NSW HEALTH INFRASTRUCTURE

Environment Management Plan for Community Health Centre, 612-624 Pittwater Road, Brookvale NSW

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WSP | PARSONS BRINCKERHOFF

Environment Management Plan for Community Health Centre, 612-624 Pittwater Road, Brookvale NSW

NSW Health Infrastructure

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ABBREVIATIONS

ACM	Asbestos-containing materials
NSW EPA	New South Wales Environment Protection Authority
ACS	Asbestos cement sheeting
ASS	Acid sulfate soils
AASS	Actual acid sulfate soils
BTEX	Benzene, toluene, ethylbenzene and xylene
EMP	Environmental management plan
ESA	Environmental site assessment
LOR	Laboratory limit of reporting
mBGL	Metres below ground level
OCPs	Organochlorine pesticides
OPPs	Organophosphate pesticides
PASS	Potential acid sulfate soils
Health Infrastructure	The entity who will be contracted by the NSW Government to deliver the Project.
RAP	Remedial action plan
TRH	Total recoverable hydrocarbons
WHS	Work Health and Safety

1 INTRODUCTION

1.1 Background

WSP | Parsons Brinckerhoff (formally Parsons Brinckerhoff) was commissioned by NSW Health Infrastructure (Health Infrastructure) to prepare an Environmental Management Plan (EMP) for the site located at 612 – 624 Pittwater Road, Brookvale (the site). The site in presented in Figure 1 in Appendix A.

Health Infrastructure intend to develop the site into a new community health centre, as a part of the Northern Beaches Health Services Redevelopment. The site has a total area of approximately 5,400 m^2 and comprises the following land parcels:

- Number 612 Pittwater Road, comprising Lot A, Lot B and Lot C of deposit plan (DP) 375728, historically used as a service station and currently vacant.
- Number 620 Pittwater Road, comprising Lot 1, DP 500541, historically used as a residence, and currently unused.
- Number 624 Pittwater Road, comprising Lot 3 DP 539384, historically and currently used for commercial and light industrial activities.

1.2 Proposed development

As a part of the construction phase of the project the following is proposed:

- Removal of the underground storage tank (UST) present in the north-east portion of number 624, Lot 3 DP 539384.
- Excavation of fill and natural material, proposed to either be re-used onsite or removed off-site to an appropriately licenced facility.
- Containment or removal of asbestos containing material around the building footings remaining in the central portion of number 624.
- Assessment and removal of a batter along the south-eastern boundary of the site.
- Assessment and containment and/or removal of material below remaining asphalt at the northern boundary of the site.

The current design for the proposed Community Health Facility consists of four levels of suspended post tensioned walls with a ground bearing slab. The lower ground floor at the northern end is proposed to be suspended.

A plan of the existing site layout, showing the approximate location of the existing UST, south-eastern batter, and remaining asphalt is provided as Figure 2, Appendix A.

A remediation action plan (RAP) has been prepared for the site that addresses the specific requirements for removal of the underground tank, containment and/or removal of asbestos material, assessment of material below the asphalt and assessment of the batter at the southern boundary. The RAP is referenced Parsons Brinckerhoff, January 2016 *Remediation Action Plan for Community Health centre, 612-624 Pittwater Road, Brookvale.*

1.3 The objectives

The objective of the EMP is to ensure that appropriate environmental management practices are followed during the development of the site. The objective will be achieved by applying the identified controls for any work requiring disturbance of subsurface materials at the site to ensure that these are undertaken in an environmentally responsible manner that protects the health of the workers and the environment during the

development of the Community Health Facility. This EMP should be implemented in tandem with the contractor's construction EMP and with consideration of the RAP. The Department of Infrastructure, Planning and Natural Resources, 2004, *Guideline for the Preparation of Environment Management Plans* was used as a base reference for this EMP.

1.4 Legislative requirements

Key legislation relevant to contaminated soil management during redevelopment of the site is listed in Table 1.1 below. Legislation outlined below should be updated when changes occur.

Table 1.1 Key legislation and guidelines

RELEVANT KEY LEGISLATION AND GUIDELINES	APPLICABLE TO PROJECT
Environment Protection Act 1997 (republication date 12 November 2014)	Establishes a process for prevention of environmental degradation and risk of harm to human health and the management of contaminated land. Offences exist in relation to activities that cause water, soil and air pollution. This document also provides limitations associated with waste removal and reuse and the order to assess and remediate land.
Environmental Protection Regulation 2005	Provides an assessment of contaminants, likely to cause harm, sources and application, movement in the environment, risks associated with the affect contamination has on the environment and human health. This regulation also details the procedures and protocols required to sample waste and erosion and sediment control measures for development sites. Soil, water and air pollution associated with generation, handling and disposal of waste are controlled through this EMP.
NSW EPA 2014, *Waste Classification Guidelines*	Defines types of wastes, procedures for assessing waste, waste storage and disposal requirements, record keeping and licence requirements. Applies to the handling, storage and disposal of contaminated materials, if uncovered during construction works.
Work Health and Safety Regulation 2011 (republication date 2 January 2015)	Provides for guidance for the application of the assessment of risks associated with health and safety associated with a hazard, task, thing, or circumstance. This regulation also provides risks associated with the disturbance of asbestos.
National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM; amended 2013)	Provides adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective approach to the assessment of site contamination.
Work Health and Safety (Asbestos) Amendment Regulation 2014	Delivers regulations applying to the removal of asbestos from premises and the controls applicable during the time of removal.
Dangerous Substances (Asbestos Safety Reform) Amendment Bill 2014	Applies to the handling of asbestos, only if the handling is not commercial handling.
National Occupational Health and Safety Commission (NOHSC) 2005, *Code of Practise for the Safe Removal of Asbestos 2nd Edition*	Provides a framework for the safe removal of asbestos and asbestos contaminating materials (ACM) from buildings and structures, plant and equipment and vehicles.
Western Australian (WA) Department of Health (DOH) 2009, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*	Provides guidance for assessing and remediating asbestos impacted sites in order to minimise the risk to public health from the future use of the site.

RELEVANT KEY LEGISLATION AND GUIDELINES	APPLICABLE TO PROJECT
Safe Work Australia 2011, *How to Safely Remove Asbestos: Code of Practice*	Provides guidance for the safe removal of ACM.
Acid Sulfate Soils Management Advisory Committee 1998, *Acid Sulfate Soils Assessment Guidelines*	Provides guidelines for the application of management practises in the planning, design and undertaking of activities that disturb acid sulfate soils.
NSW Department of Environment, Climate Change and Water (NSW DECCW) 2008, *Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage systems) Regulation*	Identifies the measures to be undertaken in protecting the environment during the operation of USTs and can be applicable during the storage and removal of USTs.
State Environmental Planning Policy No 55—Remediation of Land (SEPP55)	Identifies the procedures and requirement for the remediation of land.

1.5 Context of the EMP

The EMP has been prepared for application during the development phase of the project and will be updated as necessary. It has been prepared based on the results of the environmental investigations previously conducted at the site, outlined in Section 3, and our understanding of the redevelopment scope. The EMP should be implemented alongside the RAP prepared for the site (Parsons Brinckerhoff, Jan 2016) and the contractor's construction health and safety and environment plan.

2 SITE BACKGROUND

2.1 General information

General site information is provided in Table 2.1.

Table 2.1 General site identification details

SITE ADDRESS	612 – 624 Pittwater Road, Brookvale, 2100
LOT AND DP	Lot 1 of DP 500541, Lot A, Lot B and Lot C of DP 375728, Lot 3 of DP 539384
PROPERTY OWNER	NSW Health Infrastructure
AREA (TOTAL OF THREE LOTS)	5,400 m^2
CURRENT SITE USE	The site is currently vacant. Historically, number 612 was used as a service station, number 620 was used as a residence, and number 624 was used for commercial and light industrial purposes.
PROPOSED FUTURE SITE USE	Commercial/industrial (health facility).

2.2 Site description

2.2.1 Number 612

Number 612 (Lot A, Lot B and Lot C of DP 375728) is rectangular in shape and bordered by William Street to the south, Pittwater Road to the west and number 620 to the north. It was historically used as a service station containing seven USTs and additional fuel infrastructure. The aboveground infrastructure and fuel infrastructure was removed in 1999 and the site was validated in 2000 (PPK, 2003a), residual contamination was reported in soil at the northern boundary of the site. Material removed from the excavations was land farmed and used to backfill excavations on the site.

Currently, number 612 comprises uneven concrete hardstand with stockpiles of miscellaneous building materials.

2.2.2 Number 620

Number 620 (Lot 1, DP 500541) historically comprised an occupied residential property and is bordered by number 624 to the north, 612 to the south and Pittwater Road to the west. The since abandoned residential property was previously located in the western portion of the site, and a shed was located in the north-eastern corner of the site. All structures have been removed. The property now comprises bare land.

2.2.3 Number 624

Number 624 (Lot 3 DP 539384) was previously occupied by commercial premises and bounded by commercial land to the north and east, number 620 to the south and Pittwater Road to the west. Number 624 is irregular in shape and now comprises mostly bare land and remaining asphalt at the northern and north-eastern portions.

Asbestos containing building footings are located at the central portion of number 624 and cover an area of approximately 1,400 m^2.

The batter along the southern boundary of number 624 is approximately 32 m in length, varying from 0.2 to 1.5 m in width and an estimated depth of approximately 1.5 m.

A UST is located beneath remaining asphalt at the north-eastern portion with a capacity to contain 11,900 L of unknown product and is currently considered to be abandoned. Information relating to abandoned UST comes from SMEC (2014), and a detailed site survey conducted in June 2014 by Bee and Lethbridge Pty Ltd. The approximate location of UST is shown on Figure 1, Appendix A.

2.3 Surrounding land uses

Neighbouring land uses at the time of the last site visit were:

- to the north – commercial properties
- to the south – William Street and residential properties beyond
- to the east – Pittwater Road then Warringah Road
- to the west –commercial properties.

2.4 Sensitive human and environmental receptors

Potential sensitive human and environmental receptors include:

- residential properties to the south of the site, across William Street
- Brookvale Creek located approximately 1.3 km to the south
- groundwater previously identified approximately 0.4 mBGL below the site.

2.5 Physical site setting

The site slopes down to the north from William Street towards number 620 and remains relatively flat across number 620 and number 624. The site elevation is between 12 and 14 metres Australian Height Datum (m AHD).

The 1:100,000 Sydney Geological Series Sheet 9130 (Geological Survey of NSW Department of Minerals and Energy, Edition 1, 1983) indicates that the site is underlain by Hawkesbury Sandstone comprising well sorted, medium grained arenitic quartz sandstone.

The geology encountered onsite during previous investigations (SMEC 2014) is summarised in Table 2.2.

Table 2.2 Site Geology

DEPTH (mBGL)	LITHOLOGY ENCOUNTERED
Surface –0.2	Concrete, asphalt
Surface – depths between 0.3 and 3.3	FILL: brown sandy gravel, sandy gravel and clayey sand. Fill is present to depths of 3.3 m in areas previously excavated during tank removal works on site No. 612.
0.3 to 3.6	Clayey SAND, Sandy CLAY: grey/brown/light grey/red
2.8 to 7.0	SANDSTONE: red/brown/white, weathered and firm

Previous investigations, discussed in Section 3 of this report, indicate that the regional groundwater is shallow (identified between 0.4 and 0.8 mBGL).

A search of the Department of Natural Resources (DNR) licensed borehole register on 09 October 2015 (http://www.waterinfo.nsw.gov.au/gw/) indicated that there were five registered groundwater bores within a 500 m radius of the site.

Table 2.3 provides a summary of the information for the licensed bores and their locations.

Table 2.3 Groundwater database summary

BORE ID	OWNER AND USE	DISTANCE AND DIRECTION FROM SITE	SCREEN DEPTH (m)	SWL (mBTOC)	TOTAL DEPTH (m)	TDS (mg/L)
GW114515	Monitoring	150 (NE)	1-4	NL	4	NL
GW114516	Monitoring	150 (NE)	1-4	NL	4	NL
GW114517	Monitoring	150 (NE)	0.5-3.5	NL	3.5	NL
GW107745	Domestic	180 (SE)	11-12	9	12	NL
GW108944	Domestic	400 (W)	NL	NL	NL	NL

SWL Standing water level
TDS Total dissolved solids
NL Not listed

3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

3.1 Historical investigation reports

A number of historic investigations have been completed to characterise the extent of contamination in soil, groundwater and soil vapour at the site and document the remediation and validation of sites 612 (former service station) and number 620 (migration of contamination from number 612). Details of reports from 1998 to 2014 are provided in the RAP (Parsons Brinckerhoff, 2016).

A detailed review of the reports was conducted by WSP | Parsons Brinckerhoff in April 2015 to characterise the status of contamination at the site and define existing data gaps, prior to preparing a remediation design. The report is referenced as:

- Parsons Brinckerhoff 2015a, Review of historical reports and data gap analysis for a Community Health Centre at Brookvale, NSW (Referenced: ENV-LTR-0990).

A number of recommendations were provided as a part of the data gap review including the requirement for further investigations to ensure the site is suitable for its future use as health facility. To date, WSP | Parsons Brinckerhoff have completed a wet weather and dry weather groundwater monitoring event and a soil vapour assessment. The findings of these investigations are documented in the following reports:

- Parsons Brinckerhoff 2015b, Groundwater Monitoring Event (May 2015) - 612–624 Pittwater Road, Brookvale NSW (Referenced: 2201675A-RES-LTR-0841).
- Parsons Brinckerhoff 2015c, Soil Vapour Monitoring Event (June 2015) - 612–624 Pittwater Road, Brookvale NSW (Referenced: 2201675A-ENV-LTR-1031)

In addition, a targeted soil investigation was then completed to further characterise soils across the site and under building footprints and assess data gaps. The results of this investigation are included in:

- Parsons Brinckerhoff 2015d Targeted Soil Investigation (November-December 2015) - 612–624 Pittwater Road, Brookvale NSW (Referenced: 2201675A-RES-LTR-0841 RevB).
- The investigation identified areas impacted by asbestos, most of which was remediated and validated and reported in the validation report referenced:
- Parsons Brinckerhoff 2015e, Validation Report 612–624 Pittwater Road, Brookvale NSW (reference 2201675A-CLM-RPT-0978).

A Remediation Action Plan (RAP) was produced to document the remedial works required onsite. The RAP is referenced:

- Parsons Brinckerhoff 2015f, Remediation Action Plan for Community Health Centre, 612–624 Pittwater Road, Brookvale NSW (reference 2201675A PR_7373).

A summary of the works completed on the three Lots that comprise the site is included below.

3.2 Summary of previous site works

3.2.1 Number 612

Number 612 was historically used as a service station containing seven underground storage tanks (USTs) and associated fuel infrastructure. The fuel infrastructure was removed in 1999 and the site was remediated and validated in 2000 (PPK, 2003a). The investigation concluded that excavations near the north-west boundary of number 612 could not be fully validated due to proximity to the site's boundary. Residual

hydrocarbon contamination also remained between the northern edge of the tank pit and the northern boundary of number 612. Impacted material removed from the tank pit excavation was land farmed onsite during the remediation works for the purposes of reuse as backfill onsite.

A site audit statement completed by IT Environmental (2003) for number 612 included a review of previous investigations conducted at the site and certified the site appropriate for commercial/industrial land use. It was reported that groundwater was not to be used onsite.

Additional investigations were undertaken by SMEC (2014) and Parsons Brinckerhoff (2015) targeting backfilled material on number 612. The results indicated that the historically identified hydrocarbon impacted material at number 612 is not likely to pose a risk to future users of the site for commercial use or maintenance workers during the development. A hydrocarbon odour and discolouration is likely to be observed during removal of impacted material.

3.2.2 Number 620

Residual hydrocarbon contamination was believed to have migrated off-site from number 612 to number 620 (Parsons Brinckerhoff, 2010). Subsequently, a number of soil and groundwater investigations we conducted to determine the extent of the impact. Additional investigations identified hydrocarbon contamination in soil in the south-western corner of the site at a depth of 3.0 mBGL within sandstone bedrock, and hydrocarbon contamination in groundwater beneath the site. Remediation of impacted material in the western portion of number 620 was conducted. Following the removal of impacted soil, residual hydrocarbon impacted soil was reported at the base of the excavation at depths ranging from 2.0 m to 2.7 m and in one wall sample collected from the western boundary at a depth of 1.5 m (Parsons Brinckerhoff, 2011a).

A human health risk assessment (Parsons Brinckerhoff 2012c) and site audit report (Environ Australia Pty Ltd 2013b), completed for number 620 concluded that hydrocarbon contamination in groundwater beneath number 620 was not likely to pose any unacceptable health risks to future users of number 620 as a commercial site with basement carpark. The reports also identified that residual hydrocarbon contamination remaining near the surface of weathered sandstone bedrock may emit odours or be observed to be stained during excavation at number 620.

During remediation works in December 2015, approximately 96 m^3 of asbestos impacted fill was also identified and removed from the eastern portion of number 620 and the area validated as suitable for commercial site use.

3.2.3 Number 624

Historically, investigations conducted at number 624 were limited to the SMEC soil and groundwater investigation (SMEC 2014c). The investigation did not identify any areas of concern in soil and groundwater below the site, however a search of the Dangerous Goods Record by SMEC indicated an underground storage tank (UST) was present on site. A ground penetrating radar (GPR) survey conducted at the site identified the UST located in the north-east portion of the site. No details on the size or use of the UST were available from Health Infrastructure. It was identified that the UST should be removed prior to development and excavations should be validated in accordance with NEPM (2013).

Solutions Engineering completed an asbestos register for structures on-site in 2014 (Solutions Engineering 2014g) and identified asbestos in building structures on number 624. This was followed by the preparation of an asbestos management plan (Solutions Engineering, 2014h) to be applied during site demolition works.

A remediation action plan (RAP) was developed for the site by Parsons Brinckerhoff (2015e) and identified areas of potential contamination at the site including the area around the underground tank identified on number 624 and the soil below building footprints.

Following demolition of site buildings, further investigations were undertaken to assess soils under the building footprints. Asbestos was identified in the building footings that remain in the eastern and central portion of number 624. This material has been remediated to the extent practical, however asbestos

containing material is present in building footings that remain at the central portion of number 624 due to difficulty in removing them.

3.2.4 Acid sulfate soils

Acid sulfate soils (ASS) are acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulfides, primarily pyrite (FeS2). They are generally likely to be present in:

- marine and estuarine sediments of the recent (Holocene) geological age
- soils usually not more than five metres above sea level
- marine or estuarine settings.

Parsons Brinckerhoff (2015d) identified acid sulfate soils in natural soils across the site at depths greater than 2 mBGL. The acid sulfate soil (ASS) map sitting under the Warringah local environmental plan (LEP) (2011) identifies the general north-eastern portion of the site as being Class 4 ASS which is the second lowest ASS risk classification. Clause 6.1 of the LEP (2011) specifies that for Class 4 soils, development consent is required only for works more than 2 metres below the natural ground surface (likely for the development), or for works by which the water table is likely to be lowered more than 2 metres below the natural ground surface (unlikely for the development). It is noted that the current ground level at number 620 and number 624 is natural soil, and fill material has been removed across both sections of the site. The material at depths of approximately 2 mBGL during the targeted investigation (2015d) was described as clayey sand, sandy clay and sand of a grey, yellow, brown colour. This description is considered to be similar to natural material currently exposed at number 620 and number 624. Therefore, natural material currently exposed at the site should be treated as acid sulfate soil. At number 612, material at depths greater than 2 mBGL should be treated as ASS.

4 CONCEPTUAL SITE MODEL

4.1 Preliminary site conceptual model

The conceptual site model (CSM) has been developed based on the available information. The CSM outlines potential source, transport and receptor linkages, taking into account the site settings and surrounding land use. A source, a receptor (human or environmental) and pathway between the source and receptor must be present for a complete exposure pathway to exist. The CSM is summarised in Table 4.1.

Table 4.1 Preliminary site conceptual model

POTENTIAL SOURCES	Potential sources include: → Potentially contaminated fill material in the subsurface. → Petroleum hydrocarbons in soil at number 612 → Petroleum hydrocarbons in soil and groundwater in the western portion of number 620. → Asbestos in building footings onsite → Potential contaminants in the batter and under the asphalt → Petroleum hydrocarbons potentially in soil and groundwater in the vicinity of the UST in the north-east portion of number 624 → Acid sulfate soil in natural soils below the site
CONTAMINANTS OF POTENTIAL CONCERN	Contaminants of potential concern include: → TRH → BTEX → PAHs → heavy metals → asbestos. → Acid sulfate soil
POTENTIAL PATHWAYS	Potential migration pathways include: → Leaching and migration of contaminants vertically into underlying groundwater. → Surface water flow and lateral migration of contaminated water through preferential pathways such as drainage lines, sewers and infrastructure trenches. → Human exposure to impacted soil and/or perched groundwater during construction works (direct contact with soils and perched groundwater through dermal contact, ingestion and inhalation). → Human inhalation of vapours and asbestos fibres (onsite and offsite at neighbouring land during construction).
POTENTIAL RECEPTORS	→ Brookvale Creek located approximately 1.3 km south of the site → Groundwater last identified approximately 0.4 mBGL below the site → Drainage lines and minor waterways. → Site utility/construction personnel undertaking works during construction. → Surrounding residential occupants or commercial site users.
POTENTIAL COMPLETE EXPOSURE PATHWAYS	Potential complete exposure pathways include: → Inhalation of contaminated surface dust by construction workers at the site or users of the site and adjacent properties during construction works. → Ingestion of contaminated soil or groundwater by construction workers at the site. → Inhalation of accumulated vapour from soil or groundwater by workers at the site or users of the site.

4.2 Potential contaminants of concern

The following contaminants of concern may potentially be encountered during the construction of the site. Areas of anticipated contamination are shown on Figure 2:

- ASS been identified in natural soils at the site. The current ground level of natural soils in the northern portion of the site is 0 mBGL to 0.2 mBGL and should be treated as acid sulfate soil. Natural material at the site is described as yellow/orange/brown sand and sandy clay.
- Asbestos was previously identified in building structures and in fill at the central portions of the site. Most asbestos impacted material has been remediated and validated however, asbestos has been identified in building footings at the central portion of number 624 and may potentially be identified below remaining asphalt at the northern portion of the site.
- Minor concentrations of hydrocarbons were identified in soil at number 612. These concentrations are attributed to historically backfilled hydrocarbon impacted land farmed material following the remediation of the service station. Concentrations are considered unlikely to impact human health and the environment but may have an odour or be stained
- Hydrocarbons have been identified in groundwater and soil at the western boundary of number 620 and is likely to be identified in soil and groundwater below the residential structure onsite. Concentrations are attributed to the historical migration of hydrocarbon contamination from the service station at number 612. Hydrocarbons in groundwater were detected at concentrations that have a potential impact on the receiving freshwater and marine environments.
- Heavy metals concentrations were historically detected in soil and groundwater across the site. Concentrations exceeded the applicable freshwater and marine criteria, however, were considered indicative of regional background concentrations found naturally within groundwater.

A summary of identified contaminants of concern, including their potential effects and exposure pathways, is provided in Table 4.2.

Table 4.2 Contaminants of concern and exposure pathways

CONTAMINANT OF CONCERN	SOURCE	EFFECTS	EXPOSURE PATHWAY	RISK
ASS	ASS may be exposed during the excavation of natural soils or through lowering of the water table at the northern portion of the site.	Runoff of ASS creates water quality issues relating to acidity, soluble iron, heavy metals, and changes in bicarbonate, carbonate and dissolved oxygen levels. These changes in water chemistry can lead to the degradation to habitat. ASS soils may affect existing vegetated areas or the growth of vegetation and waterways.	Direct contact with or ingestion of acidic soil or leachate. Runoff impacting local surface water ways	Moderate, as identified in natural soils across the site.
Asbestos	Uncontrolled filling of the site historically particularly at the northern portion. If asbestos in fill is exposed through excavation, fibres may be generated at the surface.	Inhalation of asbestos fibres may cause asbestosis and possibly cancer of the respiratory system including mesothelioma.	Inhalation of free fibres or dust.	High, asbestos has been identified at the site in fill material and building footings.
Total recoverable hydrocarbons (TRH)	Hydrocarbon impact in groundwater and soil in the western portion of number 620 and in soil in the central and northern portion of number 612.	Ingestion, direct contact or inhalation of TRH may cause cancer.	Direct contact, ingestion or inhalation of volatile vapours.	Moderate, TRH may be present in groundwater and soil at the central and southern portion of the site which may be exposed during construction works.
Heavy metals	Uncontrolled filling across site.	Exposure of elevated heavy metals in fill may affect the growth of vegetation or present a human health risk. Elevated heavy metals in groundwater may impact freshwater and marine water ecosystems and domestic bores downgradient to the site.	Ingestion of soil or groundwater, or direct contact.	Low, metals have been identified but not at concentrations likely to pose a risk to human health. Environmental effects considered low risk due to land use.

5 APPLICATION OF THE EMP

5.1 Reference to the EMP

The EMP should guide the construction methodology planning and also be referred to under the following specific circumstances:

- prior to commencing works, including both 'minor works' and 'major works' (as defined in Section 6.2.1 and 6.2.2) that involve the disturbance of soils
- during work in any location where fill material is encountered
- during excavation of soils in the western portion of number 620, or where groundwater is encountered
- during excavation of soils in the central and northern portions of 612
- Where groundwater is encountered
- when the potential exists for ASS material to become exposed in natural soils
- when the potential exists for asbestos material to become exposed in fill material across the site and remaining building footings
- in the event that any unexpected contamination or potential contamination is encountered.

This EMP has been prepared to be applied during the development of the Community Health Facility; it is not applicable to the operational phase of the facility.

5.2 Responsibilities

The managing contractor appointed by Health Infrastructure are responsible for the overall implementation and maintenance of this EMP. The managing contractor appointed by Health Infrastructure are to ensure that all occupants of the site, and contractors working in these specified defined areas of the site, have been informed of the requirements of the EMP prior to commencement of any works. A copy of this plan is to be kept on site at all times during any intrusive works in these areas.

The supervisor, or person-in-charge of works, is responsible for implementing the requirements of the EMP during the course of the works and at the completion of the works.

The specific responsibilities of Health Infrastructure and the supervisor or person-in-charge of the works are outlined in Table 5.1.

Table 5.1 Specific responsibilities of Health Infrastructure and the site supervisor/person-in-charge of any future works

POSITION AND COMPANY	RESPONSIBILITIES
The managing contractor appointed by Health Infrastructure	General: - advise persons working or operating on the site of the requirements of the EMP - ensure staff and any contractors comply with the requirements of the EMP - ensure Health Infrastructure staff and contractors clearly understand the requirements of the EMP and ensure that compliance with the EMP is a condition of any agreement with these parties - ensure the conditions of the EMP are implemented and supplemented, if necessary, by any conditions of development or works approvals - commission a suitably qualified environmental consultant to update the EMP if the condition of the site is changed, and, if necessary, inform other parties of the changes - if necessary, commission a suitably qualified environmental consultant to undertake any necessary assessment, remediation, and/or validation of contamination identified during construction - if necessary, engage suitably experienced contractors (licensed asbestos assessor and/or removalist) to undertake assessment and/or removal of asbestos containing materials - ensure the site is maintained in accordance with the EMP - ensure all non-conformance and/or complaints are recorded in Appendix D of the

POSITION AND COMPANY	RESPONSIBILITIES
	EMP → ensure appropriate consents and licences (as required) are obtained for the works → provide training and induction of employees and contractors before and during the works, as appropriate (Appendix B) → maintain a log of Project Personnel (Appendix B) → provide a copy of the EMP to the supervisor or person-in-charge of the works being undertaken → ensure implementation of the EMP.
Supervisor or person-in-charge of any major works to be undertaken on the site. (The managing contractor appointed by Health Infrastructure/Contractors/ Subcontractors).	General: → implement the EMP to ensure compliance → complete the registers, databases and records required by the EMP → conduct works in an environmentally responsible manner → meet relevant occupational health and safety regulatory requirements → implement the works in a safe and responsible manner → ensure that environmental protection measures are in place and are functioning correctly during the works and after completion of the works → conduct monitoring as required in the EMP → undertake audits of activities in accordance with the requirements of the EMP → ensure non-conformance and/or complaints are reported to the appropriate Health Infrastructure personnel → ensure all works comply with relevant regulatory requirements.

5.3 Document revision

This EMP is required to be reviewed and to be updated or amended when/where necessary. The EMP must be updated if there is significant change in scope of work and/or if a new source of contamination is identified. A table of revisions is included at the beginning of this document.

It is the responsibility of Health Infrastructure to ensure the EMP supplied to any person is the current updated or amended version. The up-to-date version of the EMP will be available from Health Infrastructure.

It is the responsibility of the supervisor or person-in-charge of works proposed to be undertaken to ensure they have the current version of the EMP.

5.4 Training

A safety and environmental induction will be developed prior to work commencing and will provide the required information, instruction and training for all personnel having business on the site to enable their duties to be performed in a manner that is safe and without risk to health and minimises damage to the environment. The managing contractor will induct all site workers prior to the commencement of work.

The induction should cover the environmental controls identified in this EMP and emergency response procedures in the event of an environmental incident such as a spill or release. If any additional training requirements are identified, during site works or review of the EMP, these will be undertaken.

The managing contractor appointed by Health Infrastructure will be responsible for maintaining training records for the site, including who was trained, when they were trained, the name of the trainer and a general description of the training content.

5.5 Reporting

The following reports may be required during the work:

- → waste classification letters, identifying any waste to be removed from site, discussing analytical results and the waste classification to be prepared by the environmental consultant
- → reporting requirements including a remedial action plan and/or a validation report for unexpected finds and will be endorsed by the NSW EPA

→ inspection reports provided in Appendix C.

5.6 Non-conformance preventative and corrective action

In the event of a non-conformance, the source and nature of the event will be investigated, the effectiveness of the existing controls reviewed and modified where practical, and necessary strategies will be implemented to minimise further impacts.

5.7 Audit and review

The continued applicability of the EMP shall be reviewed and assessed every 12 months from the date of effect. The review shall include consideration of all implementation, investigation and monitoring data available from the preceding 12 months, and will be recorded in the inspection report in Appendix C. The inspection report must detail a record of inspections undertaken at the site during excavation works and to record the results of the inspections including a record of any corrective actions. Visible observation of the surface area, adequate drainage and potential signs of erosion should be recorded.

6 GENERAL SITE MANAGEMENT

6.1 Work health and safety requirements

Prior to undertaking excavation works at the site, a site safety plan should be prepared to document occupational health and safety procedures on site. All personnel at the site should be required to read and understand the safety plan and sign on prior to commencing any work on site.

6.2 General controls

6.2.1 Major works

Major works proposed for the project area include:

- excavation of soils
- construction/maintenance works which involve soil disturbance
- construction and maintenance of subsurface services, such as gas, electricity, stormwater, surface drainage, telephone cabling and water supply
- installation of equipment (e.g. building foundations) that require excavation of soils for placement of footings

For any major works, determine if specific controls are required. General controls measures for major works comprise:

- All site workers and subcontractors should complete a site induction prior to commencing any maintenance or construction works at the site (Appendix E). The induction must cover the unexpected findings protocols in section 11 of this document.
- A work health and safety (WHS) plan should be prepared by the contractor which will include safe work method statements (SWMS). This should recognise this EMP.
- Throughout the duration of any excavation or site works as part of the construction of the site, site personnel should ensure a suitably competent supervisor is present at all times to observe excavations and assess for unexpected finds, asbestos impacted soils and acid sulfate soils.
- Appropriate personal protective equipment (PPE) should be worn. Based upon the contaminants of concern at the site, long sleeved shirt, long pants and protective gloves (preferably nitrile gloves, below leather gloves) should be worn when undertaking any intrusive works. Where dusty conditions prevail, a fine water mist should be applied during excavation. A disposable P2 dust mask should also be utilised.
- Good personal hygiene must be implemented by maintenance workers at the site, including:
  - no eating, drinking or smoking during works
  - avoid contact with soil (wear gloves)
  - wash hands and clothes after work
  - wash hands before eating, drinking or smoking.
- Dust prevention measures must be put into place – if the conditions are windy, this may include dampening of fill materials prior to and during excavation works.
- The surface capping material must be reinstated following removal and disposal of all excavated potentially contaminated fill materials.

6.2.2 Minor works

Minor works for the project are those which have only limited potential for exposure, including cleaning, and general maintenance activities.

No specific controls are required for minor works, although all site workers and subcontractors should complete a site induction prior to commencing any maintenance or construction works at the site (Appendix E) and site workers are required to be aware of the unexpected findings protocols in section 11 of this document.

6.3 Excavation work

During excavation work the following procedures and controls should be in place:

- Ensure erosion and sediment controls are in place prior to works commencing particularly on highly erodible soils.
- Erosion and sediment control will include (where necessary):
  - diversion banks/drains upslope of the work to divert water around the disturbed area. Drains must discharge onto stable, preferably vegetated surfaces or through sediment controls such as silt fences
  - level spreaders or straw bales at the end of diversion banks of any overland flow paths leading from the disturbed area, to dissipate flows and trap sediments
  - geotextile filter fabric fences down slope of the work areas
  - straw bales or filter fabric socks at the entrance to any drains, gutters or watercourses.
- Maintain all sediment controls as necessary until the site is stable. Once the project site has been stabilised, temporary sediment controls will be removed.
- Any permanent water-retaining structures or other erosion and water management controls will be routinely maintained.

On completion of excavation works:

- any exposed areas are to be stabilised (that is, compacted, sealed or vegetated) as soon as practicable following completion of works
- erosion and sediment controls devices are to be removed once work areas have been rehabilitated.

6.4 Stockpile management

Stockpiles should be placed to minimise environmental impact. The design of stockpile(s) should include:

- bunding
- an impervious pad on which to place stockpiles
- minimisation of the amount of water infiltration – consider using some form of cover or capping if soil is to be stockpiled for an extended period of time
- sediment control upslope to prevent run-on water.

To manage spoil effectively and meet the above requirements, excavated materials should be stored in a designated area at each site and re-used or disposed of off-site as soon as possible following excavation.

6.5 Contaminated spoil management

Spoil containing contaminated material will require additional management to minimise potential spread of contamination or leachate. This includes:

- stockpiles containing asbestos and/or other contamination should be placed on and covered with plastic sheeting

- stockpiles containing asbestos should be monitored for dust and if necessary should be kept moist to prevent dust production
- soil that has the potential to generate vapour or odour should be kept covered and monitored to prevent exposure.

ASS which is required to be excavated should be stockpiled in accordance with the measures detailed in Section 8.

6.6 Material tracking

Stockpile tracking should include the following:

- the location, dimensions, volume, source and contamination status, on-site and off-site, if removed for disposal
- where stockpiles are moved on-site, the new location and any required validation of the area where the stockpile was removed should be recorded.
- Use of the NSW EPA waste tracking system to ensure all waste is accounted for and disposed of appropriately.

6.7 Waste disposal

6.7.1 Waste classification for off-site disposal of soil or fill

Waste classification is required for any excavated soil or fill material which is to be disposed of off-site. Soil or fill material to be taken off-site for disposal shall be assessed in accordance with the Waste Classification Guidelines (NSW EPA, 2014).

Materials excavated from the site should be tracked from ‘cradle to grave’, in order to provide detailed and accurate information about the location and quantity of all materials both on and off-site from the time of their excavation until their disposal.

For any truck or bin leaving the site, the following information would be recorded:

- origin of material
- material type
- approximate volume
- truck and/or bin registration number.

6.7.2 Waste classification for off-site disposal of groundwater

In the event that any dewatering or collection of groundwater from excavations is required, the following procedures must be followed:

- Any water pumped from the excavations or runoff collected is to be stored in retention basins, or fully contained tanks, on-site in preparation for disposal to an EPA licenced facility.
- Water samples are to be collected that are representative of the stored water; this may require sampling from different depths by a suitably qualified environmental consultant, particularly if the water has been stored long enough to allow it to settle. Samples should be analysed for contaminants of concern; i.e. TRH, BTEX, PAHs and metals. A sufficient quantity of sample, pre-filtered and/or preserved (as necessary) should be placed in appropriate sample containers and stored so as to allow a range of chemical analyses to be performed.
- Liquid waste will be disposed of in accordance with the POEO Act.

6.7.3 Waste classification for off-site disposal of soil or fill containing ASS

ASS is present in natural soils at the site and can be further visually identified by the following observations:

- soil colours – look out for green/grey colours, presence of jarosite, a distinct buttery yellow coloured iron mineral
- peaty soils
- corroded infrastructure, particularly around footings
- distinctive 'rotten egg' smell indicates the presence of hydrogen sulfide.

In addition to the general waste classification requirements, for ASS:

- for virgin excavated natural material (VENM) containing potential ASS (potential ASS (PASS); pH of 5.5 or more):
  - the materials must be kept wet at all times during excavation and subsequent handling, transport and storage
  - if sending material to a landfill, the receiving landfill must be licensed by the NSW EPA to dispose of PASS below the water table in accordance with the licence requirements
  - material can be reused on-site if it has been appropriately treated and validated (in accordance with the strategy outlined in Section 6.8)

For actual ASS (actual ASS (AASS); pH of 5.5 or less) or potential ASS that has dried out, undergone any oxidation of its sulfidic minerals or is not VENM:

- The materials must be treated (neutralised) on-site through liming, mixing and testing to ensure that the mixing of lime materials is successful. Monitoring of pH should be carried out regularly during and after the neutralisation procedure to establish the effectiveness of the treatment (in accordance with the strategy outlined in Section 6.8).
- Where excavated PASS materials cannot be re-used on-site they must be disposed of to a suitably licensed off-site waste facility.
- The receiving landfill must be licensed by the EPA to accept the class of waste as per the classification. The landfill must be informed prior to receiving the waste that the material contained actual ASS and was treated in accordance with the neutralising techniques outlined in ASSMAC (1998).
- Soil should be sampled for classification in accordance with the waste classification guidelines (NSW EPA, 2014).

6.7.4 Disposal of fragments of asbestos containing material (ACM)

All work shall be carried out in accordance with the NSW Workcover How to Safely Remove Asbestos: Code of Practice, 2011 made under section 274 of the Work Health and Safety Act 2011. Handling and disposal of asbestos waste material should also be carried out in accordance with the POEO Act, Protection of the Environment Operations (Waste) Regulation 2005 and waste classification guidelines (NSW EPA, 2014). Management of ACM material is discussed in detail in Section 7.

6.8 Importation of materials

All materials imported for use at the site should be sampled to confirm that they are suitable for use at the site. Any imported fill, either VENM or other imported material, should be accompanied by relevant documentation and the source site of the material should be inspected.

Assuming material is accompanied by appropriate documentation, samples will be collected and analysed at a rate of approximately 1 sample per 100 m^3 for the first 1,000 m^3 of imported fill materials and then 1 sample per 500 m^3 thereafter (assuming the same source). Imported fill samples would be submitted for analysis of TRH, BTEX compounds, PAHs, pesticides, PCBs, asbestos and heavy metals. Should documentation not be considered sufficient, additional sampling may be required to further assess the material.

The results of validation sampling should be compared to the NEPM (2013) criteria.

7 ASBESTOS MANAGEMENT MEASURES

7.1 Overview

This section is aimed at ensuring the health and safety of staff, contractors and visitors with regard to any asbestos containing material (ACM) or potential ACM in or on soil at the site. The plan is to be implemented during the excavation works being undertaken in the northern portion of the site where building footings contain ACM and fill material has historically been identified to be impacted with fragments of ACM or potential ACM and friable asbestos fibres or potential friable asbestos fibres.

The objective of the plan is to describe procedures to minimise exposure of all site occupants to asbestos materials through the development and implementation of the management systems outlined herein.

It is the responsibility of the managing contractor appointed by Health Infrastructure to ensure that each time an action is undertaken in areas described above, that the action is recorded and signed off.

7.2 Asbestos impacted soil excavation works

When excavation works are carried out within the identified asbestos zones, works must be carried out under the direct supervision of a contractor holding an appropriate asbestos licence from WorkCover NSW. The appropriate level of licence required is determined in consultation with the consultant prior to the engagement of the contractor. The consultant can be utilised to provide on-site support to ensure all works are conducted in accordance with the contractor's licensing conditions. All work should be undertaken in compliance with the Work Health and Safety (Asbestos) Regulation 2014 and any applicable future guidance released by NSW EPA.

This will include putting the following measures in place to address potential impacts:

- The area will be defined as containing asbestos and appropriate buffer zones (asbestos work area) will be established in accordance with the on-site recommendations of an occupational hygienist.
- Wash bays should be installed on-site to prevent tracking of contaminated soil outside the buffer zone.
- All relevant site personnel will undergo a site induction prior to entering the asbestos work area to ensure that staff and contractors are adequately trained to recognise environmental aspects, hygiene and WHS issues. The induction will incorporate the activities required to manage contamination issues as detailed in this plan.
- A water supply is to be on site for dust suppression during loading.
- At the end of each day an inspection of the work area will be made to ensure no asbestos impacted material is loose outside of the excavation area.
- Appropriate personal protective equipment (PPE) will be used within the asbestos work area including disposable overalls, a minimum P2 respirator (dust mask) and gloves.
- A decontamination area will be installed on site to enable on-site personnel to remove any dust that may contain asbestos fibres. Overalls, P2 masks, gloves and any other potentially contaminated PPE or equipment must be disposed of or properly decontaminated before leaving the decontamination area.
- Water from wash down and decontamination units will be filtered prior to re-use on site.
- Continuous asbestos fibre monitoring will be conducted by an independent hygienist at the perimeter of the area and within excavator cabs and checked daily in accordance with Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC: 3003(2005)], April 2005.
- An independent occupational hygienist should be engaged to carry out a visual assessment and validation sampling of the excavation base and walls following the completion of the works.

- All asbestos contaminated fill leaving site will be transported in a leak proof covered vehicle and disposed of at a licensed facility in accordance with NSW EPA (2014) Waste Classification Guidelines.
- Any asbestos impacted soil remaining on site must remain undisturbed, sealed and in a good stable condition.

8 ACID SULFATE SOILS MANAGEMENT STRATEGIES

8.1 General

There are a range of control and management measures available when dealing with the possible disturbance of potential acid sulfate soils (PASS) or actual acid sulfate soils (AASS). Such measures can be implemented individually or jointly as part of a combined approach.

The following general strategies are outlined in ASSMAC (1998):

- **Avoidance** – where ASS areas are avoided altogether (total avoidance) or development activities are adjusted so that the more severe areas are left undisturbed (partial avoidance).
- **Oxidation prevention** – ASS are innocuous if they are not allowed to oxidise. Oxidation can be prevented by avoidance, water table control, in situ capping or removal and burial below the water table.
- **Acid neutralisation** – acid present or produced by oxidation in the soil can be controlled by the addition of alkaline agents such as agricultural lime.
- **Leachate treatment** – where the sulfidic content of the soil is very low (quantity), deliberate oxidation with leachate collection and treatment might be appropriate. This method is generally only applicable to sands, given the lengthy drying times for clay, and would require pilot trials prior to implementation.
- **Disposal to landfill** – the ASS may be removed and disposed of at an appropriate landfill facility. Untreated ASS would require treatment as a contaminated soil for the purpose of transport and disposal.
- If natural material is exposed at the site, the probability of encountering ASS is high, should ASS be encountered and be required to be disturbed, the most feasible management strategy for the works would be oxidation prevention.

8.2 Excavation

The following management considerations should be taken into account when excavating PASS or AASS (ASSMAC, 1998):

- Where the sulfidic layer is <0.5 m deep, these areas should ideally be left undrained with minimal disturbance (i.e. generally these areas are best left waterlogged).
- Where the sulfidic layer is between 0.5 and 2.0 m deep, drainage and excavation should only be attempted in accordance with a properly designed management plan:
  - if the sulfidic layer is 0.5 to 1 m below the soil surface, excavation should be limited to areas less than 0.3 m deep
  - if the sulfidic layer is 1 to 1.5 m below the soil surface, excavation should be limited to areas less than 0.5 m deep
  - if the sulfidic layer is more than 1.5 m below the surface, excavation should be limited to areas no greater than 1 m deep.
- Where areas are ‘scalded’ or degraded and devoid of vegetation, no further drainage or excavation should be undertaken. Remediation strategies should be developed.

Should PASS be encountered, the overall remedial strategy to be adopted should include:

- burial of excavated PASS materials below the water table where possible
- neutralisation of PASS materials where re-use on site above the water table is required
- disposal of excess PASS material to an appropriate off-site facility where it cannot be reused on-site.

8.3 Spoil management

Where ASS materials are excavated, short and long term management of the material is required. If the excavated material is to be stockpiled prior to treatment and/or disposal, provisions should be made for safe storage.

The time between excavation and acid generation depends on a range of variables including, though not limited to, the texture, mineralogy, temperature and bacterial activity of the excavated material. Particular care is required when dealing with sandy sediments, which oxidise and leach more rapidly than clays. Oxidation in clays is often slower than sands due to advective and diffusive oxygen considerations.

Works that involve short term disturbance of ASS should be staged to minimise the costs associated with mitigation measures and the risk posed to the environment. In some circumstances, the sulfidic material can be reburied into anaerobic conditions as quickly as possible prior to acid generation. As a general guide, sandy soils should be reburied into anaerobic conditions within one day while clay soils should be reburied within a couple of days. Neutralising agents should be incorporated with the excavated material prior to reburial to neutralise any acid that may have been or will be produced through oxidation by excavation and reburial.

Guidelines detailing the amount of lime required to treat specific volumes of disturbed ASS are presented in ASSMAC (1998). When estimating lime requirements in accordance with ASSMAC (1998) guidelines, a safety factor of at least 1.5–2 times the weight/volume should be applied to allow for inefficient mixing of the lime and its low reactivity. In addition, the purity and effective neutralising values also needs to be included in the estimation of lime requirement, as specified in ASSMAC (1998).

8.4 Neutralisation rates

As a guide, PASS materials with a pH less than 6.0 should be considered as AASS and would require immediate neutralisation, while such materials with a pH of 6.0 or greater should be classified as PASS. The pH of the material must be measured using an appropriately calibrated pH meter.

The most common ASS neutralising method involves the addition of sufficient quantities of a neutralising agent to neutralise acid as it is produced from the gradual oxidation of the ASS. Fine agricultural lime with a pH of 8.2 is the most commonly used neutralising agent. The following factors should be considered when selecting neutralising agents:

- neutralising value (NV) and effective neutralising value (ENV)
- solubility
- pH, chemical constituents, moisture content, contaminants or impurities
- grades of lime, fineness rating or particle size
- purchase price per tonne, delivery costs and size of a full load
- spreading and mixing costs.

Appropriate neutralising treatment must be determined based on analytical results of ASS. Appendix G provides the neutralising calculations worksheet from ASSMAC (1998) which can be used to determine the appropriate dosing rates based on laboratory data from any ASS identified during the targeted soil investigation works (Parsons Brinckerhoff 2015d).

8.5 Dewatering and groundwater management

Changes in groundwater levels can have major impacts on the generation and release of sulfuric acid from ASS. Impacts on groundwater will vary according to the material properties of the aquifer, the characteristics of the proposed works and its interaction with the surrounding environment.

Works that lower the water table can result in the oxidation of ASS leading to the degradation of groundwater quality with reduced pH and increases in soluble metal and sulfate concentrations. Exposure or near exposure of groundwater during excavation increases the potential threat of contamination via sulfide oxidation.

Where PASS is identified dewatering or work resulting in a lower of the groundwater table should be avoided. Where such work is required PASS may need to be excavated and managed.

8.6 ASS control and management measures

Table 8.1 outlines the controls and management measures to be implemented to manage the potential ASS materials at the site. Works are divided into three groups based on the timing of the works:

- management measures to be implemented prior to commencing any excavation works that disturb ASS
- management measures to be implemented on-site during the excavation works
- management measures to be implemented following completion of the excavation works.

Table 8.1 Management of ASS materials

PRIOR TO EXCAVATION WORKS DISTURBING ASS	
Wash bays	Wash bays should be installed at the site to minimise off-site tracking of contaminated materials by machinery. Wash bays should be used prior to trucks/machinery leaving the site or when moving from an excavation area to a clean area of the site. Leachate controls should be employed around wash bays to minimise the spread of contamination. These should include collection of runoff.
Staged excavation planning	Staged excavation works should be implemented in the areas PASS/ASS have been identified, or are suspected, to minimise the risks posed to the environment and to minimise oxidation of in situ materials. To achieve this, the excavation area should be excavated systematically as a series of smaller 'cells' rather than one large area. Where ASS materials are left in situ as the uppermost layer and exposed (i.e. not saturated), areas should be either capped with clean virgin excavated natural material (VENM) or concrete as soon as possible prior to moving to the next area. Ideally, the optimum 'cell' size should be calculated based on the area that can be worked on and completed (including capping works) in a single day. Prior to commencement, a works schedule should be prepared indicating when each area will be excavated and capped. Areas should be marked out prior to the excavation works taking place.
DURING EXCAVATION WORKS DISTURBING ASS	
Excavation	Employ erosion control measures potentially including temporary bunding, covers, silt fences/socks and hay bales around excavations prior to the commencement of intrusive works. 'Cell' areas should be excavated separately to minimise oxidation of in situ materials and to allow for immediate capping where required.
Management of excavated materials	Excavated PASS materials may be managed using one (or a combination) of the following methods: - reburial of excavated materials at the site as soon as possible beneath the water table (this may include temporary storage prior to reburial to maintain the saturation of the materials prior to reburial) - neutralisation of excavated materials using a liming product and re-use on site - disposal of excavated materials to an appropriately licensed off-site waste facility as per the NSW EPA (2014) **Waste Classification Guidelines Part 4: Acid Sulfate Soils**. These options are discussed in further detail below.
Re-use of PASS materials	**Option 1: Immediate re-burial** Excavated PASS materials may be re-used on-site by burying the materials in an area of the site located below the water table. This must be done within 16 hours of excavation works to avoid acid generation. If the material is to remain exposed at the surface, it should be capped as detailed in the 'capping' section of this table. If the material is required to be stored for longer than 16 hours, then it must either be: - placed in a temporary holding area where it can remain saturated (either below the water table in another area of the site or in an artificial saturated area such as a holding pen filled with water) - treated as per Option 2.

	Option 2: On-site treatment and re-use Where PASS materials are to be re-used on-site in areas not saturated or more than 16 hours after excavation, these materials must be treated prior to re-use. Materials should not be placed at the immediate surface where they are exposed for aesthetic purposes. Treatment must be undertaken on a developed hardstand area or suitable engineered pad or limed surface. The hardstand area would require appropriate drainage controls to ensure that any runoff is collected. Treatment measures are discussed in Section 8.8.
Off-site disposal	If excavated PASS materials cannot be re-used on site, they should be disposed of to a suitably licensed off-site waste facility. This is discussed in further detail in Section 6.4
Capping of excavations	To minimise the generation of acids, open excavations where the uppermost exposed layer contains PASS materials should be capped as soon as possible or left saturated. If capping is necessary, one (or a combination) of the following capping options should be used: → cap with clean, imported VENM (tested to ensure it meets the appropriate criteria for imported VENM materials) → cap with re-used soil from on-site (tested to ensure it is within the adopted site assessment criteria and does not contain ASS) → cap with concrete. Capping should occur within 16 hours to minimise the environmental risks associated with acid generation. Where concrete or other building materials are to be placed directly in contact with PASS or AASS, appropriate materials should be chosen that are resistant to the long term effects of sulfate and sulfuric acid which may be produced by the soils.
Spoil management	Stockpiles containing PASS materials should be placed to minimise environmental impact from any leachate. ASSMAC (1998) indicates that the design of stockpile(s) should include the following controls: → all stockpiles to be bunded → establish leachate collection and treatment systems including an impervious pad on which to place the stockpile → if an impervious pad has not been established under the stockpile, as a precautionary measure, an apron of fine lime should be applied below the stockpile when stockpiling materials for any length of time → minimise the surface area exposed to oxidation – consider using some form of artificial capping if storage is for longer than a few weeks → minimise the amount of water infiltration – consider using some form of artificial capping → establish diversion banks upslope to prevent run-on water → establish sediment control structures to ensure sulfidic material is not eroded – consider using some form of capping. To manage spoil effectively and meet the above requirements, excavated materials should be stored in a designated area at each site and re-used or disposed of off-site as soon as possible following excavation.
Dewatering (where required)	Some dewatering may be required due to excavation occurring above the standing water level of the groundwater. Pumped water should be stored in retention basins or fully contained tanks on-site. Stored water may disposed of to a suitably licensed off-site waste facility as liquid waste, as per the NSW EPA (2014) **Waste Classification Guidelines**.

8.7 Suspected ASS

If suspected ASS is encountered at the site in accordance with the description provided in Section 3.2.4, in areas that have not been identified in previous investigations to contain ASS, field screening for pH and pH_{FOX} should be undertaken to determine whether material is actual or potential ASS. Laboratory analysis may be required to determine treatment requirements (e.g. liming rates).

Field pH measurements of all materials excavated should be taken and logged to provide broad coverage of the excavated material types encountered. One sample should be collected per 25 m^3 of excavated natural soil materials for on-site pH testing. Field pH readings of 4 or less will indicate that ASS are present with

oxidising sulfides, readings of greater than 4 but less than 5.5 indicate that the soils are acidic and may be the result of limited oxidation of sulfides.

Selected field samples should be tested for the presence of ASS using the suspension peroxide oxidation combined acidity and sulfate (SPOCAS) method. These materials will require treatment/neutralisation prior to re-use or disposal. Laboratory results should be compared to the action criteria provided in Table 4.4 of the Acid Sulfate Soils Management Advisory Committee 1998, *Acid Sulfate Soils Assessment Guidelines*. These have been provided in Table 8.2 for reference.

Table 8.2 ASS action criteria (as per Acid Sulfate Soils Management Advisory Committee, 1998)

TYPE OF MATERIAL		ACTION CRITERIA 1-1,000 TONNES DISTURBED		ACTION CRITERIA 1,000 TONNES DISTURBED	
TEXTURE RANGE	APPROX. CLAY CONTENT (%<0.002 mm)	SULFUR TRAIL %S oxidisable	ACID TRAIL mol H^+/tonne	SULFUR TRAIL %S oxidisable	ACID TRAIL mol H^+/tonne
Coarse texture (Sands to loamy sands)	≤5	0.03	18	0.03	18
Medium texture (Sandy loams to light clays)	5-40	0.06	36	0.03	18
Fine texture (Medium to heavy clays and silty clays)	≥40	0.1	62	0.03	18

8.8 Treatment measures

Where pH testing of excavated soil indicates that it is acid generating, treatment will be required prior to reburial or disposal of the material.

The most common ASS treatment measure relies on blending the soil with sufficient neutralising agent. Most treatment measures will result in a partial oxidation of ASS either deliberately or inadvertently. In most cases, the natural buffering capacity of the soils will initially contribute to the neutralisation of acid produced, however, depending on the sulfide content, additional neutralising material is typically needed.

Oxidation of sulfide and neutralisation using lime or similar agents – fine agricultural lime with a pH of approximately 8.2 is the lowest cost, most widely used, and the safest neutralising material. When estimating lime requirements in accordance with ASSMAC (1998) guidelines, a safety factor of at least 1.5 to 2 times the weight/volume should be applied to allow for inefficient mixing of the lime and its low reactivity. In addition, the purity and effective neutralising values also needs to be included in the estimation of lime requirement, as specified in ASSMAC (1998).

Other more caustic neutralising agents such as magnesium hydroxide (pH 12) or slaked lime (pH 12) pose an environmental risk to estuarine ecosystems from overdosing. In addition, workplace health and safety issues need to be considered when dealing with strongly alkaline neutralising agents such as magnesium hydroxide and slaked lime.

Works that involve the treatment of large quantities of ASS should be undertaken in stages for effective neutralisation management. Where there is a level of uncertainty with the method of lime application, field trials and/or further investigations may be required.

Neutralisation success relies on effective mixing of the neutralising agents and soil. Over the longer term iron, aluminium and gypsum precipitates may coat the neutralising agents, thereby reducing their effectiveness.

The Table 8.3 provides information regarding mixing methods for neutralising agents and potential and/or actual ASS.

Table 8.3 Mixing method summary

APPLICATION	NOTES REGARDING APPLICATION METHODS (ASSMAC, 1998)
Broadscale mechanical application	Rotary hoeing and tillage can be used to mix lime into soil over a large area. During the period of mixing, aeration of the soil is likely to increase the rate of acid production, however the lime should prevent a substantial lowering of soil pH and the proliferation of bacteria that accelerate acid production. Such methods are useful in the treatment of agriculture land and stockpiled extracted material to make it suitable for use in land formation or construction.
Lime Buffers	Establishing a 'lime buffer' at the face of any recent excavation which exposes ASS by sandbagging the face and incorporating lime under and in the sandbags so that the acid leachate flows through the sandbags; backfilling the face with clean fill mixed with lime/sand mix; and excavating a trench behind the face and incorporating a lime/sand mix or barrier so that the acid leachate/water must pass through. Insoluble coatings and preferred pathways may limit the effectiveness of 'lime barriers'.

Full lime treatment and gradual oxidation of ASS involves the quantity of lime required to neutralise all of the sulfidic material present (based on soil analysis results) plus a safety factor of 1.5 (refer to ASSMAC, 1998). This involves spreading out ASS in thin layers (0.15–0.3 m) over a thin bed of lime, air drying and mechanically breaking up clods as drying proceeds. When the soil is sufficiently dry, lime is applied and thoroughly mixed. The material is then compacted prior to the treatment of the next layer. Effective drying and mixing of lime with clay is often very difficult. In addition the sulfide distribution in some soils can be highly variable.

The advantage of this method is that although some oxidation occurs during the drying phase, the presence of an excess quantity of lime tends to prevent extreme acidity developing in the soil. When disturbed, unlimed sulfidic soils can have a pH <4, providing favourable conditions for the build-up of oxidising bacteria. Under such conditions, chemical oxidation processes may be accelerated by factors greater than a thousand fold through accelerated bacterial pyrite oxidation. A reduced or retarded acid production rate favours the complete neutralisation of acid with the added lime, reducing risk of acid leachate. When the mixed layer is compacted, air and water entry/infiltration is also reduced, further assisting the slowing of oxidation.

Hastened oxidation without lime incorporation (mixing) involves regular moistening of sulfidic soil to enhance bacterial oxidation processes and effectively aerating the soil by mechanical disturbance. It can be used to treat excavated acid sulfate sandy/loamy material with low concentrations of sulfidic material prior to its use in land formation. The method has the potential for a permanent treatment of the sulfidic material but may take an unacceptable period of time, especially in non-sandy materials. This treatment method is very problematic when dealing with marine clays or materials containing high concentrations of sulfidic material.

The approach of hastened oxidation without lime incorporation and neutralising the leachate poses greater environmental risks than the complete lime mixing method. During and after oxidation, the leachate and the soil usually contain toxic quantities of aluminium, iron and magnesium, in addition to acidity. Other heavy metals or contaminants can also be made soluble by the acid leachate. Once the soil has been properly treated by this method, it cannot be considered to be 'free' of acid generation potential until fully tested.

9 ACHIEVEMENT AND MANAGEMENT OF OBJECTIVES

9.1 Induction

All personnel, including subcontractors, undertaking major works on the site will be made aware of the requirements of this EMP and will receive an environmental induction (Appendix E) prior to commencing work. These inductions shall be recorded in Appendix B.

9.2 Duration

The EMP shall remain applicable to the site until such time as the conditions are deemed to no longer apply.

9.3 General monitoring and reporting requirements

Monitoring of any site maintenance/excavation works may be undertaken to check whether the EMP is being effectively implemented by the maintenance workers/site users/subcontractors and whether any corrective actions are required. The inspection and monitoring activities that could be undertaken are outlined in Table 9.1.

Table 9.1 Monitoring and measurement for works

ACTION	RESPONSIBILITY	FREQUENCY
Develop a WHS plan	The managing contractor appointed by Health Infrastructure	As required for major and minor works
Monitor site maintenance works and effectiveness of risk mitigation measures	The managing contractor appointed by Health Infrastructure	As required for major works
Monitor dust generation and implement mitigation measures	The managing contractor appointed by Health Infrastructure	As required for major works
Disturbed areas to be reinstated on completion of site maintenance works	The managing contractor appointed by Health Infrastructure	As required for major works
Monitor effectiveness and control of waste management of contaminated soils and appropriate disposal	The managing contractor appointed by Health Infrastructure	As required for major works

9.4 ASS monitoring and reporting requirements

Table 9.2 outlines the ASS monitoring and reporting program during the works.

Table 9.2 Monitoring and reporting program

GENERAL	Monitoring of ASS control/management procedures including excavation methods, spoil management measures, and dewatering and groundwater management should be undertaken. ASS pollution incident response investigations, including management and/or remediation measures, should be prepared as required.
SOIL MONITORING PROGRAM	The following will constitute the soil monitoring program during the works: → Field pH readings of 4 or less will indicate that ASS are present with oxidising sulfides,

readings of greater than 4 but less than 5.5 indicate that the soils are acidic and may be the result of limited oxidation of sulfides.

- Selected field samples indicating ASS should be tested for chromium reduced sulfur (SCR%) to differentiate between the sulfidic sulfur and the more environmentally benign organic forms of sulfur to indicate the presence of ASS. These materials will require treatment/neutralisation prior to re-use or disposal.
- Where soils are required to be limed, materials should be tested to ensure that the neutralisation process has been successful. Field testing should be undertaken at a rate of one per 50 m^3, if changes in liming rates or material are observed additional samples should be collected. Laboratory testing (SPOCAS) should be undertaken at a rate of 25% of field samples to confirm the results.
- For waste disposal:
  - Material is pre-classified as PASS material as per the NSW EPA (2014) **Waste Classification Guidelines Part 4: Acid Sulfate Soils** providing it is delivered to the receiving waste facility within 16 hours of excavation.
  - Failing this, material will require liming and testing to ensure that the material has been successfully neutralised and to classify the material as per the NSW EPA (2014) **Waste Classification Guidelines Part 1: Classifying Waste**.

Information should be recorded and filed for each batch of soil tested. Information should include the origin of the material, the volume, a description of the materials, laboratory results and disposal certificates (where appropriate).

ASS WATER MONITORING

If groundwater is encountered though the works the following will constitute the water monitoring program during the works:

- Any pumped water from the excavations and runoff collected should be stored in retention basins or fully contained tanks on-site.
- Water samples should be representative of the stored water and may require sampling from different depths, particularly if the water has been stored long enough to allow it to settle. A sufficient quantity of sample, pre-filtered and/or preserved (if required), placed in appropriate sample containers and stored so as to allow a range of chemical analyses to be performed.
- Water stored in basins/tanks should be tested for metals (aluminium, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel and zinc) and cations and anions to characterise the water quality. In addition, the water should be tested for physical parameters on site including dissolved oxygen, electrical conductivity, pH, reduction/ oxidation potential, temperature and turbidity.
- If runoff is stored separately to any pumped water, the requirement for site runoff can be met via the following water quality criteria being tested for and met prior to off-site discharge of collected runoff:

WATER QUALITY CRITERIA	REQUIREMENT
Total suspended solids (TSS)	No greater than 1,500 mg/L
pH	Between 6.5 and 9.0
Iron	No greater than 500 µg/L
Aluminium	No greater than 5 µg/L for pH <6.5 and no greater than 100 µg/L for pH >6.5
Oil or grease	No visible oil or grease film

ASSMAC (1998) provides water quality performance criteria. The water quality criteria (based on ANZECC 1992) to be met for the discharge of water into the environment are summarised as follows:

WATER QUALITY INDICATORS	FRESH WATER	MARINE WATER
pH	6.5–9.0	<0.2 unit change
Iron (Total)	500 µg/L	Not applicable
Total dissolved solids (TDS)	0–1,500 mg/L	> 1,500 mg/L

	Aluminium	5 µg/L for pH <6.5 100 µg/L for pH >6.5	Not applicable

10 EMERGENCY RESPONSE

10.1 General

All unplanned events, irrespective of how minor the event, shall at the first opportunity be reported to the managing contractor's supervisor and then to Health Infrastructure and relevant stakeholders and/or government agencies as necessary. Additionally, should any other site personnel, company visitors or contractors experience an unplanned event they should also report the event through their own organisation's internal reporting mechanism. Employees and contractors directly or indirectly involved with an unplanned event are obliged to assist with the investigation if requested to do so. All unplanned events shall be investigated. The degree and level of investigation shall depend on the outcome of the actual event, the outcome of a similar event if not controlled.

Discharge of water containing contamination, suspended matter, any oils or similar materials or any foaming or non-biodegradable detergents into the waterways on and adjacent to the work area is to be avoided using all proper precautions. Any release of water may be a breach of NSW EPA regulations and may be subject to action by the NSW EPA.

Any occurrence which may result in the contamination of the land, surface or groundwater or air should be immediately reported to the site supervisor and Health Infrastructure immediately. Any occurrence which does or may result in exposure of site workers or the public to contamination should be immediately reported to the site supervisor and Health Infrastructure immediately and to emergency services if necessary.

Where an occurrence is deemed to be reportable to the NSW EPA it should be reported at the earliest opportunity.

10.2 Spill management

In the event of a chemical spill, including of potentially contaminated groundwater, the following procedures will be implemented:

- Work will be immediately ceased and the spill will be contained and cleaned up using the spill kit.
- For large leaks, which cannot be contained using the spill kit, or leaks that leave the site, emergency services will be contacted for assistance (000).
- All leaks and spills to be reported as environmental incidents.

10.3 Emergency contacts

Emergency contacts for the parties are presented in **Error! Reference source not found.**.

Table 10.1 Emergency contacts

CONTACT	OFFICE NUMBER	MOBILE NUMBER
TBC		
TBC		
TBC		

11 UNEXPECTED FINDS PROTOCOL

Contamination that may not have been detected during previous investigation works may be discovered during the course of excavation works. Such contamination may be discovered due to observations such as:

- odour
- discolouration or staining of soil or rock
- seepage of unusual liquids from soil or rock
- unusual odours or sheens on groundwater
- unusual metal objects
- presence of underground storage tanks
- presence of oil
- presence of waste or rubbish above or below ground
- potential asbestos containing material
- unusual colour in soil
- unusual colour in groundwater.

If such contamination is discovered, the following procedure will be implemented:

- excavation will cease in the vicinity of the discovery
- the Health Infrastructure authorised person will be informed immediately of the event
- excavation should stop and a suitably experienced environmental consultant should undertake an assessment of any unexpected finds and determine any further actions required e.g. sampling and/or validation of material, potential for remediation and/or management
- a form recording the unexpected find/s should be completed and the register updated and signed off as appropriate (see Appendix F)
- excavation will not recommence until the extent of the contamination has been assessed and, if necessary, a remedial action plan (RAP) has been prepared
- the material will be separated from other materials and stockpiled for assessment
- sampling of the materials will be undertaken in accordance with the relevant guidelines
- samples will be analysed for a range of analytes as required
- laboratory results will be assessed to determine the appropriate waste classification of the material in accordance with the waste classification guidelines (NSW EPA, 2014)
- depending on the classification, material already excavated and stockpiled will be transported to an appropriate waste facility that is licensed to accept waste of the relevant classification or beneficially reused if appropriate
- depending on the classification, vehicles transporting the waste may need to be licensed in accordance with NSW EPA requirements. Prior to works commencing appropriate instruction shall be obtained from NSW EPA
- a waste tracking system recording the volume of material, waste classification status, removal documentation and truck and receiving landfill facility details must be recorded to ensure all waste is accounted for and disposed of appropriately in accordance with NSW EPA requirements.

A form recording any potential unexpected finds should be completed as provided in Appendix F. Any unexpected finds should be documented in the validation report to be prepared at the completion of the work.

12 REFERENCES

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- Environ Australia Pty Ltd 2013b, Site Audit Report – 620 Pittwater Road, Brookvale NSW
- Handex Australia Pty Ltd (Handex) 1998, Limited Environmental Site Assessment – 620 Pittwater Road, Brookvale NSW, Site No. No0263
- National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (NEPM 2013)
- NSW DECCW (2014) Waste Classification Guidelines; Part 1: Classifying waste.
- NSW EPA (2006) Guidelines for the NSW Site Auditor Scheme (2nd Edition).
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- NSW EPA (2012) The Excavated Natural Material Exemption
- National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013
- NSW Office of Water registered groundwater bore search: http://www.waterinfo.nsw.gov.au/gw/ [accessed 9 October 2015]
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- IT Environmental (Australia) Pty Ltd 2003b, Summary Site Audit Report Former Mobil Service Station 612 Pittwater Road Brookvale NSW
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- Parsons Brinckerhoff 2011a, Soil Validation Report 620 Pittwater Rd Brookvale, NSW 2100.
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- Parsons Brinckerhoff 2012a, Site Risk Management Plan, 620 Pittwater Road, Brookvale, NSW
- Parsons Brinckerhoff 2012b, Environmental Report, 620 Pittwater Road, Brookvale, NSW, dated June 2012.
- Parsons Brinckerhoff 2012c, On site Human Health Risk Assessment - 620 Pittwater Road, Brookvale, NSW.

- Parsons Brinckerhoff 2013a, Letter Addendum to 'On site Human Health Risk Assessment Report, June 2012.
- Parsons Brinckerhoff 2015a, Review of historical reports and data gap analysis for a Community Health Centre at Brookvale, NSW
- Parsons Brinckerhoff 2015b, Groundwater Monitoring Event (May 2015) - 612–624 Pittwater Road, Brookvale NSW
- Parsons Brinckerhoff 2015c, Soil Vapour Monitoring Event (June 2015) - 612–624 Pittwater Road, Brookvale NSW
- Parsons Brinckerhoff 2015d Targeted Soil Investigation (November-December 2015) - 612–624 Pittwater Road, Brookvale NSW
- Parsons Brinckerhoff 2015f, Remediation Action Plan for Community Health Centre, 612–624 Pittwater Road, Brookvale NSW
- Parsons Brinckerhoff 2015e, Validation Report 612–624 Pittwater Road, Brookvale NSW (reference 2201675A-CLM-RPT-0978)
- SMEC 2014a, Brookvale Community Health Centre Planning and Environmental Constraints Due Diligence Assessment.
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- SMEC 2014c, Targeted Environmental Site Assessment 612–624 Pittwater Road, Brookvale NSW.
- SMEC 2014d, Contamination Condition Review 614 – 624 Pittwater Road, Brookvale.
- SMEC 2014e, Summary of Preliminary Environmental Investigation and Review for 612-624 Pittwater Road, Brookvale.
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- State Environmental Planning Policy (Infrastructure) 2007
- State Environmental Planning Policy No 55 – Remediation of Land
- WA DoH, 2009, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia
- Worksafe, 2011, How to Safely Remove Asbestos
- Western Australian Department of Health (2009) Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.

13 LIMITATIONS

13.1 Scope of services

This Environmental Management Plan (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between Health Infrastructure (the client) and WSP | Parsons Brinckerhoff (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

13.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

13.3 Environmental conclusions

In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

13.4 Report for benefit of client

The report has been prepared for the benefit of the client and no other party. Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

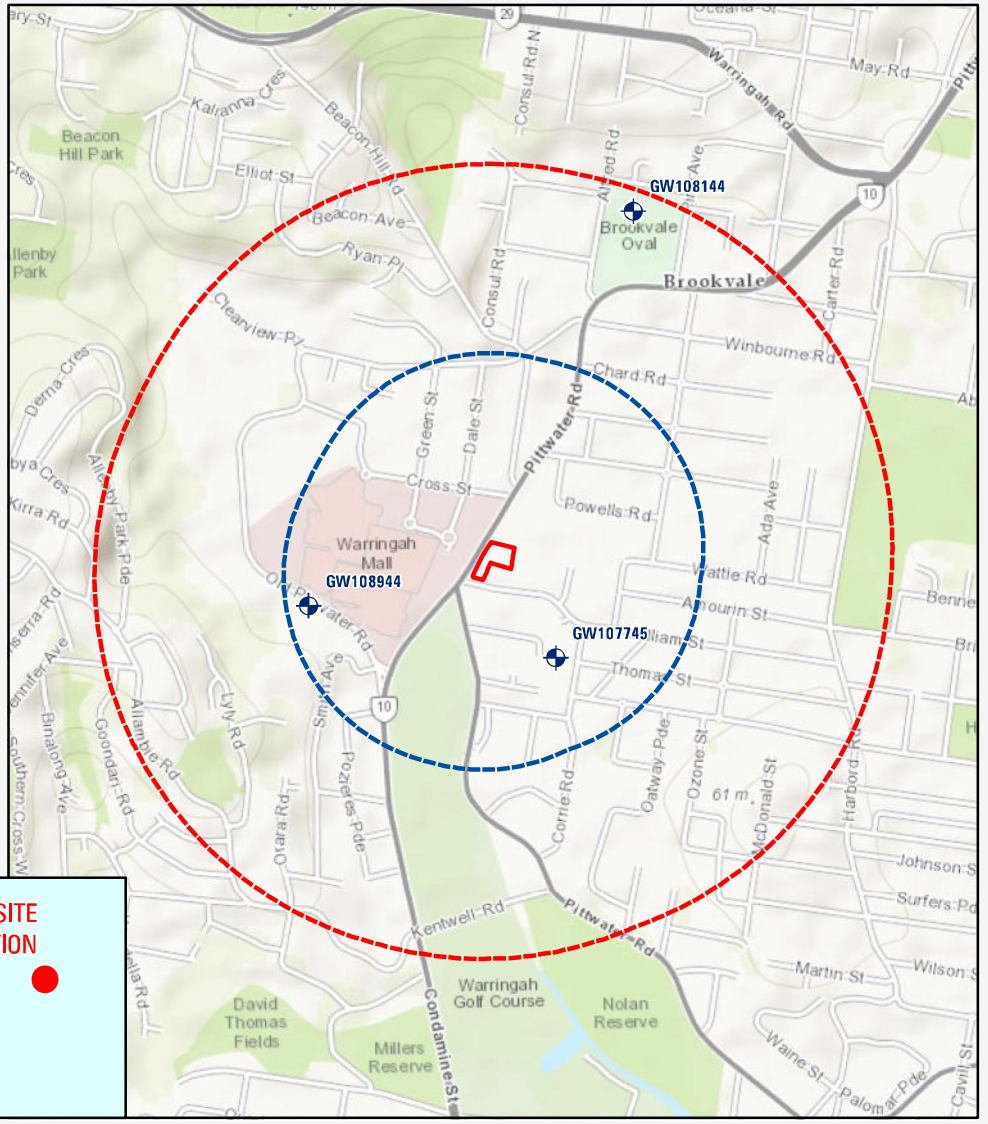
13.5 Other limitations

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

Appendix A

FIGURES



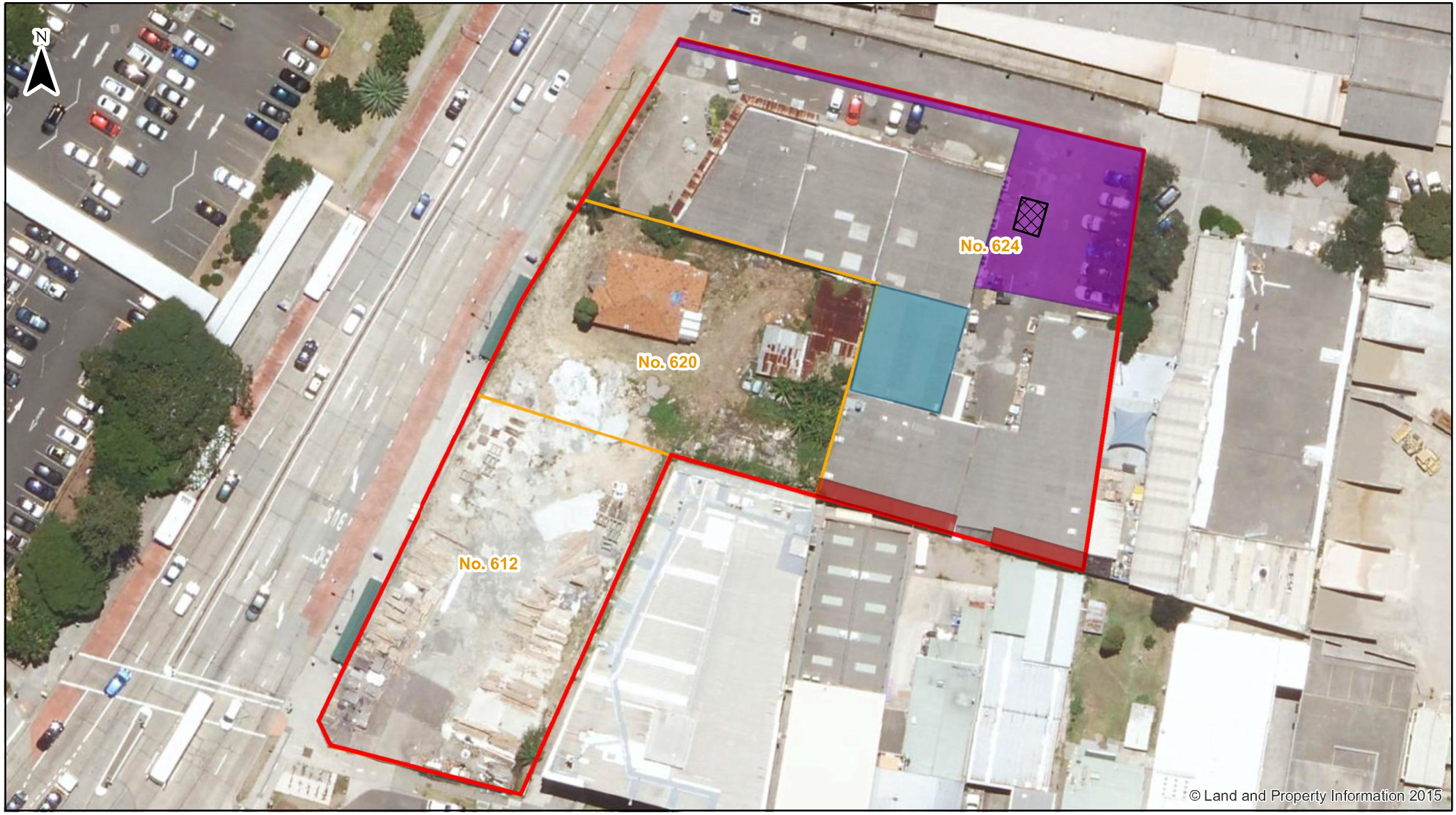
SITE LOCATION

Study area
Study area 500m radius
Study area 1000m radius
Registered Groundwater Bore

0 500
METRES

Figure 1 Site location

\\APSYDFIL03\pro\HHLTH_INFRA_NSW\220167SA_CLM_NSW_HEALTH_INFRA_BROOKVALE\10_GIS\Projects\Maps\220167SA_GIS_001_A2.mxd // MitchellEm // 12/06/2015



Underground Tank
Remaining Ashphalt
Asbestos Contaminated Building Footings (remain onsite)
Fill Batter (not assessed)
Site Boundary

0 5 10 20 30 40
Metres

Figure 2 - Remaining Area Requiring Assessment
Pittwater Rd, Brookvale NSW

Health Infrastructure

WSP | PARSONS BRINCKERHOFF

Figure created MAB 22/12/2015

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Appendix B

EMP INDUCTION REGISTER

EMP INDUCTION REGISTER

The purpose of the induction register is to acknowledge acceptance and compliance with the procedures outlined within this EMP by signing the attached log. Copies of this document must be made available for review and be readily available at the job site.

The Induction register is required to be completed by each person inducted into the EMP undertaking 'minor' or 'major works' at the site.

DATE	PERSON	COMPANY	TASK/JOB	SIGNATURE/POSITION

Appendix C

INSPECTION REPORT

INSPECTION REPORT

The purpose of the Inspection Report is to maintain a record of inspections undertaken at the site and to record the results of the inspections including a record of any corrective actions that are required. The Inspection Report is required to be completed by a representative from the managing contractor appointed by Health Infrastructure (or a delegate) following completion of the inspection.

DATE:		
INSPECTOR:	Name: Sign:	
TIME:		
SITE/AREA:		
OBSERVATIONS	**Surface condition**	**Description of location**
DRAINAGE (CHECK ALL AREAS FREELY DRAINED AND NO SIGNS OF EROSION)		
PROBLEMS (IF OBSERVED):		
REPORT TO:	Project Manager (Name):	
CORRECTIVE ACTION (IF REQUIRED):		
SIGNED BY PROPERTY MANAGER (OR NOMINEE) UPON COMPLETION:		
FEEDBACK RESPONSE TO PREVENT FUTURE OCCURRENCES		

Appendix D

COMPLAINTS AND ENVIRONMENTAL INCIDENT REGISTER

COMPLAINTS AND ENVIRONMENTAL INCIDENT REGISTER

The purpose of the Complaints and Environmental Incident Register is to maintain a register of complaints from local residents or concerned parties, which will include a record of any action taken with respect to the complaints.

The Complaints and Environmental Incident Register is required to be completed immediately following the receipt of any complaints associated with works undertaken at the site. Written complaints should be addressed or acknowledged within five days of the complaint being received. Complaints made by telephone or in person should be addressed or acknowledged within two days of receipt.

DATE	TIME	TYPE OF COMMUNICATION	NAME, ADDRESS CONTACT NUMBER OF COMPLAINANT	NATURE OF COMPLAINT	RESPONSE/ CORRECTIVE ACTION	DATE OF RESPONSE	DATE COMPLAINANT NOTIFIED OF RESPONSE TAKEN	SIGNATURE/ POSITION

Appendix E

SUMMARY EMP OF REQUIREMENTS FOR PERSONNEL UNDERTAKING WORK ON-SITE

SITE INDUCTION

SUMMARY CONTAMINATION MANAGEMENT PLAN (EMP) FOR CONSTRUCTION WORKERS

NOTE: The information in this sheet is a summary of the recommended actions provided in the site EMP. The main text of the EMP should be referred to for more information.

MINOR WORKS

Including cleaning and general maintenance activities.

No specific controls required, providing the works do not significantly disturb the surfacing and underlying fill materials, and do not break any hardstand.	☐
All site workers and subcontractors to complete a site induction through the managing contractor appointed by Health Infrastructure prior to commencing any maintenance or construction works at the site.	☐
Advised of potential contamination which may be identified during works at the site, and the contingency plan and unexpected findings protocols in Sections 7 and 8 of the EMP	☐

MAJOR WORKS

Including any activities that significantly disturb the surface ground cover and expose the underlying fill materials or break the hardstand surface.

Control measures are required to be implemented.	☐
All site workers and subcontractors to complete a site induction through the managing contractor appointed by Health Infrastructure prior to commencing any major works at the site.	☐
Site personnel should use appropriate personal protective equipment (PPE) including: → Long sleeved shirt and long pants → P2 respirator or dust mask → Protective gloves (preferably nitrile glove worn underneath leather gloves) → Other PPE required under the WHS plan for the site works.	☐
Implement good personal hygiene, including: → No eating, drinking or smoking during works → Avoid contact with soil (wear gloves) → Wash hands and clothes after work → Wash hands before eating, drinking or smoking.	☐
Advised of potential contamination which may be identified during works at the site	☐
Implement dust control measures – if the conditions are windy, this may include dampening of fill materials prior to and during excavation works.	☐
Re-instate the surface capping soil materials following replacement of the deeper soils.	☐
Classify and dispose of any surplus soils to an appropriate off-site waste facility.	☐
Validate any imported fill materials required in accordance with NEPM 2013.	☐
The EMP has been read	☐

Appendix F

UNEXPECTED FINDS RECORD

UNEXPECTED FINDS REGISTER

Unexpected finds should be reported immediately using the form attached. The unexpected finds register should be updated after an unexpected find is encountered associated with works undertaken at the site.

DATE	TIME	TYPE OF UNEXPECTED FIND	PERSONNEL ADVISED OF UNEXPECTED FIND	NATURE OF UNEXPECTED FIND	RESPONSE TO UNEXPECTED FIND (CONTROLS)	SIGNATURE/POSITION

DATE:	
PERSON MAKING REPORT:	Sign:
TIME:	
SITE/AREA:	
OBSERVATIONS: **TYPE OF UNEXPECTED FIND, CONTAMINANTS, RISKS**	

ASSESSMENT (BY SUITABLY QUALIFIED CONSULTANTS, IF REQUIRED):	
MITIGATION/CONTROLS IDENTIFIED:	
SIGNED BY PROPERTY MANAGER (OR NOMINEE):	

Appendix G

NEUTRALISING CALCULATIONS

TABLE 4.5 Treatment categories and lime required to treat a weight of disturbed acid sulfate soils – based on soil analysis

The tonnes (t) of pure fine lime required to fully treat the total weight/volume of ASS can be read from the table at the intersection of the weight of disturbed soil (row) with the soil sulfur analysis (column). Where the exact weight or soil analysis figure does not appear in the heading of the row or column, use the next highest value (or calculate values exactly using factors from Table 4.6).

Disturbed soil	**Soil Analysis - Oxidisable Sulfur (S %)** or equivalent TPA/TAA													
(tonnes)	***0.03***	***0.06***	***0.1***	***0.2***	***0.4***	***0.6***	***0.8***	***1***	***1.5***	***2***	***2.5***	***3***	***4***	***5***
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.2	0.2
5	0.05	0.05	0.05	0.05	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9	1.2
10	0.05	0.05	0.05	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.9	2.3
15	0.05	0.05	0.1	0.1	0.3	0.4	0.6	0.7	1.1	1.4	1.8	2.1	2.8	3.5
20	0.05	0.1	0.1	0.2	0.4	0.6	0.7	0.9	1.4	1.9	2.3	2.8	3.7	4.7
25	0.05	0.1	0.1	0.2	0.5	0.7	0.9	1.2	1.8	2.3	2.9	3.5	4.7	5.9
35	0.05	0.1	0.2	0.3	0.7	1.0	1.3	1.6	2.5	3.3	4.1	4.9	6.6	8.2
50	0.1	0.1	0.2	0.5	0.9	1.4	1.9	2.3	3.5	4.7	5.9	7.0	9.4	11.7
75	0.1	0.2	0.4	0.7	1.4	2.1	2.8	3.5	5.3	7.0	8.8	10.5	14.0	17.6
100	0.1	0.3	0.5	0.9	1.9	2.8	3.7	4.7	7.0	9.4	11.7	14.0	18.7	23.4
200	0.3	0.6	0.9	1.9	3.7	5.6	7.5	9.4	14.0	18.7	23.4	28.1	37.5	46.8
500	0.7	1.4	2.3	4.7	9.4	14.0	18.7	23.4	35.1	46.8	58.5	70.2	93.6	117.1
750	1.1	2.1	3.5	7.0	14.0	21.1	28.1	35.1	52.7	70.2	87.8	105.3	140.5	175.6
1,000	1.4	2.8	4.7	9.4	18.7	28.1	37.5	46.8	70.2	93.6	117.1	140.5	187.3	234.1
2,000	2.8	5.6	9.4	18.7	37.5	56.2	74.9	93.6	140.5	187.3	234.1	280.9	374.6	468.2
5,000	7.0	14.0	23.4	46.8	93.6	140.5	187.3	234.1	351.2	468.2	585.3	702.3	936.4	1170.5
10,000	14.0	28.1	46.8	93.6	187.3	280.9	374.6	468.2	702.3	936.4	1170.5	1404.6	1872.8	2341.0

L	**Low treatment**: (<0.1 t lime). Apply 0.05 t (1 bag) or 0.1 t (2 bags) of lime to prevent some soil acidity from the ASS disturbance.
M	**Medium treatment:** (>0.1 to 1 t lime).
H	**High treatment**:(>1 to 5 t lime).
VH	**Very High treatment:** (>5 tonne lime).

A detailed management plan is required if disturbing > 1,000 tonnes of ASS (oxidisable S ≥0.03 %S or equivalent TPA or TAA.)

Lime rates are for pure fine $CaCO_3$ using a safety factor of 1.5. A factor that accounts for Effective Neutralising Value is needed for commercial grade lime (see Management Guidelines).

An approximate volume (cubic m) can be obtained by dividing weight (tonne) by bulk density (t/m^3).