AEC Environmental
A GREENCAP CONSULTING COMPANY

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

'AUDIT AREA 1'
PORTION OF FORMER HILLS INDUSTRIES SITE
CORNER OF SOUTH ROAD & ACKLAND STREET
EDWARDSTOWN
SOUTH AUSTRALIA

Prepared for:

Novion Property Group
(formerly Colonial First State Global Asset Management)

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Construction Environmental Management Plan 'Audit Area 1' Portion of Former Hills Industries Site, Corner of South Road and Ackland Street, Edwardstown, South Australia (AEC Ref: 3698/AA1/CEMP/01)	3698 Audit Area 1 CEMP
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1.0 INTRODUCTION

AEC Environmental Pty Ltd (AEC) has been engaged by Novion Property Group (formerly Colonial First State Global Management) to prepare a Construction Environmental Management Plan (CEMP) for a portion of the former Hills Industries site located on South Road, Edwardstown. Following the completion of a Detailed Risk Assessment and Remediation Options Assessment (ROA) for the site, a recommendation to complete a CEMP was made.

The former Hills Industries site comprises an irregular shaped block of approximately 7.78 hectares described by 20 Certificates of Title containing 29 individual allotments. The site is in the process of being re-zoned for mixed use; it is likely that at least part of the site will be redeveloped for ongoing commercial / industrial use within the footprint of the proposed extension of the Castle Plaza shopping Centre.

For reporting purposes and to align with the proposed development plan, the entire former Hills Industries site has been split into three assessment areas, each of which is under statutory audit.

- **Audit Area 1** – Comprises 7 Certificates of Title, including Allotment 288 in which the vast majority of past operations were undertaken. Assessment and remediation works are documented within this report (Audited by Mr Warren Pump);
- **Audit Area 2** – Comprises 12 Certificates of Title. Assessment and remediation works are documented under separate cover (Audited by Mr Paul Fridell); and
- **Audit Area 3** – Comprises nine allotments in two areas (Mixed Use Area 1 and Mixed Use Area 2) with an area of 1.184 hectares. Assessment and remediation works are documented under separate cover (Audited by Mr Paul Fridell).

A plan showing the location of each Audit Area is presented in Section 2.2. This report pertains to Audit Area 1 and has been prepared for review by Mr Warren Pump.

1.1 Objectives

The purpose of the CEMP is to facilitate the management of impacted soils and works in areas under which contaminated groundwater is present. The CEMP identifies restrictions relating to site use, material re-use and presents mitigation measures to reduce potential environmental and health risks that may occur as a result of civil and associated earthworks.

1.2 Applicable Environmental Legislation, Licensing, Guidelines and Standards

Key legislation, regulations, guidelines and standards relevant to the civil and construction works for the redevelopment are detailed in Table 1.

Table 1 – Key Legislation and Guidance

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Air Quality		*Environment Protection Act 1993* *Environment Protection (Air Quality) Policy 1994* *Climate Change and Greenhouse Emissions Reduction Act 2007*	NEPC National Environment Protection (Ambient Air Quality) Measure 1998 (as amended May 2003) NEPC National Environment Protection (Diesel Vehicle Emissions) Measure 2001 SA EPA Guidelines for Environmental Management of On-site Remediation 2006 SA EPA Handbook for Pollution Avoidance on Commercial and Residential Building Sites – Second Edition 2004
Asbestos	*National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013)* *Safe Work Australia Act 2008*	*Work Health and Safety Regulations 2012*	Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC: 2018 (2005)] SA EPA Guideline: Waste containing asbestos – removal, transport and disposal 2014 Safe Work Australia Code of Practice – How to Manage and Control Asbestos in the Workplace 2011
Cultural and Heritage	*Native Title Act 1993*	*Aboriginal Heritage Act 1988* *Heritage Places Act 1993*	Commonwealth Heritage List National Heritage List SA EPA Guidelines for Environmental Management of On-site Remediation 2006

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Dangerous Goods	*Road Transport Reform (Dangerous Goods) Act 1995*	*Dangerous Substances Act 1979* *Dangerous Substances Regulations 2002* *Dangerous Goods Transport Regulations 2008*	Code of Practice for stormwater pollution prevention (1997) IATA Dangerous Goods Regulations SA EPA Liquid storage Guidelines – Bunding and spill management 2007 Safe Work Australia Code of Practice – Labelling of Workplace Hazardous Chemicals 2011 Safe Work Australia Code of Practice – Managing Risks of Hazardous Chemicals in the Workplace 2012
Flora & Fauna	*Environment Protection and Biodiversity Conservation (EPBC) Act 1999* *Threatened Species Conservation Act 1995*	*Development Regulations 2008* *Environment Protection Act 1993* *National Parks and Wildlife Act 1972* *Native Vegetation Act 1991* *Native Vegetation Regulations 2003*	City of Marion Regulated & significant Trees guidance SA EPA Guidelines for Environmental Management of On-site Remediation 2006

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Groundwater	*National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013)*	*Environment Protection Act 1993* *Environment Protection Regulations 2009*	ANZECC Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites 1992 SA EPA Guidelines for Site Contamination – Notification of site contamination that affects or threatens underground water pursuant to section 83A of the *Environment Protection Act 1993* (EPA 837/08) 2008 SA EPA Guidelines for the assessment and remediation of groundwater contamination 2009 SA EPA Guidelines for the assessment and remediation of site contamination 2014 SA EPA Guidelines for Environmental Management of On-site Remediation 2006
Odour		*Environment Protection Act 1993*	SA EPA Odour assessment using odour source modelling Guideline (EPA 373/07) 2007
Noise & Vibration		*Environment Protection Act 1993* *Environment Protection (Noise) Policy 2007*	Guidelines for the use of the Environment Protection (Noise) Policy 2007 Australian Standard AS 1055-1997 Acoustics – Description and measurement of environmental noise SA EPA Guidelines for Environmental Management of On-site Remediation 2006 Safe Work Australia Code of Practice – Managing Noise and Preventing Hearing Loss at Work 2011
Public Health & Safety		*Public Health Act 2011*	

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Soil (erosion)	*National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013)*	*Environment Protection Act 1993* *Environment Protection Regulations 2009*	Code of Practice for stormwater pollution prevention (1997)
Soil (imported)	*National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013)*	*Environment Protection Act 1993* *Environment Protection Regulations 2009*	SA EPA Guidelines for stockpile management: Waste and waste derived products for recycling and reuse 2010
Soil (insitu)	*National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013)*	*Environment Protection Act 1993* *Environment Protection Regulations 2009*	ANZECC Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites 1992 SA EPA Guidelines for Environmental Management of On-site Remediation 2006 SA EPA Guidelines for stockpile management: Waste and waste derived products for recycling and reuse 2010 SA EPA Guidelines for the assessment and remediation of site contamination 2014 SA EPA Standard for the production and use of Waste Derived Fill 2013
Traffic		*Road Traffic Act 1961*	

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Waste	*National Environment Protection (Movement of Controlled Waste Between States and Territories) Measure (NEPM) 1998* *Waste Avoidance and Resource Recovery Act 2001*	*Environment Protection Act 1993* *Environment Protection Regulations 2009* *Environment Protection (Waste to Resources Policy) 2010*	Code of Practice for stormwater pollution prevention (1997) SA EPA Guideline: Waste containing asbestos – removal, transport and disposal 2014 SA EPA Guidelines – Waste transport certificate 2010 SA EPA Guidelines for stockpile management: Waste and waste derived products for recycling and reuse 2010 SA EPA Handbook for Pollution Avoidance on Commercial and Residential Building Sites 2004 SA EPA Liquid storage Guidelines – Bunding and spill management 2007 SA EPA Standard for the production and use of Waste Derived Fill 2013
Water (surface water & stormwater)		*Environment Protection Act 1993* *Environment Protection (Water Quality) Policy 2003* *Water Industry Act 2012*	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 Code of Practice for wastewater overflow management (2008) Code of Practice for stormwater pollution prevention (1997) SA EPA Guidelines for Environmental Management of On-site Remediation 2006
Weeds and Feral Animals		*Environment Protection Act 1993* *National Parks and Wildlife Act 1972*	

Aspect	Commonwealth Legislation and Regulations	State Legislation and Regulations	Guidelines/Standards/Information
Work Health and Safety (WHS)	*Work Health and Safety Act 2011* *Work Health and Safety Regulations 2011*	*Work Health and Safety Act 2012* *Work Health and Safety Regulations 2012*	Safe Work Australia Code of Practice – Hazardous Manual Tasks 2011 Safe Work Australia Code of Practice – Health and Safety Risks 2011 Safe Work Australia Code of Practice – Managing the Work Environment and Facilities 2011 Safe Work Australia Code of Practice –Work Health and Safety Consultation, Co-operation and Co-ordination 2011

2.0 SITE IDENTIFICATION

2.1 Location

The site lies approximately six kilometres south to south-west of the Adelaide CBD on South Road, Edwardstown (see Figure 1). The nearest watercourse or surface water body is the Sturt River which lies approximately three kilometres to the west.

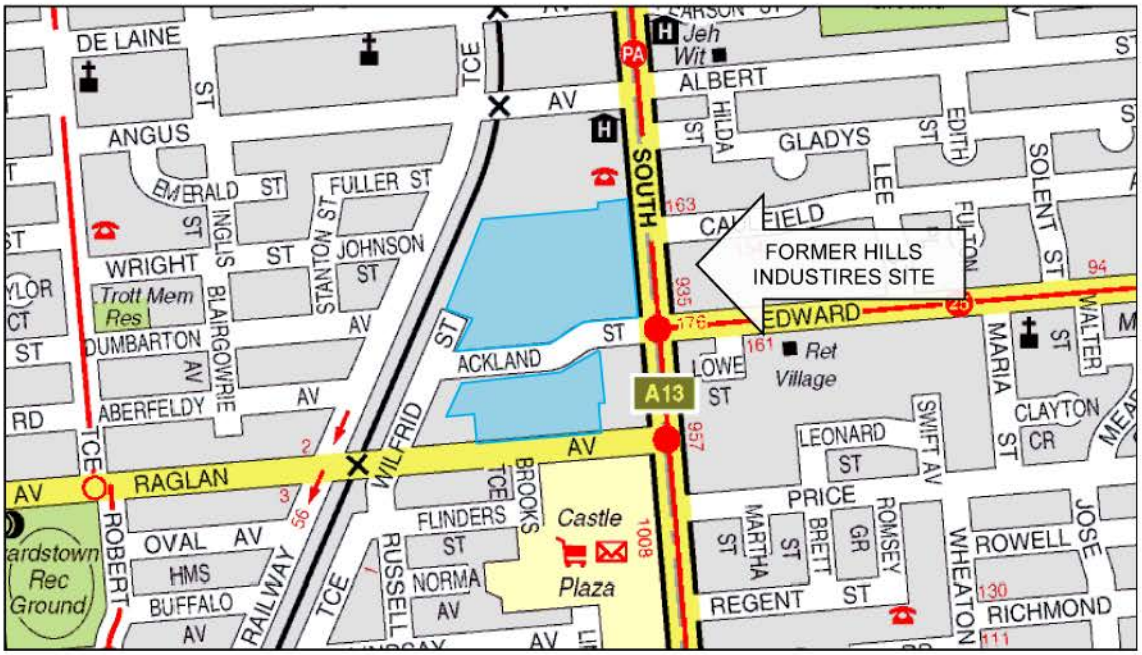

Figure 1 – Site location (source: UBD)

2.2 Legal Description

The Allotment layout is presented in Figure 2. Audit Area 1 legal description details are presented in Table 2.

Table 2 – Certificate of Title Details – Audit Area 1

Certificate of Title (Volume / Folio)	Lot Number(s)	Street Number	Street Name	Plan
5409 / 849	288	944 - 956	South Rd	Filed Plan 10796
5411 / 384	1	958	South Rd	Deposited Plan 27678
5649 / 591	4	5 - 7	Ackland St	Deposited Plan 4772
5656 / 612	5 & 6	5 - 7	Ackland St	Deposited Plan 4772
5804 / 381	290	958	South Rd	Filed Plan 10796
5804 / 382	291	1	Ackland St	Filed Plan 10796
5494 / 212	292	944 - 956	South Rd	Filed Plan 10796

All titles are legally described for the area named Edwardstown, Hundred of Adelaide. The site lies in an area currently zoned Industry / Commerce within the City of Marion.

Copies of the current Certificates of Title for the Audit Area 1 site and council zoning records are presented in Appendix A of the Environmental Site Assessment / Screening Risk Assessment report.

Figure 2 – Site location (source: www.propertyassist.sa.gov.au/plb/index.html)

2.3 Site Description & Current Land Use

The site is currently vacant unpaved fenced land with scattered vegetation.

2.4 Surrounding Land Use

The site is situated in an industrial / commercial area and is surrounded by: -

- Light commercial / industrial properties including Woolcock Commercial and Industrial Builders and the SA Government Department of Correctional Services to the north;
- Light commercial / industrial properties including homewares sales, shed / garage sales and automotive parts re-seller to the east over South Road;
- Windscreens and tinting business (likely to have been a former service station) to the south east over the South Road / Ackland Street intersection;
- Cleared land (former Hills Industries site – Audit Area 2) to the south over Ackland Street; and
- Portion of the former Hills Industries site ('Audit Area 3 – MUA1') and rail line to the west, beyond which lies Railway Terrace and residential properties.

2.5 Proposed Land Use

As part of the former Hills Industries site redevelopment, proposed concept plans show the extension of the existing Castle Plaza Shopping Centre, located to the south of the site over Raglan Avenue. The shopping centre is to extend over Raglan Avenue (to be reclaimed), over the footprint of Audit Area 2 and will extend to the north over Ackland Street (to be realigned through Audit Area 1) into Allotments 4 – 6 and 291 – 292 within Audit Area 1. The proposed extension includes the incorporation of a ventilated basement car park.

The site is proposed to be re-zoned for mixed use, i.e. light commercial / industrial with the option for the incorporation of medium-high density residential use. A proposed roadway is to run along the northern and western boundaries of the site. An excerpt from the concept plan is presented in Figure 3.

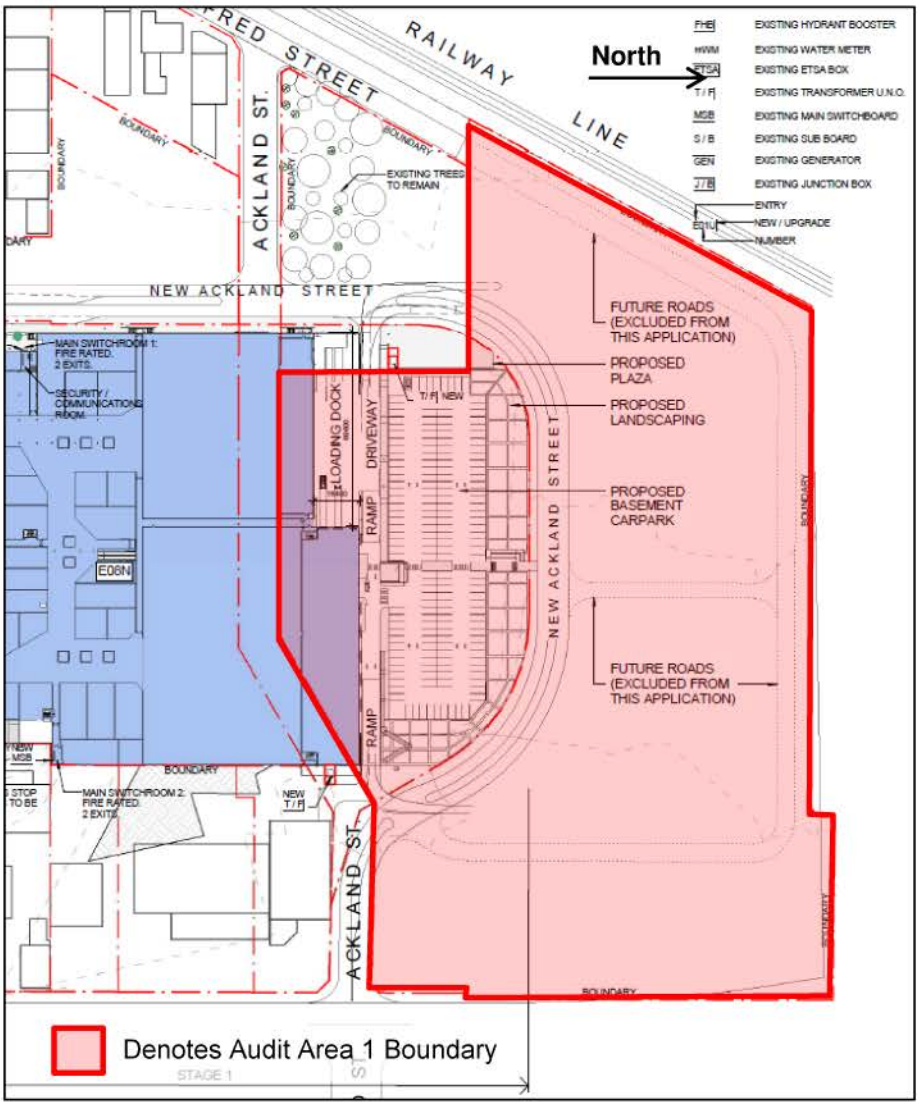

Figure 3 – Concept Plan excerpt (source: CFSGAM/Novion)

2.6 Geology & Hydrogeology

2.6.1 Regional Geology & Hydrogeology

The 1:250,000 scale Adelaide geological map produced by the South Australian Department of Mines and Energy shows the surface geology in the area is the Pooraka formation.

The Pooraka formation reportedly comprises alluvial / colluvial clays with varying amounts of sand and silt. The Soil Association map of the Adelaide region indicates the near surface soils in the area of the site generally comprise red brown clay or sandy clay soils with low lime overlying sand.

Reference to the former Department of Mines and Energy Report Book 94/9 "Soils stratigraphy and engineering geology of the Adelaide Plains" indicates the site is situated in the Adelaide Plains in a landform area known as the Lower Alluvial Plain (see Figure 4), although, as it is shown, the site location is close to the boundary adjoining the Upper Alluvial Plain. It is also noted that the site is located to the east of the Para Fault Zone.

The general geological sequence at the site area comprises:-

- Quaternary Age sediments of fluvial and marine origin of the order of 50 metres thickness. The dominant formation is Hindmarsh Clay, which is predominantly clay, but has lenses of gravels, silts and sands. The Hindmarsh Clay is covered by clayey material of the Keswick Clay and Pooraka formations
- Tertiary sediments of mainly marine origin up to 200 metres thickness are represented by limestones, sands and calcareous sandstones of the Port Willunga, Chinaman Gully, Blanche Point and other formations.
- Precambrian Age basement rock below approximately 200-250 metres depth.

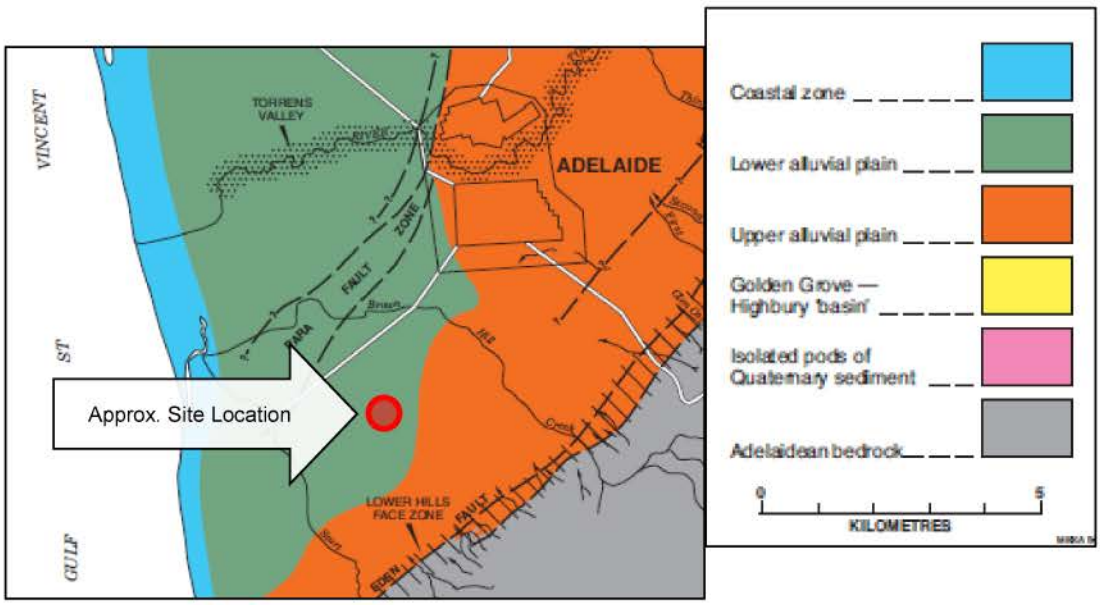

Figure 4 – Geomorphic and geologic zones of the Adelaide region (source: DME Report Book 94/9)

Cross sections presented in Report Book 94/9 indicate that the site is likely be underlain by the following:-

- Pooraka Formation – approximately 3 to 5 metres thick;
    - The Pooraka Formation typically consists of sandy clay and clayey to sandy silt, with interbeds and layers of clay, sand and occasional gravel. Layers rich in carbonate silt and segregations occur within the Pooraka Formation;
- Transitional Gley Clay and / or Keswick Clay and / or Quaternary Alluvium – approximately 5 metres thick;
    - Keswick Clay consists primarily of clay but may also contain bands of silty or gritty clay (quartz sand inclusions) and includes transitional Gley Clay – "gley" is a colour name applied to clay layers that have been subject to poor or impeded drainage conditions and have greyish to greenish colours and mottle patterns;
    - Quaternary Alluvium - is found throughout the Hindmarsh Clay, Pooraka Formation and the Keswick Clay. The deposits follow present and past drainage lines that emerge from the Eden–Burnside and Para Fault Escarpments. The material is predominantly sandy in texture may also contains abundant silt, clay, gravel and pebbles and
- Hindmarsh Clay – greater than 10 metres thick.
    - Hindmarsh Clay is predominantly clay with some sand and silt content.

This is consistent with findings during site investigations. The dominant natural soil type identified was red brown silty clay to a depth of approximately 0.8 – 1.0 metres underlain by pale brown to cream clay with calcareous inclusions. See Section 2.6.2 for further detail.

The Quaternary sediments within the Adelaide Plains include inter-bedded sand and gravel layers within which the water table (uppermost) aquifer generally occurs; and also form other deeper aquifers in the underlying Hindmarsh Clay formation (reportedly up to six distinct Quaternary aquifers have been identified – designated Q1-Q6 in literature (Gerges 2006). These aquifers are not highly utilised as the yield and water quality are highly variable. The deeper Tertiary aquifers generally have better quality water and yields, and are utilised in some areas within the Adelaide Plains.

2.6.2 Site Geology & Hydrogeology

Prior to the extensive soil remediation works conducted on the site between 2009 and 2013, the site was covered by a layer of fill material with thickness ranging between 0.5 and 1 m. The fill material varied from sands to clays with secondary inclusions of crushed rock, ash, cinder, red brick, timber and glass in some locations. Fill material extends up to 5m below ground level in the areas of deep excavation (i.e. Area B / Pit 9 and Area A / Pit 20 (see AA1 ESA/SRA report for detail).

Natural material, which underlays the fill, is represented from the top by red brown silty clays and clays to approximately 4 – 6m (interpreted as Pooraka Formation) below which the clay

becomes pale brown to grey with calcareous inclusions decreasing with depth (interpreted as Keswick Clay Formation).

The Keswick Clay Formation is then underlain by grey clays with orange brown mottling (interpreted as Hindmarsh Clay formation) which was observed below depths of 9 – 10 m.

The uppermost groundwater was encountered within the Pooraka formation (Q1 aquifer). The top of the aquifer was intercepted at approximately 5m below ground level across the site. The measured depth to groundwater level in Q1 ranges between 4.0 and 5.5 m. The corresponding surveyed groundwater levels ranged between 21.5 and 23.6 m AHD (Australian Height Datum), which corresponds with the expected regional groundwater level elevation range. The base of the aquifer is likely to be limited by the top of the Keswick Clay formation known to have poor or impeded drainage properties.

The second uppermost aquifer (interpreted as Q2) was encountered in the Hindmarsh Clay formation at a depth of approximately 14 – 15m below ground level. The Q1 aquifer is likely to be separated from the Q2 aquifer by the upper extent of the Hindmarsh Clay formation which is represented by heavy clays.

Groundwater level gauging events have demonstrate that groundwater flow underlying the site is in a westerly direction.

3.0 BACKGROUND

3.1 List of Previous Reports

The site has been historically assessed in a number of stages. A list of previous investigation reports is provided below. This report should be read in conjunction with the following:-

- Phase 1 Environmental Site Assessment – Hills Industries Site, Edwardstown. Prepared by Parsons Brinckerhoff (Report reference: 2121207A-001/RK/kmg). November 2006.
- Limited Environmental Site Investigation. Hills Industries Factory 944-958 South Rd, Edwardstown, South Australia. Prepared by Environmental & Earth Sciences NSW (Report reference: 107053). June 2007.
- Addendum to Environmental Earth Sciences NSW Report Number 107053 – Quality Assurance and Quality Control Document. Prepared by Environmental Earth Sciences NSW (Report Reference 111109). December 2011.
- VI & Risk Assessment Advice – Vapour Issues Edwardstown. Prepared by Environmental Risk Sciences (Report reference: A/10/L101-B). January 2010.
- VI & Risk Assessment Advice – Vapour Issues Edwardstown. Prepared by Environmental Risk Sciences (Report reference: A/10/L201-C). December 2010.
- Remediation Management Plan: PCE Impact Soils – Source Removal Works Report – Allotment 288, Hills Industries Site, South Road, Edwardstown, South Australia. Prepared by AEC Environmental (Report Reference: 3698/RMP01). March 2011.
- Remediation of PCE Impact Soils – Source Removal Works Report – Allotment 288, Hills Industries Site, South Road, Edwardstown, South Australia. Prepared by AEC Environmental (Report Reference: 3698/R02). February 2012.
- On-Site Vapour Risk Assessment – 944-958 South Road, Edwardstown. Prepared by Environmental Risk Sciences (Report reference: AEC/12/EVR001-E). August 2015.
- Environmental Site Assessment & Screening Risk Assessment – 'Audit Area 1' Portion of Former Hills Industries Site, Corner of South Road & Ackland Street, Edwardstown, South Australia. Prepared by AEC Environmental (Report Reference: 3698/AA1/01). September 2015. Referred to herein as the AA1 ESA/SRA.
- Detailed Risk Assessment – 'Audit Area 1' Portion of Former Hills Industries Site, Corner of South Road & Ackland Street, Edwardstown, South Australia. Prepared by AEC Environmental (Report Reference: 3698/DRA/01). September 2015. Referred to herein as the AA1 DRA.
- Remediation Options Assessment – 'Audit Area 1' Portion of Former Hills Industries Site, Corner of South Road & Ackland Street, Edwardstown, South Australia. Prepared by AEC Environmental (Report Reference: 3698/ROA/01). September 2015. Referred to herein as the AA1 ROA.

An overview of these reports is presented in the following sections.

3.2 Background Information

The former Hills Industries site (which includes Audit Area 1) has been investigated on numerous occasions (including on-going investigation and additional reporting on various remediation and validation works) as follows:

3.2.1 Site History

Parsons Brinckerhoff (PB) conducted a Site History report for the entire former Hills Industries site - *"Phase 1 Environmental Site Assessment – Hills Industries Site, Edwardstown" (Document Ref. 06-0699-00-2121207A, 9 November 2006)* in 2006.

The historical information reviewed indicates the northern half of the former Hills Industries site (i.e. that located to the north of Ackland Street) has a long history of industrial use. The Pengelley family (furniture and carriage makers) and the Spurl / Sporrel families (possibly blacksmiths) occupied the north portion (i.e. Allotment 288) of the site from as early as the 1840's. It is possible that furniture and carriage manufacture continued on this portion of the site (Hill family) during which time part of the site was leased to the Municipal Tramways Company. Hills Industries occupied this portion of the site from the 1950's until the site demolition commenced in 2009.

The Ackland Street fronting portion of the Audit Area 1 site was likely to have been part of the fodder business (Ackland Chaff Mill) prior to the establishment of Ackland Street.

Based on the site history review the following potential on-site contamination sources / issues were identified including:-

- Former use of underground tanks (up to six) for the storage and dispensing of fuels;
- Former use of aboveground tanks (AST) for the storage and dispensing of fuels;
- Historical activities in this portion of the site included storage and use of lubricants, use of a solvent bath and a plating shop, storage and use of acids and caustic solutions, storage and use of fuels, and general widespread chemical storage.
- Historical on-site disposal of waste acids onto the ground and a lined pit.
- Use of in-ground sumps / drains to collect waste chemicals:-
- Historical use of a weighbridge:-
- Historical vehicle maintenance, which included vehicle service pits, hoists, and washdown areas.
- Use of polychlorinated biphenyls (PCBs) in transformer oils:-
- Use of bitumen / asphalt for hard cover.
- Historical use of termiticides and weedicides.
- Presence of asbestos-containing materials in building products.
- Fuel related contamination resulting from the use of portions of the site for car parking.
- Use of fill material to level the site, particularly the former low-lying land to the west.

The potential sources of site contamination associated with these past site uses include (but may be restricted to):-

- Use and disposal of solvents;
- Use and disposal of acids and alkalis during anodising works;
- Heavy metals and fuels during light engineering works;
- Former use of aboveground and underground tanks for the storage and dispensing of fuels;
- Foundry operations;
- Historical vehicle maintenance;
- Use of in-ground sumps/drains to collect waste chemicals;
- Use of fill material to level the site;
- Use of polychlorinated biphenyls (PCBs) in transformer oils;
- Use of bitumen to seal the site;
- Historical use of termiticides and weedicides; and/or
- General uses of fertilisers, pesticides and herbicides across the site.

3.2.2 Soil Investigations

Intrusive investigations were first undertaken in mid-2007 by Environmental & Earth Sciences (EES) comprising of the drilling / excavation of seventy two (72) soil bores / test pits across the site.

AEC soil investigations commenced in 2008 and are summarised as follows:-

- **31 October – 14 November 2008** – AEC drilled 14 soil bores (BH101 – 113 and BH126).
- **28 September – 12 November 2009** – AEC excavated 41 test pits (TP101 – 141) as part of solvent impact investigation works (EES Areas of Concern A and B).
- **17 – 26 March 2010** – AEC supervised the excavation of 28 test pits (TP201 – 228) within the footprint of the former Satellite Dishes / Playtime / Clotheslines Building.
- **5 July – 14 August 2012** – AEC drilled 5 soil bores (BH401 – 405) along the solvent impact plume centreline to assess the condition of the aquifer material.
- **2013** – AEC excavated 57 test pits (TP401 – 457) and 8 trenches (TR1 – TR8) as part of further investigation works presented in the endorsed sampling and analysis plan for Audit Area 1.
- **2008 – 2013** – AEC has undertaken various delineation, remediation and validation works. The majority of these works were conducted in conjunction with site demolition activities.
- **2014** – AEC drilled two soil bores (BH501 and BH502) on the northern (west) boundary of the site.

Fill depth was reported to range across the site and was typically deeper toward the western boundary. Fill material across the eastern half of the site typically ranged from 0.2 to 0.5 metres in thickness and extended to 0.5 – 1.0 metres in thickness to the west (averaging approximately 0.7 metres). Fill materials varied, comprising loose sands (with gravel and blue metal inclusions) in the upper layers and clays and silty clays in deeper fill layers. Clay fill secondary inclusions were variable, including brick fragments, combustion wastes (including coke, ash, charcoal and/or cinders), timber, bone and metal fragments.

Deeper pockets of fill material (i.e. >1m) were identified in various areas:-

- car park located in the north east corner of the site (backfilled basement);
- former Woodroffe Facility in the south eastern corner of the site;
- beneath the former Playtime / Clothesline Building (also associated with former underground tunnels);
- west of the TV / Antennas Buildings (backfilled UST pit);
- approximate location of a former transformer and sump adjacent the former Auto Press; and
- backfill sands in the location of the former USTs (part of the former fuel dispensing facility) located to the west of the TV Antennas Building.

Hydrocarbon and / or solvent odours and staining were identified in three locations:-

- solvent odours in near surface and deep soils in the footprint of the Ironing Tables Building;
- solvent and/or light fraction hydrocarbon odours in near surface and deep soils in the north west corner of the site near the Auto Press and Press Shop; and
- hydrocarbon staining and odour in the base of a backfilled UST pit located to the west of the TV/Antennas workshop.

Zones of fill material with varying degrees of combustion waste impact were identified in six general areas across the site:-

- Satellite Dishes/Playtime Building (surface and near surface fill material);
- Clothesline Building (deep subsurface fill material);
- North west corner of the site, likely associated with fill material used in the development of the former SAR rail siding (surface and near surface fill material);
- North east Car Park (surface and near surface fill material);
- Front Office/Trampolines Building (surface and near surface fill material);
- Maintenance Building (backfilled brick-lined well); and
- Woodroffe Facility (surface and near surface fill material).

3.2.3 Groundwater Investigations

Onsite groundwater investigations comprised the installation and sampling of 28 groundwater monitoring wells and the sampling of two existing groundwater monitoring wells. The locations of the wells are shown on Figure 5.

Groundwater underlying the site is at a depth of 4.0 – 5.5 metres below the surface and reported a TDS range of 480 to 2,400mg/L (2013/2014).

Significant chlorinated hydrocarbon impact (primarily PCE) has been identified underlying the northern portion of the site, extending off-site to the west.

Heavier fraction hydrocarbon impacts have been identified in two locations, along the northern portion of the site (light fraction impacts being likely attributable to the identified solvent impacts) and heavy fraction impacts in the northern portion and beneath the former Clothesline Building footprint.

Isolated cyanide, hexavalent chromium, manganese, nickel and zinc, benzene and xylene impacts have also been identified across the site as a result of past activities carried out on the site.

Boron and nitrate concentrations exceeding adopted screening criteria (ecosystem protection, drinking water and irrigation) were reported in groundwater underlying much of the site. The concentrations reported in groundwater underlying the site are considered to be indicative of naturally occurring background levels (in the case of boron) and a combination of ambient / historical impact-related concentrations (in the case of nitrate) across the local region given its past history of agricultural use.

Groundwater impacts are further discussed in the AA1 DRA report for the former Hills Industries site, presented under separate cover.

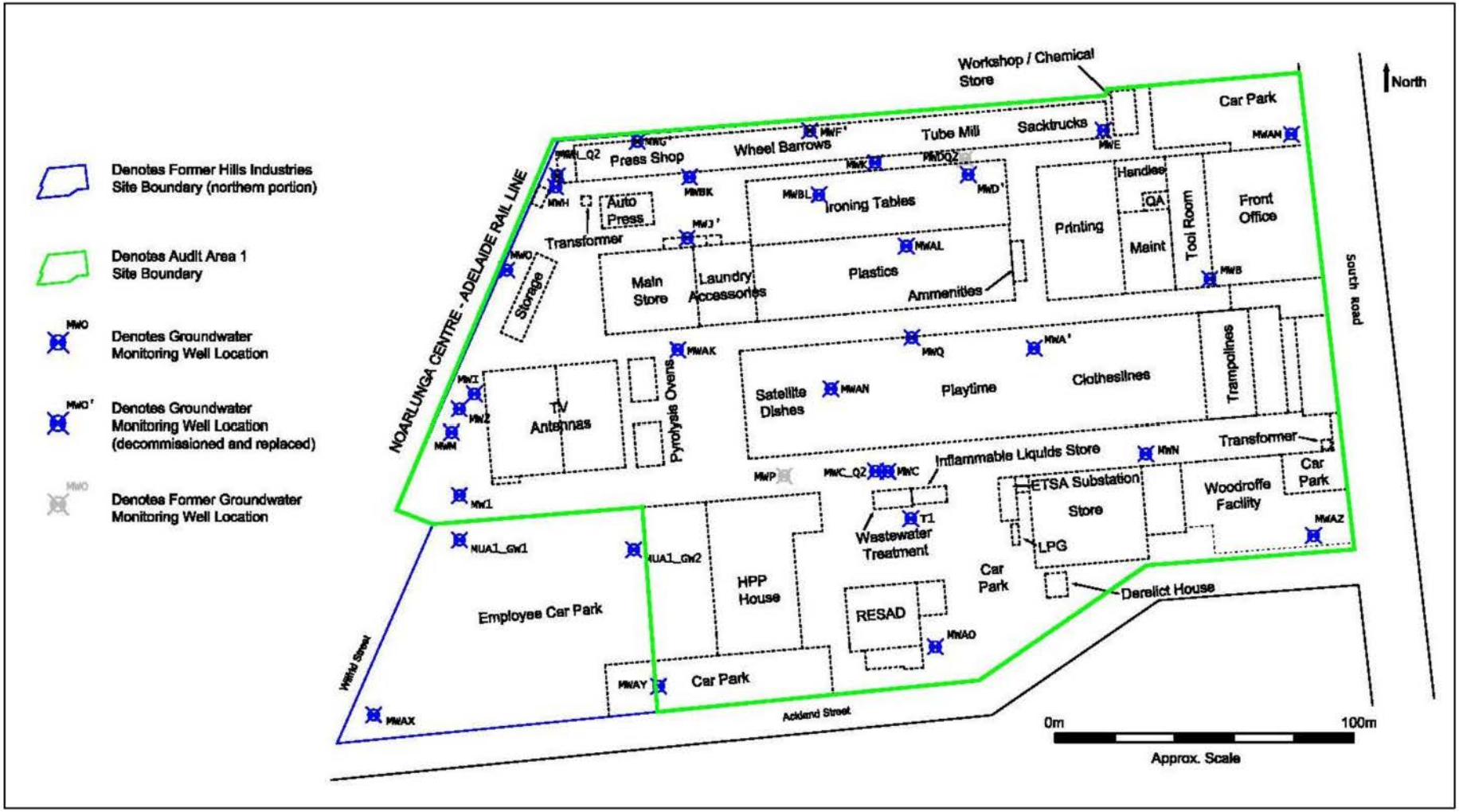

Figure 5 – Audit Area 1 Groundwater Monitoring Well Locations

3.2.4 Soil Vapour Investigations

Soil vapour risk assessments were undertaken relating to the solvent impacts (chlorinated hydrocarbons) identified in soil and groundwater.

Margins of Safety (MOS) were developed to assess potential vapour intrusion risk based on soil gas data collected on-site. The potential site-use scenarios considered include the following:

- Scenario 1 – Commercial / industrial – with buildings constructed as slab-on-grade and exposures may occur by long-term workers within these buildings;
- Scenario 2 – Commercial / industrial with underground car park – this includes a multi-storey development with 1 level of basement car park (extending to 3m depth) where exposures by long-term workers may occur in the basement as well as in work areas located on the ground or upper floors;
- Scenario 3 – Mixed use (including medium / high density residential) – with buildings constructed as multistorey buildings on a slab, with commercial/retail premises on the ground floor and residential on the upper floors. Exposures by both long-term workers and residents may occur in these buildings;
- Scenario 4 – Mixed use (including medium/high density residential with potential basement use) – this includes a multi-storey development with 1 level of basement car park (extending to 3m depth) with mixed commercial and residential areas above. Exposures by long-term workers and residents may occur in the basement as well as in work areas located on the ground or upper floors;
- Scenario 5 – Standard residential – this is assumed to comprise low to medium density residential homes constructed on a slab where exposures by residents may occur within the home;
- Scenario 6 – Standard residential with basement – this includes a medium to high density residential building with 1 level of basement car park (extending to 3m depth). Exposures by residents may occur in the basement as well as on the ground or upper floors; and
- Scenario 7 – Public open space – where exposures may occur by residents or workers in outdoor/open spaces only.

Risks to future commercial / industrial workers, residents in a medium to high density setting (i.e. scenarios 3, 4 and 6) and public open space users (i.e. Scenario 7) were considered acceptable. Low density residential use (i.e. Scenario 5) is considered unacceptable above areas where groundwater is impacted with chlorinated solvents (i.e. along the plume centre line along the northern site boundary).

The results suggest there are no major risks to future site occupants for the proposed site use being mixed use. No significant risk has been identified for workers in excavations (i.e. service trenches up to 1.5m bgl during construction and maintenance or appropriately constructed basement excavations up to 3m) above the impacted groundwater.

4.0 SOIL REMEDIATION WORKS

4.1 Completed Remediation Works

Specific areas identified for additional remediation/clean-up and validation works were recommended in desktop (PB) and intrusive investigations (EES and AEC) conducted between 2007 and 2014.

4.1.1 Remediation Rationale & Methodology

Validation works (excluding Area B, which was a large area near the northern boundary of the site (north eastern corner of the former Ironing Tables Building) that was inferred to be the source of solvent contamination in groundwater – see Section 4.1.2) were performed opportunistically as the site was demolished. Material excavated from around subsurface structures and/or impacted areas was stockpiled on hardstand whilst samples were analysed for classification of the material. Later in the demolition once available hardstand was removed, impacted stockpiles were stored on high density polyethylene (HDPE). All stockpiles with visual or olfactory impacts were covered with plastic until removal from site.

Validated excavations were reinstated with either site-sourced material (if deemed suitable for re-use) and/or imported clean material.

Completed remediation works are detailed in the AA1 ESA/SRA report and the locations of these works are presented in Figure 6.

4.1.2 Remediation Rationale & Methodology – 'Pit 9' / 'Area B'

Significant solvent impact was identified in soils in the vicinity of a former solvent bath located in the north east corner of the Ironing Tables building. This area was identified as a high risk of ongoing impact to groundwater and was subsequently remediated during demolition works.

Bulk solvent-impacted material excavation works were completed in this area (see Figure 6). The excavation was extended to approximately 5m below ground level and validated in accordance with an approved Remediation Management Plan (RMP).

The excavation was reinstated with a combination of site-sourced and imported material in accordance with the RMP. The backfill materials (and placement of) are summarised as follows:

Various materials were sourced for the backfill of the excavation. A summary of the materials used for backfill (endorsed by the Auditor) is presented below:-

- **Ballast** – homogenous quarry material sourced from the Sellicks Hill Quarry used for backfill at the base of the excavation (approximately 22.5-22.9m AHD).
- **Site-sourced Material** – approximately 2,800m^3 of materials generated on-site from various sources (primarily excavation overburden) was tested and classified as intermediate landfill cover (ILC) and deemed suitable for backfill at an intermediate depth. This material was used to reinstate the excavation between 2 – 4m bgl (approximately 24.9-26.9m AHD.

- **Imported Material** – two materials were tested and approved for use at the site for backfill purposes. This was used to backfill the excavation at the base (i.e. >4m bgl) using a red brown silty/sandy clay and grey boral sand (upper 2m).

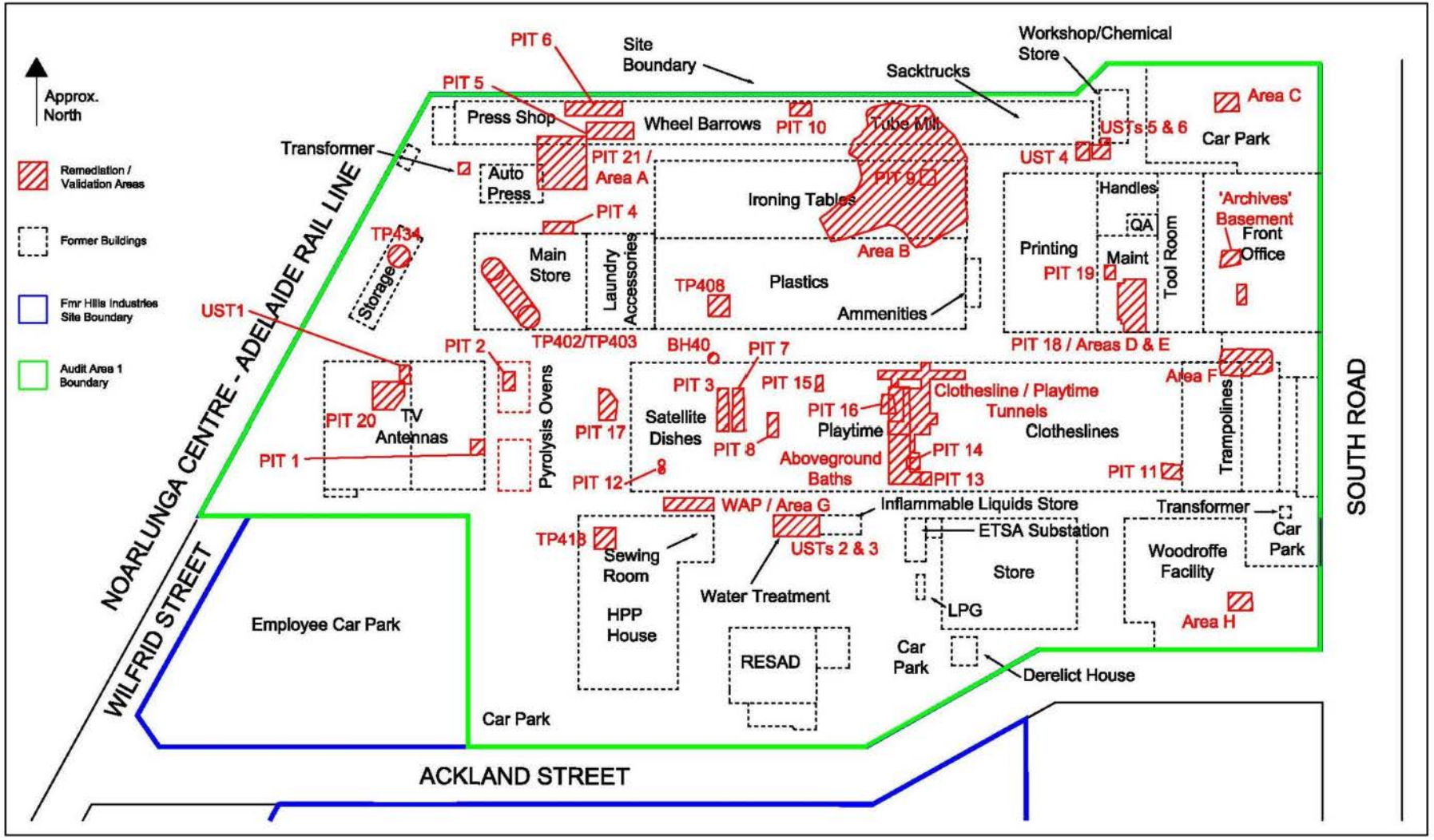

Figure 6 – Remediation and Validation Works locations

4.2 Post-Remediation Site Condition

4.2.1 Post-Remediation Site Condition – Soil

Various EIL exceedences are scattered across the site (see Section 5.3.1 of AA1 ESA/SRA) and as presented in Figure 7.

It is noted that the investigation and validation results were collected prior to the 2013 amendment of the NEPM (1999). As the assessment process has continued beyond the transition between the 1999 investigation levels and 2013 revised investigation levels the investigation and validation results were rescreened against the new (2013) criteria. This has resulted in minor number of results that now exceed the current criteria in the instance that the new criteria is more sensitive than its predecessor.

This particularly relates to PAH results, however, it is noted that the most severely PAH-impacted fill material has been removed from the site (i.e. in 'Areas of Concern F and H'), however some combustion-waste impacted materials remain onsite with impacts below the acceptable investigation levels and/or as a result of the investigation level amendment. Management measures for this material are presented in Section 7.

Based on the reported groundwater concentrations, solvent impacts may remain in aquifer material under the solvent-impacted soil area (i.e. EES Area of Concern B, see Section 6.10.3 of AA1 ESA/SRA) however significantly elevated chlorinated hydrocarbons were not reported in samples collected from within the aquifer material, nor in the remediation excavation base.

Combustion waste (typically ashy fill material) is scattered across the site. The approximate distribution of this material is presented in Figure 8. It is noted that this material has been adequately assessed and is considered suitable to remain on the site for the proposed development. Remaining impacts, including isolated pockets of ashy material on site for which HIL/HSL exceedences exist are summarised in Table 3 and presented in Figures 9 and 10.

Table 3 – Potential Exposure Pathways and Risks to Human Receptors from Impacted Soil

CoPC	Material (Depth)	Location, concentration and further information source	Potential Receptors	Potential Exposure Pathways	Risks from Exposure	Mitigation Measures / Actions
EIL Exceedences						
Heavy metals, TPH & PAH	Fill & Natural Material	Scattered across site (see AA1 ESA/SRA Section 5.3.1)	Vegetation	Plant uptake	Vegetation stress / mortality	Inclusion of clean fill material (>1m) in future garden areas
HIL/HSL Exceedences						
Lead	Fill (0.2-0.3m)	BH06 – adjacent north west corner of former Workshop/Chemical Store (AA1 ESA/SRA Section 6.22)	Construction (civil) workers	Dermal and inhalation (negligible); Ingestion (possible)	Increase in lead concentration in blood (>10µg/dL), affects to neurosystem, haematological and cardiovascular systems	Implementation of HSE Plan (inc use of appropriate PPE)
	Fill (0.3-0.4m)	TP224 – footprint of former Playtime Workshop (AA1 ESA/SRA Section 5.3.8)				
Nickel	Ashy Fill (0.9-1.0m)	TP401 (1,400mg/kg) – north west corner of site (AA1 ESA/SRA Section 5.3.8)	Construction (civil) workers	Inhalation (negligible); Dermal and ingestion (possible)	Skin hypersensitivity	Implementation of HSE Plan (inc use of appropriate PPE)
	Natural Clay (0.4-0.5m)	Footprint of former Maintenance Workshop (AA1 ESA/SRA Section 6.19)				
Lead & Nickel	Fill (>3m)	Backfilled brick-lined well (P18BW) in footprint of former Maintenance Workshop (AA1 ESA/SRA Section 6.19)	Construction (civil) workers	As above	As above	Implementation of HSE Plan (inc use of appropriate PPE)
TPH & BTEX)	Natural Clay (>3m)	North western corner of site in the vicinity of former Pit 6	Construction (civil) workers	Dermal contact, ingestion and inhalation (possible)	Carcinogenic (benzene)	Implementation of HSE Plan (inc use of appropriate PPE)

CoPC	Material (Depth)	Location, concentration and further information source	Potential Receptors	Potential Exposure Pathways	Risks from Exposure	Mitigation Measures / Actions
Carcinogenic PAHs as Benzo(a)pyrene TEQ	Disturbed Natural Clay (0.6m)	Pit 2 (5.3mg/kg) – footprint of former Pyrolysis Ovens (AA1 ESA/SRA Section 6.3)	Construction (civil) workers	Inhalation (negligible); Dermal and ingestion (possible)	Carcinogenic via all routes of exposure	Implementation of HSE Plan (inc use of appropriate PPE)
	Ashy Fill (0.2-0.3m)	Pit 20 (3.9mg/kg to 7.2mg/kg) – footprint of former TV Antennas Workshop (AA1 ESA/SRA Section 6.35)				
	Ashy Fill (0.4-0.5m)	TP430 – adjacent north east corner of former Workshop/Chemical Store				
	Ashy Fill (0.0-0.1m)	TP426 (4.7mg/kg) & TP427 (6.3mg/kg) – footprint of former Store	Construction (all) workers; Site visitors			Implementation of HSE Plan (inc use of appropriate PPE)
	Ashy Fill (0.0-0.5m)	Area F & TP211 (4.8 to 8.2mg/kg) – adjacent central portion of eastern site boundary (AA1 ESA/SRA Section 6.23)				
	Ashy Fill (0.0-0.5m)	Area H (HTP4-6.1mg/kg & HTP7-9.3mg/kg) – located in south east corner of the site (AA1 ESA/SRA Section 6.24)				
CHC – PCE	Natural silty clay (>5m)	Sub Pit 9 / Area B (AA1 ESA/SRA Section 6.10)	Construction (civil) workers	Inhalation, dermal contact and ingestion (possible)	Classified as 'likely to be carcinogenic' by all routes of exposure	Implementation of HSE Plan (inc use of appropriate PPE)

NOTES: BTEX – Benzene, Toluene, Ethylbenzene, Xylene(s); CoPC – Contaminants of Potential Concern; CHC – Chlorinated Hydrocarbons; HSE Plan – Health, Safety and Environmental Plan; PPE – Personal Protective Equipment; TPH – Total Petroleum Hydrocarbons

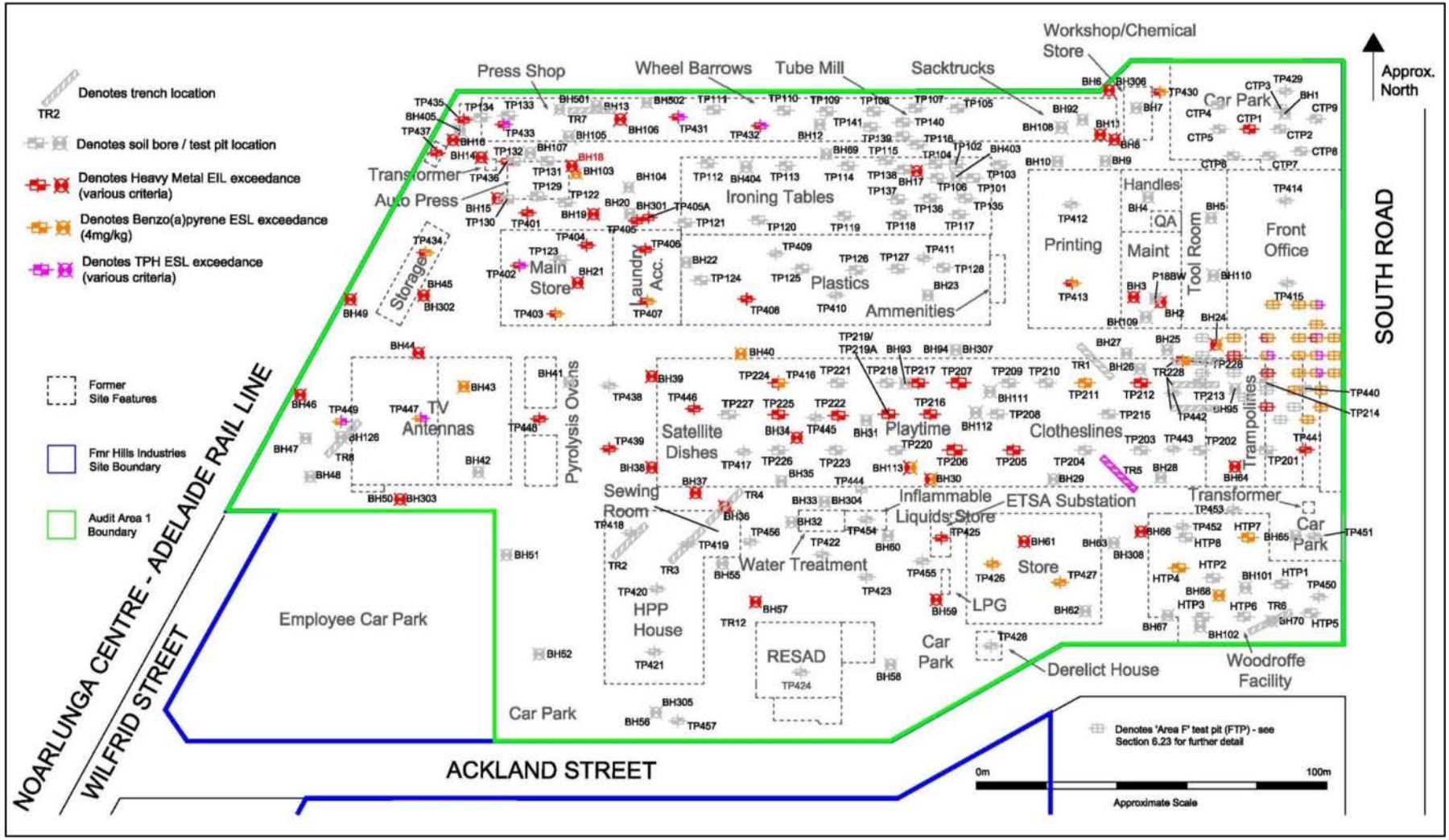

Figure 7 – Soil EIL/ESL Exceedences (former site layout overlay)

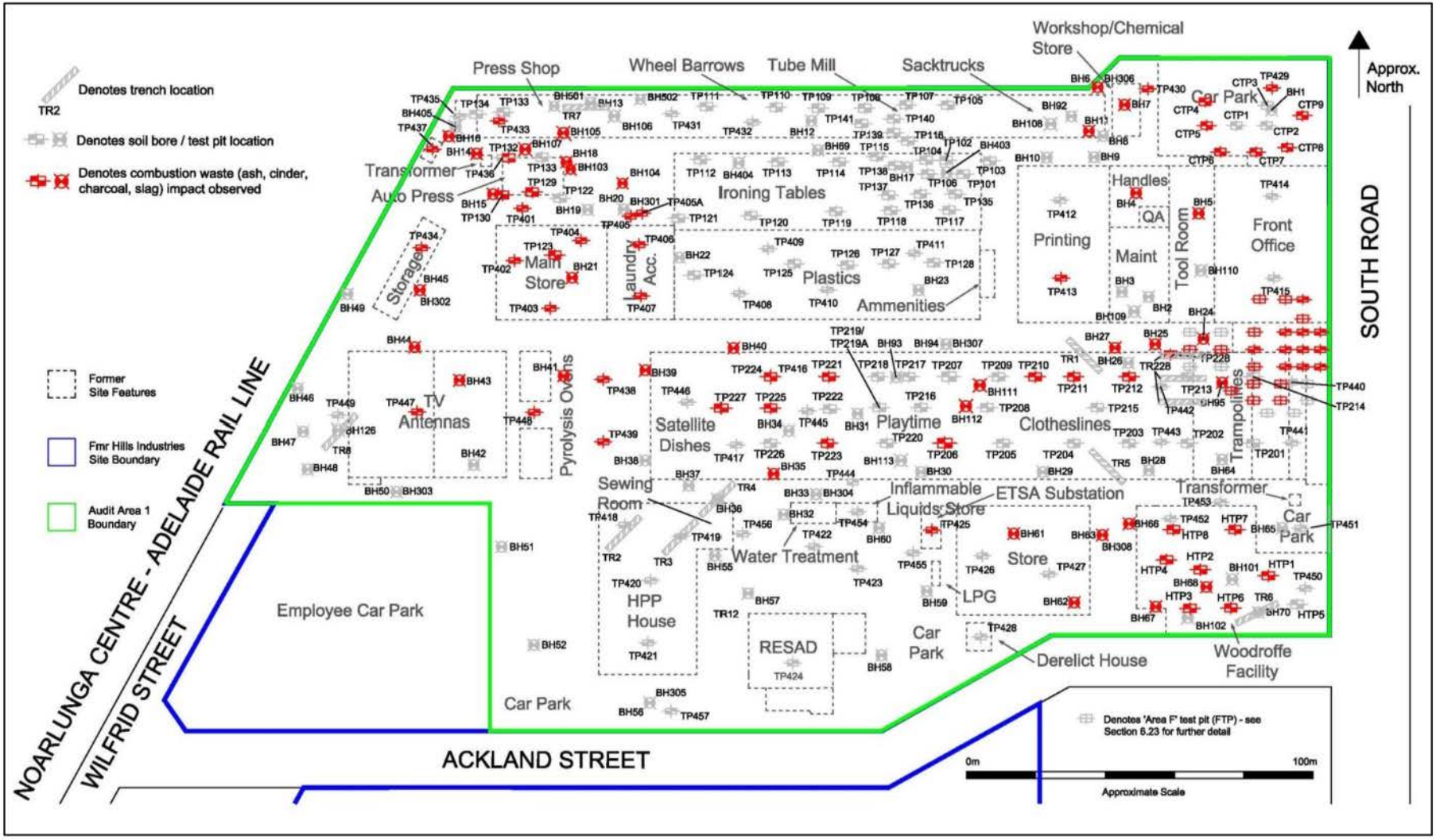

Figure 8 – Approximate Distribution of Combustion Waste Impacts (typically within fill material in upper 0.5m)

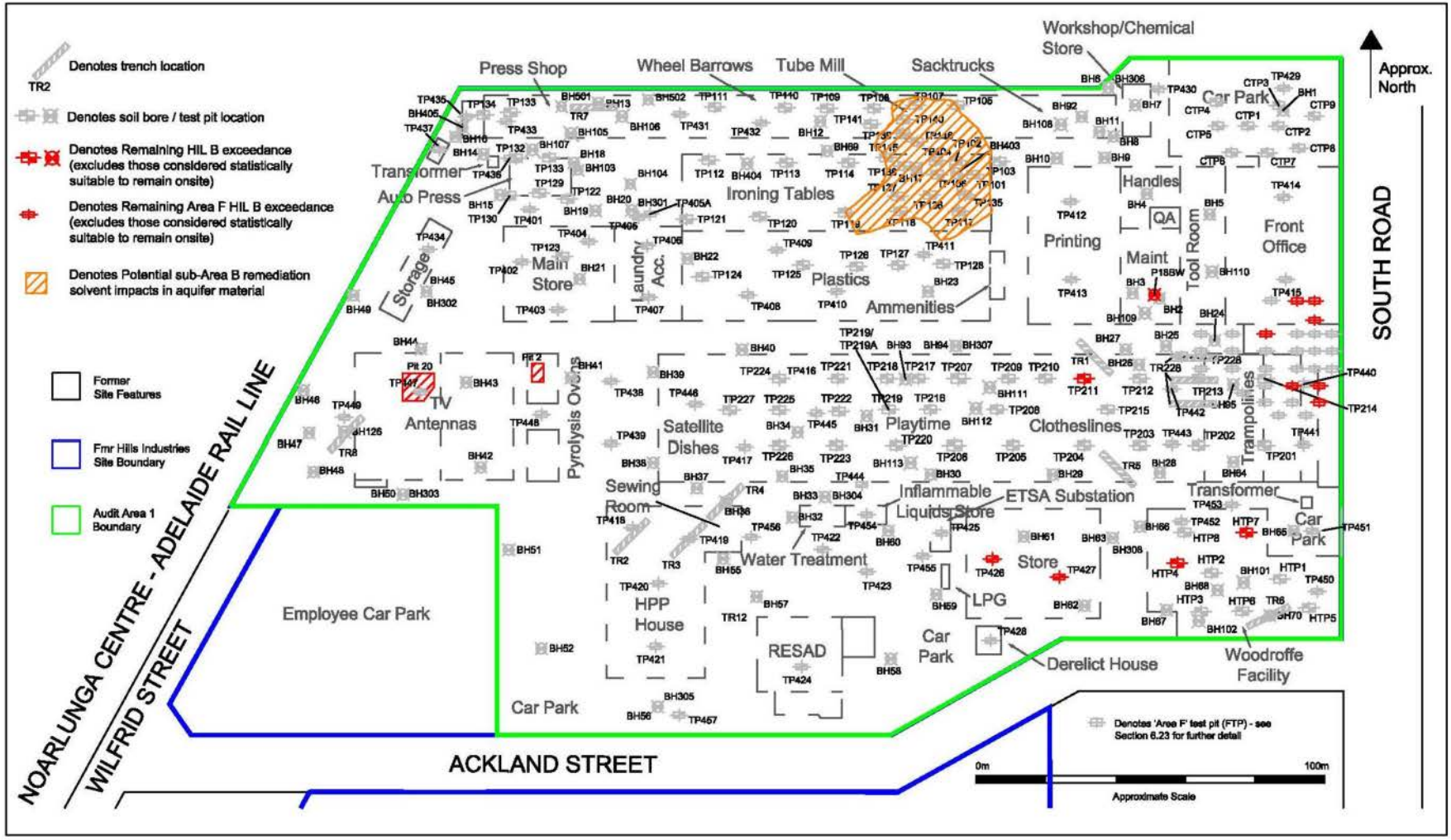

Figure 9 – Remaining site impacts, including HIL B Exceedences (former site layout overlay)

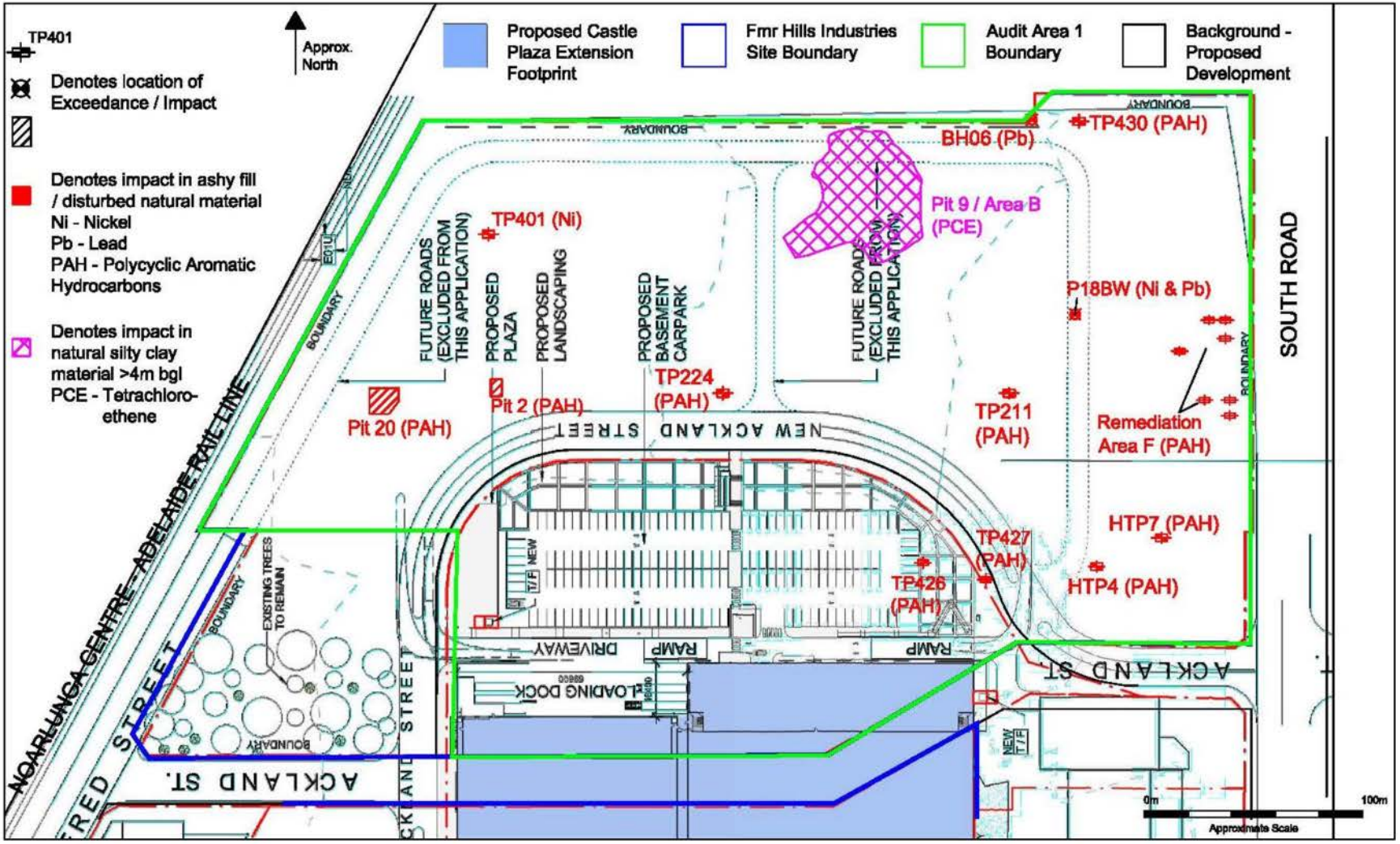

Figure 10 – Remaining HIL B Exceedences (proposed redevelopment overlay)

4.2.2 Site Condition – Groundwater

The chemical concentrations which were reported in groundwater samples collected from the wells located within the Audit Area 1 above their respective adopted environmental guideline values were as follows:-

- nitrate;
- total organic carbon (TOC);
- heavy metals (boron, lead, manganese, nickel and zinc);
- total petroleum hydrocarbons (C6 – C9);
- total petroleum hydrocarbons (C10 – C36);
- benzene;
- xylenes (total);
- volatile chlorinated hydrocarbons:
    - tetrachloroethene (PCE);
    - trichloroethene (TCE);
    - cis-1,2-dichloroethene (cis-1,2-DCE); and
    - vinyl chloride.

The presence of boron and zinc in the onsite groundwaters are likely be associated with the background (ambient) groundwater which enters the site from the east. Other chemicals reported in groundwater samples are likely to be associated with the potential contaminating activities and sources identified at the former Hills Industries site and/or a combination of ambient conditions (e.g. nitrate).

A review of the potential exposure pathways for groundwater to impact on human health within the Audit Area 1 site boundaries is summarised in Table 4.

Table 4 – Potential Exposure Pathways and Risks to Human Receptors from Impacted Groundwater

CoPC	Potential Receptors	Potential Exposure Pathways	Risks from Exposure	Mitigation Measures / Actions
CHC – PCE, TCE, DCE, VC	Construction (civil) Workers	Inhalation	**Potential** (depending on the depth of excavations). It is noted that the vapour risk assessment discussed in Section 7.0 of the AA1 DRA demonstrates that risk to the human health of construction workers (if groundwater is not exposed) is expected to be acceptably low.	If groundwater is exposed during deep (>4m) excavations along the CHC plume (see Figure 11) the air quality should be monitored. Deep excavations should be treated as potential "confined spaces" and appropriate health and safety protocol should be developed under the guidance of a HSEP.
		Dermal	**Unlikely.** The chemicals identified in groundwater do not have potential to cause skin problems or penetrate through the skin at the reported concentrations.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
		Ingestion	**N/A.** It is extremely unlikely that maintenance workers would use raw groundwater (if exposed) for drinking during construction works.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
TPH/BTEX	Construction (civil) Workers	Inhalation	**Unlikely.** Concentrations do not exceed HSLs.	Avoid exposure via the implementation of HSE Plan during works including use of appropriate PPE.
		Dermal	**Unlikely.** The chemicals identified in groundwater do not have potential to cause skin problems or penetrate through the skin at the reported concentrations.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
		Ingestion	**N/A.** It is extremely unlikely that maintenance workers would use raw groundwater (if exposed) for drinking during construction works.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
Nitrate	Construction (civil) Workers	Inhalation	**Unlikely.** Non-volatile.	N/A
		Dermal	**Unlikely.** The chemicals identified in groundwater do not have potential to cause skin problems or penetrate through the skin at the reported concentrations.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
		Ingestion	**N/A.** It is extremely unlikely that maintenance workers would use raw groundwater (if exposed) for drinking during construction works.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.

CoPC	Potential Receptors	Potential Exposure Pathways	Risks from Exposure	Mitigation Measures / Actions
Heavy Metals	Construction (civil) Workers	Inhalation	**Unlikely.** Non-volatile.	N/A
		Dermal	**Unlikely.** The chemicals identified in groundwater do not have potential to cause skin problems or penetrate through the skin at the reported concentrations.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.
		Ingestion	**N/A.** It is highly extremely that maintenance workers would use raw groundwater (if exposed) for drinking during construction works.	Avoid direct contact via the implementation of HSE Plan during works including use of appropriate PPE.

NOTES: BTEX – Benzene, Toluene, Ethylbenzene, Xylene(s)
CoPC – Contaminants of Potential Concern
CHC – Chlorinated Hydrocarbons
HSE Plan – Health, Safety and Environmental Plan
PPE – Personal Protective Equipment
TPH – Total Petroleum Hydrocarbons

Table 4 shows that there is potential risk to human health of construction workers involved in deep excavation if groundwater is exposed. Appropriate health and safety protocol should be developed for works within the excavations. However, the risk to the human health will remain acceptably low if the excavations do not expose groundwaters impacted with volatile chemicals (refer Section 8.0).

The location of the groundwater solvent impacts are presented in Figure 11, a hydrogeological cross-section of the solvent impacted area (along the northern boundary of the site) is presented in Figure 12.

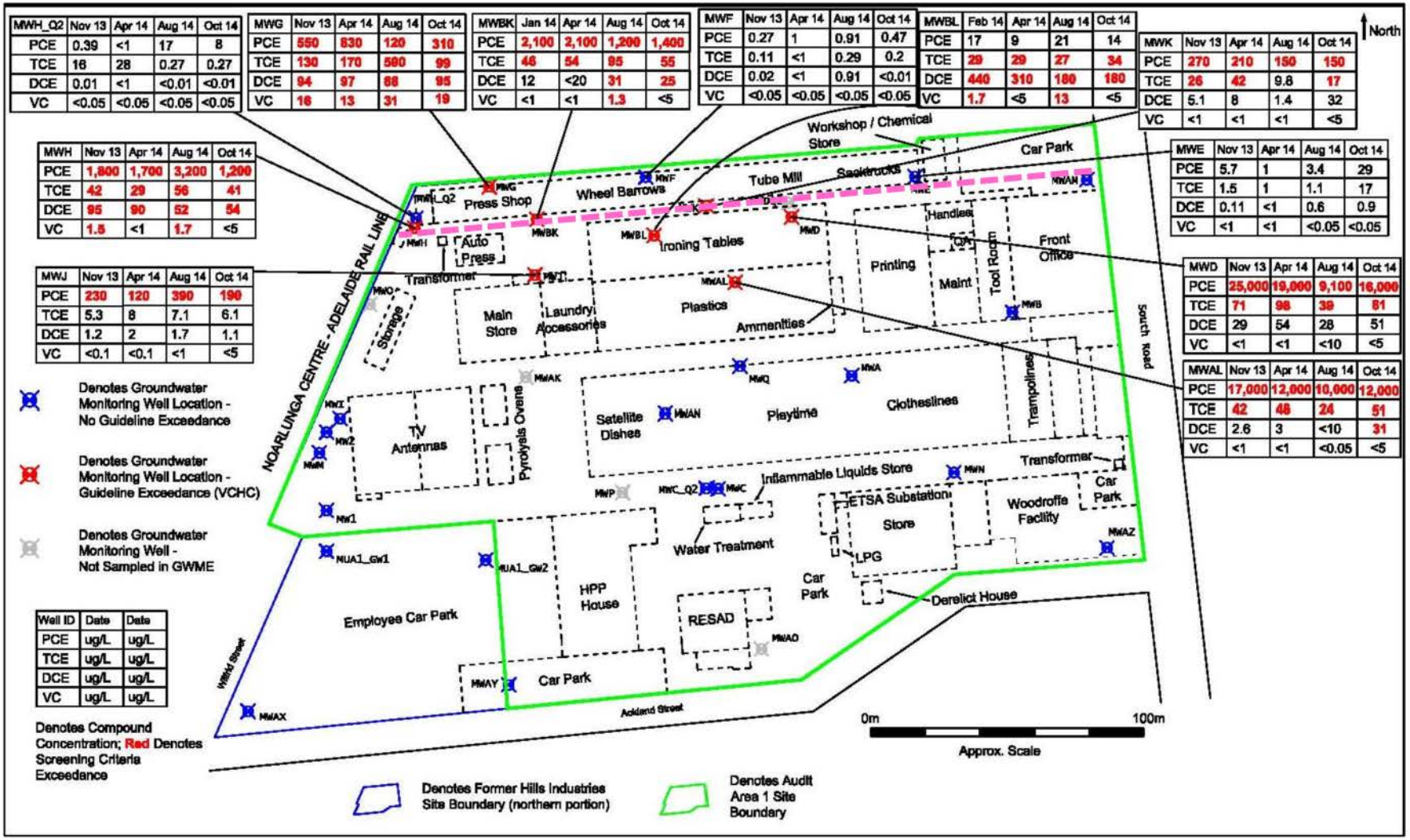

Figure 11 – Chlorinated Hydrocarbon Exceedences in Groundwater 2013-2014 (dashed line represents location of cross-section presented in Figure 12)

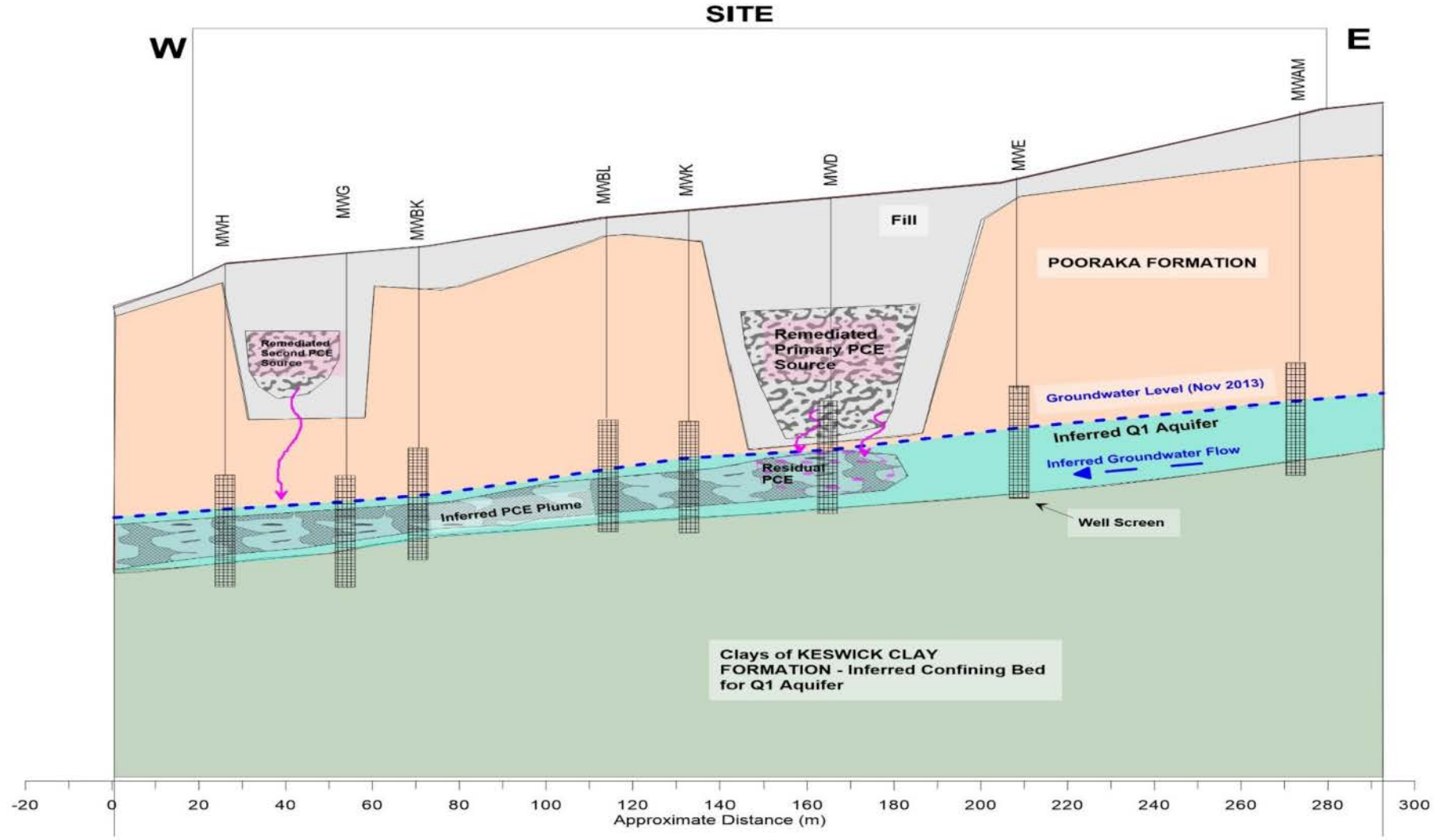

Figure 12 – East-West Conceptual Hydrogeological Cross Section

4.2.3 Site Condition – Soil Vapour

Volatile chlorinated hydrocarbon impacts have been recorded in soil vapour over the solvent plume located along the northern boundary of the site. As presented in the risk assessments (summarised in and attached to the AA1 ESA/SRA and DRA reports) and summarised in Section 3.2.4, the results suggest there are no major risks to future site occupants for the proposed site use. The risk assessment also concluded that the level of risk posed to workers in service trenches up to 1.5m bgl (construction and maintenance) and within basement excavations up to 3m is considered acceptable.

Whilst it is considered unlikely that groundwater will be exposed during development works (>4m bgl) it is noted that exposure to chlorinated hydrocarbons via direct contact and volatile chlorinated hydrocarbon vapour may result if this occurs. See Section 6.2 for further guidance relating to the interception of impacted groundwater.

4.2.4 Site Condition – General

Materials and infrastructure that may be identified during civil works include:

- Ashy fill material, see Figure 8 and Photograph 1.

Photograph 1 – Example of ashy fill material

Photograph 2 – Example of ashy fill lens ('Area F')

- A suspected former brick-lined well (Reference: P18BW) in the footprint of the former Maintenance Workshop, see Figures 9 and 10; and Photograph 2.

Photograph 2 – Pit 18 brick-lined well

- Odorous material along the northern boundary of the site relating to impacts associated with former in-ground pits in the north east corner of the former Ironing Tables Workshop footprint and north west corner of the site the former Press Shop/Auto Press footprint, see Figure 10.
- Potential voids in the footprint of the former Woodroffe's Building, see Figure 10. Such voids were not identified in further assessment works.
- Potential remnant structures/voids in the footprint of the former Clotheslines Building (associated with tram access tunnels), see Figure 10. In-ground infrastructure was removed during demolition works.
- Any other potential in-ground structures that have not been identified during demolition and assessment works.