8
Zinc	2.4
Benzene	600
Toluene	180
Ethylbenzene	80
Total xylenes	75
Benzo(a)pyrene	0.1
PAH	If recorded above LOR, assess against DGV presented in ANZG (2018) if recorded above LOR ¹
Phenol	185
OC/OP pesticides	If recorded above LOR, assess against DGV presented in ANZG (2018) if recorded above LOR ¹

¹: Refer to <http://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search/master-table> (last accessed 16 October 2018)

6.3 Sediment

Material collected from the base of dams and creeks at the site will be assessed against soil criteria (as defined in Section 6.1 above) to assess for possible risks to receptors of relevance to the proposed development as well as to sediment criteria as defined in CSIRO Land and Water Science Report 08/07 *Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines* (CSIRO, 2013) and summarised in Table 13 below. If the adopted RAC is exceeded, additional analysis and/or assessment will be required as detailed in CSIRO (2013).

Table 13: Adopted Sediment RAC

COPC	Guideline Value (adopted RAC) mg/kg
Arsenic	20
Cadmium	1.5
Chromium	80
Copper	65
Lead	50
Mercury	0.15
Nickel	21
Zinc	200
Total PAH	10,000
Total DDT	1.2
p,p'-DDE	1.4
o,p'- + p,p' -DDD	3.5
Chlordane	4.5
Dieldrin	2.8
Endrin	2.7
Lindane	0.9
Total PCBs	34
TPH	280

6.4 Assessment of VENM

All soil/rock material imported to the site must be VENM as defined under NSW EPA *Waste Classification Guidelines* (EPA, 2014). As the NSW EPA has no specific VENM assessment criteria (in terms of contaminant thresholds) VENM should be reviewed on the basis of the source site history and observations of the material.

Assessment of inorganic contaminants should be conducted with reference to the published background ranges for typical Australian soils in Berkman (1989) *Field Geologists Manual* and/or ANZECC (1992) (see extract in Table B1, Appendix B). Assessment of organic contaminants should be conducted with reference to their analytical practical quantitation limits.

7. Assessment of Remediation Options

7.1 Remediation Goal

The ultimate goal/objective of the remediation will be to render the site compatible with the proposed land use (residential).

7.2 Extent of Remediation

The extent of remediation is summarised below:

- Nickel and TRH exceedances in soil at location SS1; and
- TRH exceedances in soil associated with timber power poles at the site.

Drawing 1 attached show the location of known timber power poles at the site.

7.3 Remediation Options Assessment

The preferred hierarchy for remediation of soil at contaminated sites in a decreasing order of preference, as set out in NEPC (2013) and outlined in NSW EPA *Contaminated Land Management Guidelines for the NSW Site Auditor Scheme* 3rd Edition, 2018 (NSW DEC, 2006) is:

- 1) Onsite treatment of excavated soil (so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level); and
- 2) Offsite treatment of excavated soil (so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site).

If the above is not practicable:

- 3) Consolidation and isolation of the contaminant by containment within a properly designed barrier; and
- 4) Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.

DP assessed selected remediation alternatives, taking into considerations their applicability for the Site, time constraints, economic feasibility, and potential environmental and health impacts. Off-site treatment is generally not viable for the contaminants observed at the site, therefore this option is not further considered at this time. The remediation options evaluation is summarised in Table 14 below.

Table 14: Remediation Options Evaluation

Option	Evaluation	Option Ranking
Option 1: On site treatment prior to on site re-use	The soil could be subject to ex-situ treatment (e.g. solidification/stabilisation). Given that the contamination is likely to be confined to an isolated area, this treatment technology is likely to be cost prohibitive compared to other options. Also, this options still involves on site containment and any on site containment would require a long term environmental management plan for the long term management of the contamination on site.	Possible however likely cost prohibitive

Option	Evaluation	Option Ranking
Option 2: Off-site treatment	The soil could be subject to ex-situ treatment (e.g. solidification/stabilisation). Given that the contamination is likely to be confined to an isolated area, this treatment technology is likely to be cost prohibitive compared to other options.	Possible however likely cost prohibitive
Option 3: Containment of the impacted soil on site beneath an engineered barrier	Owing to the recorded presence of TRH in impacted soils, containment of the impact on the site is unlikely to be suitable as potential exposure pathways to underlying groundwater will remain.	Not suitable
Option 4: Off-site disposal to landfill	Off-site disposal would involve the removal and disposal of contaminated soils to a licensed facility. This option would remove the requirement for a long-term management plan, and considering the likely small volume of material, is the most cost effective of potential options.	Preferred

7.4 Selected Remediation Option

Based on the findings of the options assessment, the most suitable remediation option for the site is off-site disposal to landfill.

8. Remediation Methodology

8.1 Overview

The extent of remediation works is summarised in Section 7.2. Taking into account the nature and potential extent of remediation required, the proposed development and the requirements of the auditor, the recommended remediation approach is summarised below (in order):

- Collect surface water and sediment samples from dams and creeks at the site as outlined in Section 5.1;
- Carry out a site walkover to confirm the location of all timber power poles within the site;
- Remove and appropriately dispose of (under the POEO Act 1997) timber power poles at the site and drums at location SS1;
- Excavate and dispose of nickel and TRH impacted soils from location SS1, and TRH impacted soils associated with power poles; and
- Validate the excavation after removal of impacted soils.

8.2 Excavate and Dispose of Hydrocarbon Impacted Soil

The DSI identified nickel and TRH impacted soil at location SS1, and TRH impacted soil associated with timber power poles. The approximate remediation dimensions for each location is 5 m x 5 m x 0.5 m below the depth of impact however this may be greater, depending on the findings of validation sample analysis, therefore it will be necessary to “chase out” any remaining contamination.

Prior to the removal of the TRH impacted soil, it will be necessary for the Remediation Contractor to remove and appropriately dispose of timber power poles and drums.

Soils will be excavated and placed immediately into trucks for landfill disposal, where possible. Any stockpiling of excavated spoil will be kept at a minimum, i.e. less than 24 hours and within the remediation area as much as practicable. It will be necessary to validate the footprint of any stockpiles of impacted soil that is placed outside of the remediation area (refer to Section 10).

8.3 Delineate and Validate the Excavation//Stockpile Footprints

After removal of impacted soil, it will be necessary for the Environmental Consultant to validate the extent of the excavation in accordance with the Validation Plan (refer to Section 10).

9. Remediation Strategy

The detailed procedures and sequence for the remediation work will rest with the contractor and will depend upon the equipment to be used and the overall sequence of the remediation or development. It is the contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP does not relieve the contractor(s) of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the immediate workspace. This RAP sets out the minimum standards and guidelines for remediation that will need to be used in preparing a method statement.

Any asbestos remediation works must be undertaken by an appropriately licensed asbestos Remediation Contractor and in accordance with *Work Health and Safety Regulation NSW 2011* and any other applicable SafeWork NSW or Safe Work Australia regulations or guidelines.

9.1 Site Establishment

Prior to the implementation of remediation, the site is to be established in accordance with all NSW legislative requirements.

9.2 Contingency for Unexpected Finds

If unexpected conditions are encountered during site works (such as buried tanks, unexpected contaminated soil or contaminants including additional ACM or FA/AF asbestos, uncontrolled filling containing anthropogenic material in the proposed temporary drainage basin (in the eastern portion of the site) and/or impact identified in the assessment of dam and creek samples), the following general approach will be adopted:

- Stop work in the area of impact and barricade area to prevent access;
- The Remediation Contractor is to contact the principal's representative (PR) and the Environmental Consultant;
- The Environmental Consultant will make an assessment of the severity/extent of the unexpected find in terms of the potential impact to human health and the environment;
- The Environmental Consultant will liaise with the PR as required;
- The Environmental Consultant will provide advice to the PR regarding the recommended course of action;
- The client will obtain necessary approvals from Council; and
- The Remediation Contractor is to implement the agreed management/remedial strategy.

9.2.1 Unexpected Finds Containing Asbestos – Additional Requirements

In the case of an UXF including asbestos, DP recommends that the asbestos Remediation Contractor must be licensed for Class B asbestos removal. A Class B licence is suitable for the remediation related to areas impacted with asbestos given that asbestos at the site has been identified in the bonded (non-friable) form (i.e. ACM in good condition). Considering the nature of the site it is recommended that air quality monitoring is undertaken during bonded ACM removal work by DP. In the event that significant quantities of AF or FA are observed during the remediation, the Proponent shall advise Council, works shall cease until a Class A asbestos removal license is obtained by the Remediation Contractor. A licenced asbestos assessor must undertake air quality monitoring for all removal work requiring a Class A asbestos removal licence. The licensed asbestos Remediation Contractor must give written notice to SafeWork NSW at least five days before remediation work commences.

Where required, field screening and laboratory analysis for asbestos in soil shall be carried out including field screening (gravimetric assessment) for asbestos and scheduling s 500 mL samples of the soil for laboratory analysis with reference to NEPC (2013).

Air quality monitoring for airborne asbestos fibres using the membrane filter method in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* (NOHSC: 3003, April 2005) is to be conducted prior to commencement of works (baseline) and on a daily basis when works involving the excavation, transport or placement of asbestos impacted and potentially impacted soils/materials are being conducted within the site. The Environmental Consultant is to conduct the air quality monitoring or manage the works through an experienced contractor. If friable asbestos is recorded at any stage of the remediation works, air quality monitoring will be required to be carried out by a suitably licensed asbestos assessor.

The client will be notified by the Environmental Consultant of any laboratory detections of airborne asbestos fibres during the course of the works. In the event of detections equal to or above 0.01 fibres per millilitre (f/ml) i.e. the practical limit of detection using the membrane filter method, the Remediation Contractor should make appropriate modifications to works methods, as required. The adopted guideline for air quality monitoring is the para-occupational limit endorsed in enHealth 2005 and recommended in DoH (2009) to protect the public around contaminated sites.

9.3 Loading and Transporting of Spoil

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the *POEO Act* (1997). All required licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Transport of spoil shall be via a clearly delineated, pre-defined haul route.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding the appropriate licence, consent or approvals to dispose of the waste materials according to the classification outlined in the NSW EPA *Waste Classification Guidelines* (2014) and with the appropriate approvals obtained from the NSW EPA, if required.

The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the site. A record of the truck dispatch will be provided to the PR. Asbestos transporters and facilities receiving asbestos waste in NSW weighing more than 100 kilograms, or consisting of more than 10 square metres of asbestos sheeting in one load must track and report this waste to the EPA using WasteLocate5.

9.4 Waste Management

9.4.1 Special Area – Management Requirements

It is noted that immediately south of the site is bushland associated with a designated 'Special Area'⁶, surrounding the Nepean River. Land designated as 'Special Areas' are intended by Water NSW to protect the quality of stored water and to maintain the ecological integrity of the designated area of land. Whilst the site is located outside of the catchment associated with the designated area, the Remediation Contractor is required to implement the following as a precautionary measure to prevent surface water/near surface water encountered during remediation works and earthworks from entering the Special Area:

- Ensure the sides of any excavation works and stockpiles are positioned (e.g. raised or bunded) so to prevent any surface water drainage leaving the excavation or stockpiling area during a rainfall event;
- Minimise pooling of water within the excavation and/or within stockpiling areas; and
- Placement of an impermeable barrier (e.g. tarpaulin) at the base of stockpiles.

⁵ <http://www.epa.nsw.gov.au/your-environment/waste/transporting-asbestos-waste-tyres/tracking-asbestos-waste-locate>

⁶ Declared under the WaterNSW Act 2014 and regulated by WaterNSW.

9.5 Materials for Use in Backfilling and Imported Fill

Any additional material required for redevelopment works, including backfilling of remedial excavations shall be either:

- uncontaminated material from the site (i.e.: materials meeting the RAC sourced from outside of the remediation areas and not containing unexpected finds); or
- imported material, which is to be analysed and certified as VENM, as well as meeting the RAC via a validation certificate by the Contractor. The material and material management should also comply with relevant legislation (e.g. POEO Act 1997). Sampling density and testing requirements for VENM are further detailed in Section 9.5.1 below.

Materials used on site should also meet other requirements (e.g. geotechnical and salinity requirements or any specific fill management plan which is devised for the site).

9.5.1 Assessment of VENM

All soil/rock material imported to the site must be VENM as defined under NSW EPA *Waste Classification Guidelines* (EPA, 2014) and subject to sampling and testing as defined below:

- VENM proposed to be imported should include analyses of samples at the following rates;
 - o Material below 5,000 m³: 1 sample per 1,000 m³ (minimum 3 samples);
 - o Material above 5,000 m³: 1 sample per 5,000 m³ (minimum 5 samples);
 - o Bedrock VENM should be sampled at a rate of 1 sample per 50,000 m³ with a minimum of five samples; and
- Samples are to be analysed for heavy metals, PAH, TRH, BTEX, total phenols, PCBs, OCPs and asbestos.

9.6 Material Tracking Requirements (in/out of site)

It will be necessary to track all material to and from the site in accordance with the *POEO Act* (1997) and the NSW EPA (2018) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)* and must include the following (Sections 9.6.1. and 9.6.2. respectively).

9.6.1 Import of VENM

All VENM imported to site must have been subject to a VENM review (refer to Section 9.5.1) which confirms the material is VENM and suitable for import to the site. A site record of 'suitable' import sources is to be maintained at the site and must include the material description, the material source address and the volume of material approved for import.

Upon arrival at the site, each load of VENM is to be checked at the site entrance and the following recorded in a daily log:

- Date and time of arrival of each load;
- Waste company managing the import source;

- Material source (address) and description; and
- Material volume (or tonnage).

Copies of delivery dockets are to be retained and presented along with the daily log to the Environmental Consultant for inclusion in the Validation Report.

9.6.2 Offsite Disposal

A waste classification assessment should be carried out in accordance with NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* (EPA, 2014) for any material requiring offsite disposal. The scope of the assessment will depend on the volume and type of material requiring disposal.

A copy of the waste classification report is provided to the Remediation Contractor and the accepting landfill prior to disposal. The accepting landfill must have a current valid licence (under the *POEO Act*, 1997) to accept the class of waste disposed. Copies of all disposal dockets detailing the material source, material type, volume, date/time of disposal and destination (i.e. landfill) must be retained and presented to the Environmental Consultant for inclusion in the Validation Report. The Validation Report is required to confirm the type and status of the licence held by the landfill.

10. Validation Plan

10.1 Validation Scope

10.1.1 Validation Data Quality Objectives (DQO)

The objective of the validation plan is to assess the results of post remediation testing against the RAC stated within this RAP (Section 6) and to provide information on environmental impacts which may have resulted from the works. The DQO encompasses any unexpected finds encountered at the site, if indeed any are.

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) procedures to demonstrate the repeatability and reliability of the results.

The following DQOs will be adopted based on those provided in Appendix B, Schedule B2 of NEPC (2013). The DQO process for the validation works is outlined below:

State the Problem

Walker proposes to build a residential subdivision of the site. Review of the findings of the DSI identified localised impact associated with historical spillage of fuels and oils from drums, and associated with a timber power pole at the site. The identified impact therefore requires remediation.

The “problem” to be addressed as part of the validation exercise is therefore to confirm the remediation areas have been suitably remediated after completion of the required remediation works.

Identify the Decision

The validation status of the remediation areas (and therefore the suitability of the site for the proposed development) shall be assessed based on a comparison of the analytical results against the RAC. The following specific decisions should be considered as part of the validation works:

- Do field observations and analytical results confirm the identified impact has been suitably remediated?
- Is the validation data sufficient to make a decision regarding the suitability of the site for the proposed development?
- Are there any potential off-site migration issues or potential migration into groundwater that need to be considered?

Identify Inputs to the Decision

Inputs into the decisions are as follows:

- Completion of a remediation inspection (of the excavation);
- Do further soils need to be removed, i.e. do visual/olfactory observations indicate impacted soils have been removed (or otherwise);
- Collection of samples of media in accordance with this validation plan;
- Field and laboratory QA/QC in accordance with this validation plan to assess the suitability of the environmental data for the validation assessment;
- Analyse samples for the identified contaminants of concern; and
- Review laboratory results against the RAC defined in Section 6 of this report.

Define the Boundary of the Assessment

The boundaries of the assessment are defined in Section 7.2 of this report.

Develop a Decision Rule

The decision rules to be used to determine whether the remediation works have been satisfactorily completed include the following:

- Are sampling densities and analytical suites complete and correct with reference to Section 10 of this report?
- Do the laboratory analytical results meet or exceed the RAC?

Field and laboratory test results were considered useable for the assessment after evaluation against the following data quality indicators (DQIs):

- Precision – a measure of variability or reproducibility of data;
- Accuracy – a measure of closeness of the data to the ‘true’ value;
- Representativeness – the confidence (qualitative) of data representativeness of media present on site;
- Completeness – a measure of the amount of usable data from a data collection activity; and
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event.

Specify Acceptable Limits on Decision Errors

Decision errors for the respective COPC for fill and natural soils are:

1. Deciding that validation results exceeds the adopted SAC when they truly do not; and
2. Deciding that validation results are within the adopted SAC when they truly do not.

Decision errors for the validation assessment shall be minimised and measured by the following:

- Sample collection and handling techniques should be in accordance with DP's *Field Procedures Manual*;
- Samples shall be prepared and analysed by a NATA-accredited laboratory with the acceptance limits for laboratory QA/QC parameters based on the laboratory reported acceptance limits and those stated in NEPC (2013);
- The analyte selection is based on the previously identified exceedances with respect to the criteria adopted in the DSI;
- The RAC were adopted from established and NSW EPA endorsed guidelines. The RAC have risk probabilities already incorporated; and
- A NATA accredited laboratory using NATA endorsed methods shall be used to perform laboratory analysis. Where NATA endorsed methods are not used, the reasons are stated. The effect of using non-NATA methods on the decision making process are explained.

Optimise the Design for Obtaining Data

Sampling design and procedures that were implemented to optimise data collection for achieving the DQOs included the following;

- NATA endorsed methods shall be used to perform laboratory analysis where possible;
- To optimise the selection of soil samples for chemical analysis, all samples collected for volatile analysis shall be screened using a calibrated photo-ionisation detector (PID) allowing for site assessment and sample selection; and
- Adequately experienced environmental scientists/engineers shall be utilised to conduct field work and sample analysis interpretation.

A checklist of Data Quality Indicators (DQI) will be completed as part of the validation assessment.

10.1.2 Validation of Excavations

The following validation works will be carried out by the Environmental Consultant:

- Removal of identified impact:
 - o Visual inspection of the excavation extent for any visual/olfactory indicators of contamination;
 - o If hydrocarbon odours/staining is observed during the visual inspection, additional soil will be removed until no odours/staining are observed; and
 - o The excavation will be validated in accordance with NSW EPA (1993) *Sampling Design Guidelines* and comprise minimum 5 samples; one per face and one from the excavation base. If validation sample results do not pass RAC, an additional 0.3 m of soil shall be removed from the associated face. The excavation shall be kept open (but secured from pedestrian access) until the Environmental Consultant confirms all validation samples pass criteria.

10.1.3 Validation of Stockpile Footprints

The footprint of any stockpile generated from excavations carried out within the remediation area will require validation in accordance with the NSW EPA (1993) Sampling Design Guidelines.

10.2 Quality Assurance Plan

10.2.1 Sample Collection and Handling

The general sampling procedures comprise:

- The use of stainless steel or disposable sampling equipment;
- Decontamination of sampling equipment prior to the collection each sample;
- Labelling of the sample containers with individual and unique identification including Project No. and Sample No.; and
- The use of chain-of-custody documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

10.2.2 Field QA/QC

Appropriate sampling procedures will be undertaken to prevent cross contamination. These include:

- Standard DP operating procedures are followed;
- Replicate and triplicate field samples are collected and analysed for the same suite as primary samples;
- Samples are stored under secure, temperature controlled conditions;
- Chain-of-custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory; and
- Proper disposal of contaminated soil, fill or surface water originating from the site.

10.2.3 Laboratory QA/QC

A NATA accredited laboratory will be used to conduct analysis.

10.2.4 Achievement of DQO

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

10.3 Validation Reporting

A validation assessment report will be prepared by the environmental consultant in accordance with EPA NSW *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (2011). The objective of the validation report will be to confirm that the site has been remediated to a suitable standard for the proposed redevelopment and that no related adverse human health and environmental effects have occurred as a result of the works. The validation report will also include a summary of the information from previous investigations.

The validation report will include:

- Documentation of the implementation of the Remedial Strategy;
- Details of the location and total estimated volume of materials excavated and replaced within the site and volume of material removed from the site for disposal as well as the tonnages reported by the licensed landfill;
- Photographic record during the works and of final excavations;
- Survey records of excavations and final levels after fill placement;
- Drawings showing contamination assessment sample locations and validation sample locations;
- Detailed analytical results;
- Details of materials imported to the site, as required; and
- Details, including survey records, of the final cover.

11. Site Management Plan

It is the responsibility of the Contractor to develop a Site Management Plan (SMP) for earthworks at the site detailing overall site management, environmental management (including soil, air and water) and occupational health and safety (OH&S) plans. This section provides a brief summary of some of the items which need to be included in the Contractor's plans.

Works shall comply with all legislative requirements including, but not limited, to those set out under the following Acts (and subsequent amendments and regulations):

- Environmentally Hazardous Chemicals Act (1985);
- *Hazardous Chemicals Act* (1985) (under review);
- Environmental Offences and Penalties Act (1989);
- Agricultural and Veterinary Chemicals Act (1994);
- *Protection of the Environment Operations Act* (POEO) (1997) and associated exclusions;
- *Pesticide Act* (1999);
- Work Health and Safety Act 2011;
- *OHS Amendment (Dangerous Goods) Act* 2003 (including *OHS Amendment (Dangerous Goods) Regulation* 2005); and
- *POEO Amendment Act* 2005 (including *POEO Amendment (Scheduled Activities and Waste) Regulation* 2008).

11.1 Site Operations

The schedule of remedial works, including timing and staging is to be prepared by the Contractor to meet the requirements of this RAP.

Remediation works will be restricted to the hours set out by Council.

It is the site owner/developers responsibility to ensure that appropriate personnel are appointed to manage and conduct the remediation and validation works. This will include:

- The Principal's Representative (PR – Walker), who is responsible for overseeing the implementation of this RAP;
- The Contractor, who is responsible for overseeing the implementation of this RAP, conducting the remedial works (may be subcontracted) and managing the site; and
- An Environmental Consultant, who will be responsible for providing advice as required for the remedial works and undertaking the validation works in accordance with this RAP.

Other parties who may be employed to assist in the implementation of this RAP include, but are not limited to, occupational hygienist(s) and licensed asbestos contractor(s).

The Contractor will be responsible for preparing a list of contacts for the works, including emergency contacts for the site operations and provision of signage at the site to allow the public to contact nominated site personnel out of hours.

11.2 Environmental Management

The work shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The Contractor shall have in place an Environmental Management Plan (EMP) which addresses the following items:

- Site stormwater management plan;
- Soil management plan;
- Noise control plan;
- Dust control plan;
- Odour control plan; and
- Contingency measures for environmental incidents.

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

- fugitive dust leaving the confines of the site is minimised;
- no water containing suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- spoil is managed in accordance with this RAP; and
- noise and vibration levels at the site boundaries comply with the legislative requirements.

11.3 Occupational Health and Safety

The Contractor should develop a site emergency response plan (ERP) and work health and safety management plan (WHS). This will ensure the safety of the personnel working on site, given any likely emergency situation which may occur. The WHS and ERP should include emergency phone numbers and details of local emergency facilities.

Appropriate fencing and signage should be installed around and within the site to prevent unauthorised access to the site, restricted access remedial areas and deep excavations. Signage should be appropriate to inform of the occurrence of asbestos remediation works.

All asbestos works will be conducted by an appropriately licensed asbestos contractor and in accordance with SafeWork requirements.

All personnel on site should be required to wear the following personnel protective equipment (PPE) at all times (as a minimum):

- Steel-capped boots;
- High visibility clothing; and
- Hard hat meeting AS1801-1981 requirements.

The following additional PPE will be worn as required:

- All PPE required by the Licenced asbestos contractor (e.g. P2 disposable dust mask or a particulate half-face mask with a P3 filter, disposal coveralls);
- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary, particularly during demolition);
- Disposable coveralls (if necessary) to prevent contact with splashed contaminated soil, materials or water;
- Nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves; and
- Any additional protection identified by the Environmental Consultant.

All contractors are required to show compliance with the Work Health and Safety Regulation 2011, including the preparation of a Site Safety Management Plan and Safe Work Method Statements.

12. Conclusions

It is considered that remediation in accordance with this RAP will render the site suitable for the proposed residential subdivision.

It is noted that the rural residential property located in the north east corner of the site (refer to Drawing 1, Appendix A) will be subject to a contamination investigation once the property is vacated at a later (currently unknown) date.

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report (or services) for this project at Stages 1 and 2, Wilton Junction, NSW in accordance with DP's proposal MAC180325. The work was carried out under contract reference ME_132208996_5 (W2007). This report is provided for the exclusive use of Walker Corporation 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.

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 (geotechnical/environmental/groundwater) 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
Drawing 1

About this Report

Douglas Partners



Introduction

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

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

Copyright

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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



		CLIENT: Walker Corporation		TITLE: Site Layout and Remediation Locations Proposed Residential Subdivision Stages 1 and 2, South East Wilton Junction			PROJ. #: 92269.02
OFFICE: Macarthur		DRAWN BY: EMG					DRAWING No: 1
SCALE: As shown		DATE: 9 Apr 2019					REVISION: 1