

9 September 2020

Department of Education
Attn: Andrew Watts
Level 8, 259 George Street
Sydney, NSW 2000

By email: Andrew.Watts32@det.nsw.edu.au (Cc: Matt.Hannibal@colliers.com)

Dear Andrew,

RE: INTERIM AUDIT ADVICE LETTER NO. 1 - REVIEW OF REMEDIAL ACTION PLAN, PROPOSED GREEN SQUARE SCHOOL, 3 JOYNTON AVENUE, ZETLAND, NSW

Ramboll Australia Pty Ltd
Level 3, 100 Pacific Highway
PO Box 560
North Sydney NSW 2060

T +61 2 9954 8100
www.ramboll.com

Ref 318000967

1. INTRODUCTION

1.1 Background and Objective

As a NSW Environment Protection Authority (EPA) accredited Contaminated Sites Auditor, I am conducting an Audit in relation to the subject site under the NSW *Contaminated Land Management Act 1997* (the CLM Act). This initial review has been undertaken to provide an independent review of the suitability and appropriateness of a Remediation Action Plan (RAP).

The subject site is located within the former Royal South Sydney Hospital (RSSH) site at 3 Joynton Avenue, Zetland, NSW (Attachment 1), which has been the subject of several contamination investigations. The former RSSH site and portions of the RSSH site that are located in areas to the southeast and the south of the subject site have been subject to environmental site audits for the development of a Childcare Centre and the Green Square Community and Cultural Precinct, respectively. The subject site for this audit includes portions of the site audit area for the Green Square Community and Cultural Precinct site audit which are located in the southern portion of the subject site, including the community playground and basketball court. The site audit area does not include any overlapping areas with the adjacent Childcare Centre development, although a portion of the site will be dedicated to the Childcare Centre as a playground.

The details of the three previous environmental site audits are as follows:

- 'Site Audit Report, Former Royal South Sydney Hospital, 3 Joynton Ave, Zetland, NSW' dated 23 January 2013 prepared for City of Sydney Council by WSP Environmental Pty Ltd (Site Audit Statement No: SAS17 Sec B; Site Auditor: Rebeka Hall) and subsequent 'Interim

Ramboll Australia Pty Ltd
ACN 095 437 442
ABN 49 095 437 442

Audit Advice No. 2: Endorsement of JBS&G (September 2014) Remediation Action Plan for 3 Joynton Avenue, Zetland NSW' dated 24 September 2014 prepared for City of Sydney Council by ZOIC Environmental Pty Ltd.

- 'Site Audit Report, Green Square Childcare Centre, 3 Joynton Avenue, Zetland, NSW 2017' dated 20 September 2017 prepared for City of Sydney Council by Enviroview Pty Ltd (Site Audit Statement No: 0301-1521; Site Auditor: James Davis).
- 'Site Audit Report, Green Square Community and Cultural Precinct, 3 Joynton Avenue, Zetland, NSW' dated 20 June 2018 prepared for City of Sydney Council by Enviroview Pty Ltd (Site Audit Statement No: 0301-1530; Site Auditor: James Davis).

The current site audit relates to the proposed development of a school (Green Square Public School) (Attachment 2). The current site layout, including the location of the proposed playground to be dedicated to the adjacent childcare, is shown in Attachment 3.

1.2 Scope of Work

This interim letter is based on a review of the documents listed below and observations made on a site visit on 11 June 2020, as well as discussions with the Department of Education and JBS&G Australia Pty Ltd (JBS&G) who prepared the Remediation Action Plan (RAP) that is the subject of this interim audit advice letter (IAA).

The reports reviewed for this IAA were:

- 'Geotechnical Investigation for Proposed New School at 3 Joynton Avenue, Zetland, NSW Part Lot 2 DP1174641' dated 28 February 2018, JK Geotechnical (JK).
- 'Part 1 – Review of Existing Contamination Reports for Proposed Green Square Public School at 3 Joynton Avenue, Zetland, NSW' dated 9 March 2018, Environmental Investigation Services (EIS) (*the Contamination Report Review*).
- 'Preliminary Site Investigation for Proposed Green Square Public School at 3 Joynton Avenue, Zetland, NSW' dated 9 March 2018, EIS (*the PSI*).
- 'Validation Report - Joynton Avenue and Zetland Avenue Mid UST area, Package 4A, Green Square Town Centre Development, Zetland, NSW' dated 10 July 2018, AECOM Australia Pty Ltd (AECOM) (*the AECOM Validation Report*).
- 'JBS&G response to Interim Audit Advice 1: Proposed Green Square Public School Development, 3 Joynton Avenue, Zetland, NSW' dated 18 June 2020, JBS&G (*the Response to Auditor Comments*).
- 'School Infrastructure NSW, Green Square Public School Remedial Action Plan' Rev 1 dated 3 September 2020, JBS&G (*the RAP*).

Other reports I considered which were reviewed in previous site audits were:

- 'Remediation Action Plan, former South Sydney Hospital 3 Joynton Avenue, Zetland, NSW' dated 23 September 2014, JBS&G Australia Pty Ltd.
- 'The Council of the City of Sydney Green Square Childcare Centre Long Term Environmental Management Plan', dated 9 June 2017, JBS&G (*the Childcare Centre LTEMP*).
- 'The Council of the City of Sydney Green Square Community and Cultural Precinct Long Term Environmental Management Plan', dated 10 April 2018, JBS&G Australia Pty Ltd (*the Community and Cultural Precinct LTEMP*).

Environmental site investigations that were reviewed in previous site audits and that contain environmental data relevant to this Audit are listed below. Relevant borehole logs and analytical data were included in the RAP and I have not reviewed the source reports.

- 'Report on Phase 1 Preliminary Contamination Assessment Royal South Sydney Community Health Complex' dated December 1998, Douglas Partners Pty Ltd (DP, 1998).
- 'Preliminary Assessment, Geotechnical Constraints and Potential Site Contamination, South Sydney Hospital Site, Joynton Avenue, Zetland' dated July 2000, Golder Associates (Golder, 2000).
- 'Report on Phase 2 Contamination Assessment, 3 Joynton Avenue, Zetland' dated November 2007, DP (DP, 2007).
- 'Supplementary Contamination Assessment Former South Sydney Hospital 3 Joynton Ave Zetland NSW' dated October 2012, JBS (JBS, 2012).
- 'Report to City of Sydney Council on Environmental Site Assessment for Proposed Mixed Use Development at 3 Joynton Avenue, Zetland, NSW' dated 11 December 2014, EIS (EIS, 2014).
- 'The Council of the City of Sydney Green Square Community and Cultural Precinct Validation Report', dated 14 May 2018, JBS&G (*the Community and Cultural Precinct Validation Report*).

2. SITE DETAILS

2.1 Location

The site details are as follows:

Street address:	3 Joynton Avenue, Zetland, NSW 2017 (Attachment 2)
Identifier:	Part Lot 2 DP 1174641 (Attachment 3)
Local Government:	City of Sydney Council
Owner:	City of Sydney Council
Site Area:	Approximately 4,983 m ² , including 276 m ² parcel of land that is proposed to be dedicated to the adjacent childcare centre
Zoning:	No. 5(a) (Special Uses Zone – Hospital) under South Sydney Local Environmental Plan No. 114

The western and eastern boundaries of the site are well defined by Portman Street and Joynton Avenue, respectively. The southernmost portion of the site is approximately 130 m north of Hansard Street, which represents the southern boundary of the former RSSH site. The northern site boundary comprises the future location of Zetland Avenue.

2.2 Adjacent Uses

The site is located within an area of mixed residential and commercial/industrial land uses. The surrounding site uses include:

North: Construction site comprising new Zetland Avenue works, beyond which is a mixed use apartment building construction site with a two level basement excavation

East: Joynton Avenue, beyond which are several construction sites for a proposed redevelopment with mixed land uses (recreational, residential and commercial), Waranara Early Education Centre (Childcare Centre) is adjacent to the east in the southern portion of the site

South: Green Square Community and Cultural Precinct and Childcare Centre (in the eastern portion)

West: Portman Street, across which are several construction sites proposed to be redeveloped to accommodate mixed land uses (recreational, residential, commercial and essential infrastructure easements).

The Childcare Centre immediately adjacent to the site's southern and eastern boundaries represents a nearby sensitive receptor.

2.3 Site Condition

The RAP reported the site lies at an elevation between 17.5 to 18.8 m Australian Height Datum (AHD) and is situated within an area of gently undulating dune formations.

The central section of the site is occupied by a three-storey building of brick and concrete construction (Naomi Wing Rehabilitation Building). The building contains a hydrotherapy pool and a gym area on the ground level. A single storey building of brick and timber construction that has been used as a community hall is located in the northeast section of the site. An operational electricity substation is located at the south-western corner of the Naomi Wing Rehabilitation Building. The northern portion of the site contains a newly constructed asphalt/concrete paved carpark which was constructed over an underground storage tank (UST). Temporary site sheds are present adjacent to Portman Street to the west of the Naomi Wing Rehabilitation Building. The south-western portion of the site comprises a community playground with a hardstand pavement area and a basketball court and table tennis tables, surrounded by landscaping beds with ground cover and medium to large shrubs and mulch. Asbestos impacted soil that was generated during the Childcare Centre and the Community and Cultural Precinct redevelopment works have been placed and capped in this area which is subject to ongoing management under the Community and Cultural Precinct LTEMP as considered in the Enviroview (2018) site audit.

The Auditor's observations during the site visit are generally in accordance with the observations noted above by JBS&G. The following additional observations were noted by the Auditor during the site visit on 11 June 2020:

- The vegetated area to the south of the Naomi Wing Rehabilitation Building is approximately 1 to 1.5 metres beneath the ground level of the basketball court that is located in the southern portion of the site, indicating the presence of filling material to level the southern basketball court and community playground area, located behind a retaining wall.
- The Naomi Wing Rehabilitation Building contains a below ground pump room area in the central portion of the building footprint where electrical plant and a dewatering pump are located, associated with the ground level pool.

2.4 Proposed Development

It is understood that the site is to be redeveloped by the Department of Education – School Infrastructure NSW (SINSW). It is understood that the proposed Green Square Public School building will occupy almost the entire site, with areas along the northern and western margin of the school building footprint to be covered in hardstand and a portion in the east to be dedicated as a playground for the Childcare Centre.

For the purposes of this audit, the 'residential with accessible soil' land use scenario has been assumed as it is appropriate for Primary School and Childcare Centre development.

3. SITE HISTORY

The RAP provided a summary of the site history based on site characterisation data from previous key assessment reports and site audit reports for the former RSSH site, and portions thereof, which included review of historical aerial photographs, Council records, SafeWork NSW records, site photographs, NSW EPA records and historical Certificates of Title. The Auditor has summarised the site history below:

- ca.1820: Construction of Waterloo Dam
- 1909-1913: Decommissioning of the Waterloo Dam and development of the site as Royal South Sydney Hospital comprising wings for out-patients, mortuary, kitchen and laundry buildings
- 1919-1985: Construction of numerous new buildings, including the Esme Cahill Building (nurses' quarters) in 1938, the boiler room and laundry in 1949, and lecture hall in 1953
- ca. 1990-1994: RSSH ceases operations as a general hospital and operated as a rehabilitation centre and subsequently as a community health centre. A boiler room and an equipment lending building, formerly used as a laundry, were located in the north-western portion of the site
- 2007: three large reinforced concrete gatic covers identified as possible petrol USTs were observed in the northern section of the site during the Phase 2 Contamination Assessment by DP (2007). While it was understood that these features were removed with the construction of the new car park in around 2018, the AECOM Validation Report (July 2018) stated that "*the UST located in the proposed Zetland Avenue Mid carpark will remain in place for the current temporary car park construction works but will be removed appropriately in the future during the school development works to occur in this area.*" Consequently, a UST remains beneath the car park area north of the Naomi Wing Rehabilitation Building
- Mid-2013: the majority of the buildings located within the wider former RSSH site (offsite) had been demolished, with the ground surface largely comprising exposed site soils
- 2014: The site underwent various changes during the redevelopment of the broader RSSH site. Only the Naomi Wing Rehabilitation Building, including a hydrotherapy pool, and a Community Hall and an electricity substation are currently located within the site
- 2015 to Present: Temporary stockpiling was evident at the site between 2015-2016. Temporary capping activities are understood to have occurred during adjacent childcare centre development works. The northern portion of the site appeared to have been raised and developed as an asphalt/concrete paved car park circa April 2018. The south-eastern extent of the site was developed as a community playground constructed as part of the adjacent community and cultural precinct redevelopment works. This area contains asbestos impacted soils capped and managed under the Community and Cultural Precinct LTEMP.

The Auditor understands that a Hazardous Building Material survey will be undertaken for the remaining site structures prior to demolition. Friable asbestos in linoleum, pipe lagging and roof sheeting in buildings within the former RSSH site was first identified during the Phase 1 Preliminary Contamination Assessment (DP, 1998). Subsequent investigations confirmed the presence of ACM fragments on the ground surface and in fill materials within the site area.

Based on a search of the EPA records undertaken by the Auditor, the site does not appear to have been regulated or notified to the EPA under the CLM Act.

3.1 Auditor’s Opinion

The site history provides an adequate indication of past activities at the site, including a number of potential sources of contamination: impacted fill material, UST (exact number and location unknown), former laundry and boiler room (refer Attachment 4), substation and uncontrolled demolition of buildings containing hazardous building materials.

4. CONTAMINANTS OF CONCERN

The PSI includes a list of the potential and/or known contaminants of concern and potentially contaminating activities, based on the site history and review of the previous investigations, which have been tabulated in Table 4.1.

Table 4.1: Contaminants of Potential Concern

Area	Activity	Potential Contaminants
Beneath buildings and around the whole site	Filling to achieve existing site levels	Copper, lead, nickel, zinc, PAHs, TPHs, BTEX, asbestos The Auditor notes OCPs, OPPs, phenols and PCBs may also be contaminants in fill
North-western corner of the Naomi Wing Rehabilitation Building	Up to three USTs are suspected to exist beneath the car park hardstand surface	Lead, TPHs, BTEX, PAHs The Auditor notes volatile organic compounds (VOCs) may be potential contaminants associated with the laundry
Adjacent to south-western corner of the Naomi Wing Rehabilitation Building	Substation (kiosk)	PCBs The Auditor notes phenols and TPHs may also be potential contaminants associated with the substation
North-western and south-western sections of the site	Stockpiles were previously located on the site but these have been removed	Metals, TPHs, BTEX, PAHs, OCPs, OPPs, PCBs, asbestos
Naomi Wing Rehabilitation Building in the central section of the site and the Community Hall building in the north eastern section of the site	Hazardous building materials	Asbestos, lead, PCBs

Metals: arsenic, copper, chromium, cadmium, lead, mercury, nickel, zinc

TPH: total petroleum hydrocarbons

TRH: total recoverable hydrocarbons

BTEX: benzene, toluene, ethylbenzene, xylenes

PAHs: polycyclic aromatic hydrocarbons

PCBs: polychlorinated biphenyls

OCPs: organochlorine pesticides

OPPs: organophosphorus pesticides

The contaminants of concern identified in the RAP based on the results of previous investigations of the site included asbestos (ACM and free asbestos fibres), metals (in particular lead), carcinogenic PAHs (reported as Benzo(a)pyrene TEQ) and TRH.

4.1 Auditor’s Opinion

The contaminants of potential concern presented in Table 4.1 adequately reflect the site history and site conditions. The revised contaminants of concern presented in the RAP are considered to adequately reflect the results of the various site investigations.

There has been no assessment by the consultants for the presence of per- and poly-fluoroalkyl substances (PFAS) but in the Auditor's opinion there are no indications in the site history that they would be potential contaminants of concern.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

JBS&G reviewed geological maps and reported that the site is underlain by a unit of Quaternary sediments that is commonly referred to as the Botany Sand Beds (BSB) comprising unconsolidated to semi-consolidated permeable sands. The sands are fine to medium grained quartz marine sands with minor shell fragments and podzols. The sand is interspersed with peat lenses, peaty sands, silts and clays, which become more common in the lower part of the sequence. BSB can reach thicknesses of up to 60 m and are generally underlain by the Hawkesbury Sandstone Formation.

Soils in the vicinity of the site are comprised of the Tuggerah Soil Landscape Group which typically occurs on gently undulating to rolling coastal dune fields with local relief to 20 m and slope gradients ranging between 1% to 10%. These types of soils are noted to comprise deep podzols on dunes and podzols/humus podzols intergrades on swales. The soils represent an extreme wind and wave erosion hazard, are non-cohesive and exhibit very low fertility and very high permeability.

Over 50 boreholes have been undertaken at the site during investigations between 1998 and 2018 (Attachment 4). The sub-surface profile encountered is summarised by the Auditor in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 0.05	Asphaltic concrete (located in the northern car park area)
0.05 up to 3.0	Fill material, heterogeneous, brown gravelly sand and brown gravelly clayey sand. Trace levels of brick, concrete, tile, glass, metal, ash and slag waste. The thickness of this layer varies from 0.8 m to 3 m. Fibre cement fragments were observed in fill in a limited number of locations.
1.6 to depth	Silty sand, fine to medium grained, dark brown, trace of ash.

mbgl – metres below ground level

A number of locations were terminated in fill material (including four of the nine borehole locations in the PSI) however sufficient locations were advanced to confirm that the materials beneath the fill across the site are natural sands.

Based on the EIS review of the Department of Land and Water Conservation (1997) 'Acid Sulfate Soil Risk Map (2nd Edition) for Botany Bay, the site is located within an area classified as "no known occurrence of acid sulfate soils (ASS)". The nearest occurrence of identified ASS comprises sediments in Alexandra Canal, located approximately 1.3 km southwest of the site.

According to the RAP, intrusive investigations undertaken at the site by JBS (2012) did not identify natural soils at the former RSSH site exhibiting characteristics of ASS or potential ASS (PASS). EIS reported in the PSI that the ASS assessment undertaken during the Environmental Site Assessment by EIS (2014) at the former RSSH site did not identify ASS or PASS to a depth of 4.5 m (approx. RL 14.5m). The PSI concluded that "Based on the geological and soil characteristics of the site [...] management of development activities is not required to address the potential for impact of ASS."

5.2 Hydrogeology

The RAP reports that two main groundwater systems are anticipated to operate in the vicinity of the site, including a shallow unconfined to semi-confined aquifer system within the BSB and a deeper confined groundwater system within fractures of the porous Hawkesbury Sandstone formation at the base of the Botany Basin aquifer.

Review of the Department of Planning, Industry and Environment Botany Basin Groundwater Management Map indicates that the site is within Zone 2 of the Botany Groundwater Management Zones, which includes a domestic ban on groundwater use for drinking water, watering gardens, washing windows and cars, bathing or to fill swimming pools due to known or suspected contamination from past industrial activity. Extraction of groundwater for industrial use is permitted with approval and regular monitoring of water quality.

Consistent with the historical extensive use of groundwater in the Botany Sands aquifer, the RAP reports that a significant number of registered groundwater wells were previously identified in the proximity of the site for monitoring or industrial purposes.

During the PSI, three groundwater wells were installed at locations BH2 (MW2), BH5 (MW5) and BH9 (MW9) to depths of up to 6 mbgl. A single round of groundwater sampling of the three new wells was undertaken in February 2018 and a fourth well (MW05) was installed and sampled by JBS&G in 2012. Standing water levels (SWLs) during the PSI were reported between 3.1 to 4 mbgl, which represents approximately 15 and 14 mAHD in the northern and southern portions of the site, respectively. This indicated groundwater movement in a southerly direction at the time of the PSI, which is consistent with a regional groundwater movement in the deeper confined sandstone/shale bedrock underlying the site in a south-westerly direction. The nearest surface water receptor to the site is Shea's Creek, located approximately 680 m to the northwest of the site and Alexandra Canal located approximately 1.4 km to the southwest of the site. These waterways have an existing degraded water quality.

5.3 Auditor's Opinion

The depth of fill, underlying stratigraphy and hydrogeology have been adequately characterised and are sufficiently well known for the purpose of remediation planning. Groundwater at the site is present below 3.1 mbgl and is subject to the controls of the Zone 2 Groundwater Protection Zone of the Botany Basin.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

Table 6.1 below provides a summary of the data sources, field investigations conducted within the site area and analytical data obtained. Investigation locations are shown on Attachment 4.

Table 6.1: Summary of Investigations

Investigation	Field Investigations Within Site Area	Analytical Data Obtained
DP (1998)	2 borehole locations (Boreholes 2 and 3)	Soils: Metals, PAHs
Golder (2000)	6 hand auger locations (HA1, HA1a, HA1b, HA6, HA12 and HA13)	Soils: Metals TPH, BTEX, PAHs, OCPs, PCBs, phenols, asbestos (absence/ presence)
DP (2007)	7 borehole locations (BH13, BH16, BH17, BH18, BH20, BH28, BH29)	Soils: Metals TPH, BTEX, PAHs, OCPs, PCBs, phenols

Investigation	Field Investigations Within Site Area	Analytical Data Obtained
JBS (2012)	18 borehole locations (BH17A, BH17-E, BH17-N, BH17A-S, BH17A-W, BH20A, BH20A-S, BH20A-W, BH31, BH32, BH33, BH34, BH35, BH36, BH37, BH38, BH40, BH55) 1 groundwater monitoring well (BH32/MW5)	Soils: Metals TPH, BTEX, PAHs, OCPs, OPPs, PCBs, phenols, asbestos (absence/ presence) Groundwater: Metals TPH, BTEX, PAHs
EIS (2014)	9 test pit locations (TP308, TP309, TP310, TP311, TP312, TP313, TP314, TP315, TP316)	Soils: Metals, asbestos (absence/ presence)
PSI (EIS, 2018)	9 borehole locations (BH1 to BH9) 4 soil samples from 2 stockpiles (X1, X2, X3, Y1) 3 groundwater monitoring wells (MW2, MW5, MW9) installed at borehole locations BH2, BH5 and BH9	Soil: Metals, TRH/BTEX, PAHs, OCPs, OPPs, PCBs, chlorinated VOCs, asbestos (absence/presence) TCLP leachability: Metals, benzo(a)pyrene (B(a)P) Groundwater: Metals, TRH/BTEX, PAHs, VOCs
Community and Cultural Precinct Validation Report (JBS&G, 2018)	3 validation sample locations (V34, V35, V36)	Asbestos (500 ml AF/FA)
AECOM Validation Report (AECOM, 2018)	3 test pit locations (CPTP-N, CPTP_E, CPTP_W) and one hand auger sampling location to sample the soils inside and at the base of the UST (UST_1.9)	Soils: Metals, TRH, BTEX, asbestos (absence/presence)

The majority of the data relevant to the current site condition was reviewed in previous site audits by WSP (2013), Zoic (2014) and Enviroview (2017 and 2018). Not all of the source reports were available for review by the previous auditors, who also relied on summaries presented in the previous RAPs.

With respect to overall data quality:

- WSP (2013) concluded *"The Auditor considers the overall QA/QC program for the investigation adopted by JBS to be in general accordance with the NEPM (1999) and NSW EPA endorsed guidelines, and is considered appropriate to address the data gaps in previous works, and to characterise the Site."*
- Enviroview (2018) concluded *"Overall, the quality measures reviewed were found to adequately comply with the requirements outlined in relevant guidelines (NEPC, 1999, Amended 2013) and (NSW EPA, 2017)." and "Overall, based upon the QA/QC assessments completed by the consultants (and noting that in some cases they are limited in extent) the data is considered to be adequately reliable for the purpose of providing preliminary site characterisation."*

Further consideration of the quality of data reviewed in the previous site audits is not made herein. The Auditor has assessed the quality of the data presented in the PSI and the AECOM Validation Report by review of the information presented in the referenced reports, supplemented by field observations. The Auditor's assessment of the analytical data follows in Tables 6.2 and 6.3.

Table 6.2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
<p><i>Data Quality Objectives (DQO)</i></p> <p>The AECOM Validation Report and the PSI defined specific DQOs in accordance with the process outlined in Schedule B2 of NEPM (2013).</p>	<p>These were considered appropriate for the investigations conducted.</p>
<p><i>Sampling pattern and locations</i></p> <p><i>Soil:</i> Investigation locations for the PSI were spaced on a judgemental sampling plan to gain coverage of the majority of the site outside the footprint of the remaining buildings.</p> <p>Sampling locations undertaken by AECOM included four test pits around the UST located in the southern portion of the car park. As the UST was reported to be located directly adjacent to the building, it was not possible to sample at the southern end of the UST.</p> <p>Soil sampling locations from previous investigations cover the majority of the site, including limited sampling within the footprint areas of the buildings and substation kiosk.</p> <p><i>Groundwater:</i> Three monitoring wells were installed during the PSI (MW2, MW5 and MW9) positioned in a triangle providing reasonable coverage of the site area. Although an additional four previous groundwater locations (MW1, MW4, MW5, and MW6) were sampled by JBS (2012) and groundwater data was reported in the RAP, three of the four sample locations were off-site and located within the wider former RSSH site, with only BH32/MW5 located onsite, located at the northwest corner of the Naomi Wing Rehabilitation Building.</p>	<p>In the Auditor's opinion the soil investigation locations adequately target the main areas of concern and the combined investigation locations provide adequate investigation coverage of the site.</p> <p>Soil sampling within the footprint of the existing buildings was limited. Additional soil sampling within the footprint of remaining buildings is proposed during the development stages of the works for waste classification purposes and to complete the characterisation of the site.</p> <p>MW2, MW5 and MW9 are positioned approximately 20 m to the east, northwest and west of the inferred UST location. No groundwater wells are located in a close downgradient position from the suspected USTs (i.e. to the south or southwest) however MW9 is located to the south/southwest at a distance of around 40-50 m, providing downgradient coverage. Overall the groundwater well locations provide adequate coverage of the site and are sufficient to identify significant groundwater contamination due to the UST and former laundry.</p>
<p><i>Sampling density</i></p> <p><i>Soil:</i> The combined investigations comprise over 50 locations, in addition to 4 stockpile sample locations. For a site area of approximately 5,000 m², this density exceeds the minimum of 13 sample locations recommended by the EPA (1995) <i>Sampling Design Guidelines</i>.</p> <p>The frequency of analysis for individual analytes is included in Table 8.1. A maximum of 69 samples were analysed, for lead. The majority of samples were analysed for the primary contaminants comprising metals, TRH, BTEX and PAHs, with a reduced frequency of 10 samples for phenols and around 20 samples for OCPs, OPPs and PCBs. 45 small volume samples were analysed for presence/absence of asbestos.</p> <p><i>Groundwater:</i></p> <p>EIS sampled the three new wells onsite in 2018, with MW5 sampled by JBS in 2012.</p>	<p>The density of soil and groundwater sample locations across the site is considered adequate. The density of analysis for the contaminants of concern is considered acceptable, although the lack of large volume samples for the identification of asbestos is noted.</p>
<p><i>Sample depths</i></p> <p>Soil samples were collected and analysed from a range of depths, with the primary intervals being within the shallow fill (generally less than 0.5 m) and around the fill/natural sand interface (varying from between approximately 1.6 to 2.8 mbgl).</p>	<p>In the Auditor's opinion, this sampling strategy was appropriate and adequate to characterise the primary material types present on site and the material with the highest potential for contamination (surface/ shallow fill).</p>
<p><i>Well construction</i></p> <p>The three monitoring wells installed during the PSI were installed to depths of approximately 6 mbgl, with screen intervals from a depth of approximately 3 to 6 mbgl intersecting the water table in sand.</p>	<p>Well screens intersected the water table allowing identification of floating product, if present, although would not be appropriate to identify chlorinated VOCs. Overall the well construction</p>

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
<p>Wells were constructed of 50 mm Class 18 PVC. A 2 mm sand filter pack was used around the screen section with a bentonite seal placed above the screen. A gatic cover was installed at the surface with a concrete plug.</p> <p>The borehole log for location BH32/MW5 shows that the well construction included a screen interval from 0.7 mbgl to the end of the borehole at 3.7 mbgl, intersecting the water table in sand. WSP (2013) reported that the well was constructed with 50 mm Class 18 PVC with machine slotted screen. The well was installed 2 m below the depth at which groundwater was initially encountered.</p>	<p>was considered acceptable considering the lack of field or laboratory evidence of impacts by VOCs.</p>
<p><i>Sample collection method</i></p> <p><i>Soil:</i> The PSI locations were drilled using spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) split spoon sampler or directly from the auger when conditions did not allow use of the SPT sampler. AECOM (2018) undertook test pits around the UST location. Soil samples were collected directly from the centre of the excavator bucket using a hand trowel. Sample collection of stockpile material was undertaken using hand equipment, following removal of the surficial 0.2-0.3 m of material from the surface of the stockpile.</p> <p><i>Groundwater:</i> Wells were developed using a submersible electrical pump with single-use tubing until steady state conditions were achieved which included a constant SWL and stabilisation of the water quality parameters.</p> <p>Groundwater samples were obtained using a low flow peristaltic pump with dedicated sample tubing.</p>	<p>Sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination. Given the key contaminants at the site are asbestos, metals and non-volatile organic contaminants (PAHs, TRH), this deficiency is not considered to be significant.</p> <p>The majority of investigation locations at the site were boreholes. This is not ideal for identification of asbestos in soil. JBS&G have considered in the RAP that fill material as a whole across the site is impacted by asbestos.</p> <p>The groundwater sampling method was appropriate.</p>
<p><i>Decontamination procedures</i></p> <p><i>PSI:</i> Sampling personnel used disposable nitrile gloves during sampling activities. Re-usable soil sampling equipment was decontaminated in accordance with procedures outlined in the PSI.</p> <p>Dedicated sampling equipment and single-use tubing was used for each well during the PSI. During development the pump was flushed between monitoring wells with potable water and the pump tubing was discarded after each sampling event.</p> <p><i>AECOM Validation Report:</i> The hand trowel was reportedly decontaminated with detergent solution and a new pair of nitrile gloves was worn for the collection of each sample.</p>	<p>Acceptable</p>
<p><i>Sample handling and containers</i></p> <p>Samples were placed into laboratory prepared and preserved sampling containers and the samples were chilled during storage and subsequent transport to the analytical laboratories. Samples for asbestos analysis were placed in plastic zip-lock bags.</p> <p>Groundwater samples were handled and transported in accordance with the recommendations in AS/NZS 5667.1:1998.</p> <p>The PSI does not specify if groundwater samples to be analysed for heavy metals were field filtered. Therefore the metals concentrations reported in the PSI may be over- or under-estimated depending on the groundwater pH.</p>	<p>Acceptable.</p>
<p><i>Chain of Custody (COC)</i></p> <p>Completed COC forms were provided in the reports reviewed.</p>	<p>Acceptable</p>
<p><i>Detailed description of field screening protocols</i></p> <p><i>Soil:</i> Field screening for volatiles was undertaken using a photoionisation detector (PID). Soil sub-samples were placed in ziplock plastic bags and the headspace measured for VOCs after allowing time for equilibration.</p> <p><i>Groundwater:</i> Field parameters were measured during well sampling and development using a YSI Multi-probe water quality</p>	<p>Acceptable</p>

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
<p>meter including pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh).</p>	
<p><i>Calibration of field equipment</i> The reports indicated that calibration had been undertaken prior to use and checks were performed during use. Calibration certificates from the equipment supplier were provided in the AECOM Validation Report. The PID calibration certificates were not provided in the PSI, although EIS state that PID calibration certificates are maintained on file by EIS.</p>	<p>Acceptable. The absence of PID calibration records in the PSI is not considered significant given that field and laboratory results were consistent.</p>
<p><i>Sampling logs</i> Soil borehole and test pit logs were provided within the PSI and the AECOM Validation Report, indicating sample depth and lithology and sampling intervals. Groundwater field sampling records were provided, indicating SWL, field parameters, methodology and observations.</p>	<p>Acceptable</p>

Table 6.3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
<p><i>Field quality control samples</i> Field quality control samples for the PSI and AECOM Validation Report included an appropriate frequency of intra and inter-laboratory duplicates for soil and groundwater. The AECOM Validation Report included 4 rinsate blanks and 3 trip blanks. The PSI included 1 trip blank and 1 trip spike, but no rinsate blank. The absence of a rinsate blank was justified by EIS due to the single-use of equipment/tubing, eliminating the potential for cross-contamination while maintaining standard decontamination procedures during soil sampling.</p>	<p>Acceptable</p>
<p><i>Field quality control results</i> PSI: Relative percent difference (RPD) non-conformances were reported for some metals and PAHs in four duplicate soil sample pairs. No RPD exceedances were reported for groundwater duplicate samples. Values outside the acceptable limits were attributed to sample heterogeneity and difficulties associated with obtaining homogeneous duplicate samples of heterogeneous matrices. As the primary and duplicate sample results were below the site assessment criteria, the exceedances were not considered by EIS to have had an adverse impact on the data set as a whole. The results of the trip blank and trip spike were within appropriate limits. AECOM Validation Report: RPDs were reported within the DQI limits. The results of trip blanks and rinsate blanks were within appropriate limits.</p>	<p>Acceptable.</p>
<p><i>NATA registered laboratory and NATA endorsed methods</i> The primary laboratories used were Envirolab Sydney (PSI) and ALS Environmental (AECOM Validation report). Secondary laboratories were Envirolab Victoria (PSI) and Envirolab Sydney (AECOM Validation report). Laboratory test certificates were NATA stamped and analytical methods were consistent with Schedule B(3) of NEPM (2013).</p>	<p>Acceptable</p>
<p><i>Analytical methods</i> Analytical work undertaken during the PSI and the AECOM Validation Report included standard analytical methods for all</p>	<p>Acceptable</p>

Field and Lab QA/QC	Auditor's Opinion
<p>analyses with analytical methods included in the laboratory test certificates.</p> <p>Asbestos analysis was largely by presence/absence analysis of small volume samples, with three samples analysed as 500 ml samples in accordance with NEPM (2013). These three samples were obtained during the validation of the adjacent Community and Cultural Precinct redevelopment at validation sample locations V34, V35 and V36 and were previously assessed in the Site Audit Report for the Green Square Community and Cultural Precinct by Enviroview Pty Ltd (Site Audit Statement No: 0301-1530).</p> <p>The NEPM (2013) method is not NATA accredited.</p>	
<p><i>Holding times</i></p> <p>Analyses undertaken during the PSI and the AECOM Validation Report investigation were extracted and analysed within holding times.</p>	Acceptable
<p><i>Practical Quantitation Limits (PQLs)</i></p> <p>PQLs were less than the threshold criteria for the contaminants of concern.</p>	Acceptable
<p><i>Laboratory quality control samples and results</i></p> <p>Laboratory quality control samples undertaken included laboratory control samples or certified control samples, matrix spikes, method blanks, laboratory duplicates and surrogate spikes.</p> <p>The results were generally within control limits with the exception of:</p> <p><i>PSI:</i></p> <ul style="list-style-type: none"> • Some RPD exceedances for heavy metals in two duplicate sample pairs. Additional triplicate laboratory analyses were undertaken for these samples and the concentrations were below the site assessment criteria. • No matrix spike recovery for mercury was reported for one sample. <p><i>AECOM Validation Report:</i></p> <p>Surrogate spike recovery outliers were less than the lower DQO. These samples were not part of the data set relevant for the remediation of the site and from offsite locations (i.e. sample exceedances not applicable for the purposes of the current site assessment).</p>	Acceptable
<p><i>Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy)</i></p> <p>The PSI included predetermined data quality indicators (DQIs) that were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes, surrogate spikes and internal standards. These were discussed with regard to the five category areas. The PSI concluded that <i>"the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives."</i></p> <p>The AECOM Validation Report included a data validation report discussing the QA/QC data evaluation and concluded that <i>"The quality of the data has been assessed as acceptable for the purposes of this assessment."</i></p>	An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.

6.1 Auditor's Opinion

The previous site audits have been relied upon in this review for the purpose of assessing the quality of the historical data. In considering the data from EIS (2018) and AECOM (2018) the Auditor concludes that:

- The data is likely to be representative of fill and natural material at the site although there were deficiencies in the assessment of asbestos (small volume samples from boreholes) which may underestimate the extent of asbestos impact in fill. JBS&G have considered in the RAP that fill material as a whole across the site is impacted by asbestos. This is considered appropriate to address this deficiency.
- The data is largely complete.
- The data from the historical investigations and the PSI and the AECOM Validation Report is adequately comparable.
- The results of field and laboratory duplicates indicate that the contaminant concentrations in heterogeneous fill material are variable, which limits the precision of the data.
- The data is considered to be accurate.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed the soil data against Tier 1 criteria from National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed development, the human health criteria for 'residential with garden/accessible soil' and ecological criteria appropriate for 'urban residential and public open space' were adopted. The residential criteria are applicable to primary school and child care centre usage.

7.1 Soil Assessment Criteria

Human Health Assessment Criteria

- NEPM (2013) Health Investigation Levels (HILs) for 'Residential' (HIL-A) land use.
- NEPM (2013) Health Screening Levels (HSLs) for 'Low-High Density Residential' (HSL-A&B) land use assuming a sandy soil type. Depth to source adopted was <1 m as an initial screen.
- NEPM (2013) Management Limits (MLs) for petroleum hydrocarbons for 'Residential and Open Space' land use and assuming coarse soil texture. Criteria are relevant for operating sites where significant sub-surface leakage of petroleum hydrocarbons has occurred and when decommissioning industrial and commercial sites. Criteria are therefore conservative when applied at the site.
- NEPM (2013) HSLs for Asbestos Contamination in Soil for 'Residential A' (HSL-A) land use. The criteria for asbestos fines/ fibrous asbestos (AF/FA) are relevant for 500 ml samples. A criteria of 'no asbestos detected' has been adopted for small volume (presence/absence) samples.

On 11 April 2013, the Standing Council on Environment and Water (SCEW) agreed to amend the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM 1999 (2013)). The amendment came into effect on 16 May 2013.

There are differences in the criteria and the fractions of petroleum hydrocarbons reported between the original and amended NEPM 1999 (2013). Petroleum hydrocarbon data collected prior to the revision was generally reported as TPH C₆-C₉ (F1 old), TPH C₁₀-C₁₄ (F2 old), TPH C₁₅-C₂₈ (F3 old) and TPH C₂₉-C₃₆ (F4 old). The amendment provides criteria for TRH C₆-C₁₀ minus

BTEX (F1), TRH >C₁₀-C₁₆ minus naphthalene (F2), >C₁₆-C₃₄ (F3) and TPH >C₃₄-C₄₀ (F4) and laboratories generally now report against these fractions.

The historical data reported as the "old" fractions has been assessed by the Auditor in comparison to the equivalent "new" fraction with consideration given on a case by case basis as to whether this is a reasonable and conservative approach based on the observed composition of the contamination. Discussion is provided herein where a variation to a direct comparison has been applied (e.g. where the sum of BTEX or naphthalene has been subtracted from the F1 old and F2 old concentrations).

Ecological Assessment Criteria

- NEPM (2013) Ecological Screening Levels (ESLs) for 'Urban Residential and Public Open Space' land use, assuming coarse soil.
- NEPM (2013) Ecological Investigation Levels (EILs) for 'Urban Residential and Public Open Space' land use. The Auditor has adopted the terrestrial ecological investigation levels used in the RAP which were based on the criteria applied in the PSI. EILs for selected metals were calculated using average site specific soil parameters for pH (9), cation exchange capacity (CEC) (26 cmol/kg) and clay content (3%), as well as ambient background concentrations (ABC) for aged soils in an urban high traffic setting from Olszowy et al (1995). The Auditor notes that the locations, number of samples and source data that were used in the calculation of the average pH, CEC and clay content for use in the determination of the site specific EILs was not provided in the PSI. The Auditor has adopted the site specific criteria as an initial screen, noting that EIL exceedances are not likely to change the proposed remediation strategy (discussed in Section 11).
- Canadian Council of Ministers of the Environment (CCME) (2010) *Canadian soil quality guidelines: carcinogenic and other polycyclic aromatic hydrocarbons (PAHs)* soil quality guideline (SQG) for benzo(a)pyrene for 'Residential/parkland' land use. The SQG has been referenced in addition to the NEPM (2013) ESL as it is based on a larger and more up-to-date toxicity database than the low reliability NEPM (2013) ESL.

Soil Aesthetic Considerations

The Auditor has considered the need for soil remediation based on 'aesthetic' contamination as outlined in *Section 3.6 Aesthetic Considerations* of NEPM (2013) Schedule B1, which acknowledges that there are no chemical-specific numerical aesthetic guidelines. Instead, site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

7.2 Groundwater Assessment Criteria

Human Health Assessment Criteria

- NEPM (2013) HSLs for 'Low-High Density Residential' (HSL-A&B) land use assuming a sand soil type and a depth to groundwater of 2 to <4 m.

Drinking water and recreational use criteria were not considered given the location of the site within the Zone 2 Groundwater Protection Zone and the nature of the receiving water (not used recreationally).

Ecological Assessment Criteria

- Australian and New Zealand Governments and Australian state and territory governments (ANZAST) (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. (www.waterquality.gov.au/anz-guidelines) (the ANZG). Groundwater Default Guideline Values (DGVs) provided are concentrations that, if exceeded, indicate a potential environmental problem at the point of use and 'trigger' further investigation. The 95% marine water level of

protection was adopted since the closest receptor is Alexandra Canal, an adapted artificial waterway (formerly known as Sheas Creek). The DGVs are largely equivalent to the trigger values (TVs) from the ANZECC (2000) guidelines that were referenced in the PSI.

7.3 Consultant's Assessment Criteria

The environmental quality criteria referenced by the Auditor are generally consistent with those adopted in the PSI, AECOM Validation Report and the RAP.

8. EVALUATION OF SOIL RESULTS

8.1 Field Results

In assessing the results of the most recent investigations, the Auditor made the following observations regarding field results:

PSI (EIS, 2018):

- Fill material was encountered at the surface or beneath the pavement in all boreholes to a maximum depth of approximately 2.8 mbgl, with boreholes at five of the nine borehole locations (BH1, BH3, BH4, BH6, BH9) terminating in fill material at depths of between 0.4 to 1.8 mbgl. Fill material contained anthropogenic materials, including concrete, gravel, bricks, ash and slag, as well as igneous rock fragments.
- Underlying natural sandy soil was located beneath the fill material at borehole locations BH2, BH5, BH7 and BH8, terminating between 3.45 mbgl to 6.0 mbgl.
- No odour observations and PID readings were recorded on the borehole logs.
- Asbestos was not observed in any of the fill material, with an asbestos fibre cement fragment recorded on the ground surface at location JF1.

AECOM Validation Report (AECOM, 2018):

- Fill (silty gravelly sand) extended to the maximum depth of investigations of 2.5 mbgl at sampling locations CPTP_W and CPTP_N with refusal on concrete at 1.4 mbgl at CPTP_E.
- Fragments of potential ACM were noted on the ground surface in the UST area, which was unsealed at the time of the investigation and which is now covered by an asphalt carpark surface.
- No odour or staining was observed and PID readings were less than 2 ppm and considered by AECOM (2018) to be representative of background concentrations.

These findings were generally consistent with the previous investigations which did not identify widespread evidence of impact by petroleum hydrocarbons, although identified the presence of asbestos on the ground surface and in fill. ACM (or asbestos as loose fibre bundles) was observed or reported by the laboratory in fill at a number of previous sample locations and consequently the RAP considered fill materials within the site to be impacted with asbestos.

8.2 Analytical Results

Soil samples across historical investigations and for the recent PSI and the AECOM Validation Report were analysed for a variety of contaminants including metals, TRH/BTEX, PAHs, PCBs, OCPs, OCCs, phenols and asbestos. The relevant data for the site were presented in the RAP and have been assessed against the environmental quality criteria by the Auditor as summarised in Table 8.1. Soil sampling locations are presented in Attachment 4.

It is noted that soil samples from sample location BH20, which identified elevated lead concentrations in shallow fill (0.4 m-0.5 m) off-site to the north of the northern site boundary,

has not been included in the evaluation of the analytical soil data set for the site. The location is shown in Figure 4 to provide a reference point for BH20 in relation to the position of the northern site boundary.

Table 8.1: Evaluation of Soil Analytical Results – Summary Table (mg/kg)

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
Fibre cement fragment	2	2	-	Chrysotile and Amosite asbestos detected	
AF/FA in soil	3	0	<PQL	0 above HSL 0.001%	-
Asbestos (presence/absence) in soils	43	3	-	Chrysotile or Chrysotile and Amosite asbestos detected	-
Benzene	46	0	<PQL	0 above HSL A&B 0-1 m, sand 0.5 mg/kg	0 above ESL (urban residential) (coarse) 50 mg/kg
Toluene	46	0	<PQL	0 above HSL A&B 0-1 m, sand 160 mg/kg	0 above ESL (urban residential) (coarse) 85 mg/kg
Ethylbenzene	46	0	<PQL	0 above HSL A&B 0-1 m, sand 55 mg/kg	0 above ESL (urban residential) (coarse) 70 mg/kg
Total Xylenes	46	1	2.0	0 above HSL A&B 0-1 m, sand 40 mg/kg	0 above ESL (urban residential) (coarse) 105 mg/kg
F1 (TRH C ₆ -C ₁₀ minus BTEX)	28	0	<PQL	0 above HSL A&B 0-1 m, sand 45 mg/kg	0 above ESL (urban residential) (coarse/fine) 180 mg/kg
F2 (TRH >C ₁₀ -C ₁₆ minus naphthalene)	28	0	<PQL	0 above HSL A&B 0-1 m, sand 100 mg/kg	0 above ESL (urban residential) (coarse/fine) 120 mg/kg
TRH C ₆ -C ₁₀ or TPH (C ₆ -C ₉)	49	1	50	1 above HSL A&B 0-1 m, sand 45 mg/kg	0 above ESL (urban residential) (coarse/fine) 180 mg/kg
TRH >C ₁₀ -C ₁₆ or TPH (C ₁₀ -C ₁₄)	49	2	1800	1 above HSL A&B 0-1 m, sand 100 mg/kg	1 above ESL (urban residential) (coarse/fine) 120 mg/kg
TRH >C ₁₆ -C ₃₄ or TPH (C ₁₅ -C ₂₈)	49	3	8100	1 above ML (urban residential) 2500 mg/kg	3 above ESL (urban residential) (coarse) 300 mg/kg
TRH >C ₃₄ -C ₄₀ or TPH (C ₂₉ -C ₃₆)	49	2	370	0 above ML (urban residential) 10,000 mg/kg	0 above ESL (urban residential) (coarse) 2800 mg/kg
Naphthalene	55	7	0.8	0 above HSL A&B 0-1 m, sand 3 mg/kg	0 above EIL (urban residential) 170 mg/kg
Benzo(a)pyrene	54	40	14	-	14 above ESL (urban residential) 0.7 mg/kg

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
					0 above CCME SQG 20 mg/kg
Benzo(a)pyrene TEQ	54	17	19.75	7 above HIL A 3 mg/kg	-
Total PAHs	56	40	162.6	0 above HIL A 300 mg/kg	-
Total Phenols	10	0	<PQL	0 above HIL A 3000 mg/kg	-
Arsenic	60	13	11	0 above HIL A 100 mg/kg	0 above EIL (urban residential) 100 mg/kg
Cadmium	60	2	1.3	0 above HIL A 20 mg/kg	-
Chromium	60	56	75	0 above HIL A 100 mg/kg	0 above EIL (urban residential) 333 mg/kg
Copper	60	57	210	0 above HIL A 6000 mg/kg	0 above EIL (urban residential) 248 mg/kg
Lead	69	62	990	6 above HIL A 300 mg/kg	0 above generic EIL (urban residential) 1100 mg/kg
Mercury	60	16	0.8	0 above HIL A 40 mg/kg	-
Nickel	60	54	98	0 above HIL A 400 mg/kg	0 above EIL (urban residential) 355 mg/kg
Zinc	60	59	800	0 above HIL A 7400 mg/kg	0 above EIL (urban residential) 1082 mg/kg
PCB	25	1	0.2	0 above HIL A 1 mg/kg	-
Chlordane	22	5	0.5	0 above HIL A 50 mg/kg	-
Other OCP	22	50	<PQL	0 above HIL A	0 above EIL (DDT: 180 mg/kg)
OPP	22	0	<PQL	0 above HIL A	-

n number of samples
 - No criteria available/used
 NL Non-limiting
 <PQL Less than the practical quantitation limit

In assessing the analytical results, the Auditor makes the following observations:

- Laboratory detections of asbestos were made within the fill soil profile at sample locations BH32 (0.5-0.8), TP308 (0-0.2m) and TP316 (0.3-0.5). Fibre cement fragment were observed in fill at BH32 and on the ground surface at a number of locations (near USTs, SS2, stockpile sample location JF1 and at a location approximately 5 m east of BH7, adjacent to the Naomi Wing Memorial Building ("Suspected ACM" location shown on Attachment 4)). The fibre cement fragments identified were confirmed as asbestos-containing (Chrysolite and Amosite).
- Concentrations of lead exceeding the adopted human health criterion of 300 mg/kg are present in six fill material samples from six sample locations in the north of the site (BH20A_0.7-0.8, BH31_0-0.1, BH32_0.5-0.8, BH4_0.5-0.95, BH5_1.5-1.95, and CPTP_W_2.5). Slight hydrocarbon odour and staining and a PID reading of up to 30.1 ppm was present in grey to black coloured gravelly fill material at location BH32.

- TCLP leachability testing of fill material samples for lead, B(a)P and nickel was undertaken on between 4 and 8 samples from locations BH17A, BH31, BH32, BH34, BH3, BH4, BH5, BH6, BH9 and X3. TCLP analysis for lead included the analysis of fill material samples with the highest recorded lead concentrations (BH32_0.5-0.8 – 990 mg/kg lead; BH31_0-0.1 – 330 mg/kg lead; BH4_0.5-0.95 – 360 mg/kg lead; BH5_1.5-1.95 – 420 mg/kg lead). The TCLP leach testing results indicated that the leachable concentrations of lead were generally low (0.03 to 1.8 mg/L), with the exception of fill material sample BH32_0.5-0.8, which recorded a TCLP leachable lead concentration of 48 mg/L. Section 3.15.2 of the RAP has identified the need for further targeted sampling and TCLP and ASLP leach testing of fill material at 0.5 m depth intervals to a maximum depth of 4 mbgl at lead hotspot BH32 to assess the lateral and vertical extent of lead-leachable fill material and to assess if the fill material from this hotspot location may be retained onsite.
- Exceedance of the human health site assessment criterion for B(a)P TEQ of 3 mg/kg were observed in fill material in seven samples from six locations (BH5, BH6, BH9, BH17, BH17A and BH32). Borehole logs from these locations indicated the presence of black and grey fill material containing brick fragments, black asphalt and a hydrocarbon odour and staining (at BH32). DP (2007) previously attributed the elevated B(a)P concentrations in fill material at BH17 to former building and construction works at that location, with JBS&G (2012) attributing the elevated concentrations of B(a)P to historic industrial land use impacts.
- Concentrations of B(a)P in 14 fill material samples from 12 locations also exceeded the terrestrial ecological criterion for an urban residential land use, of 0.7 mg/kg however are below the CCME SQG of 20 mg/kg. Leachable B(a)P concentrations, based on TCLP analyses, were below the analytical limit of reporting (<0.001 mg/L) in all eight samples analysed, including in samples from locations with the highest B(a)P concentrations.
- Concentrations of TPH (C₆-C₁₀ and C₁₁-C₁₄ fractions) exceed the respective human health criteria in shallow fill material in sample location BH32 (0-0.1 m) with a concentration of 1,800 and 8,100 mg/kg, respectively. The fill material at that location also contained anthropogenic material (plastic, brick and asphalt), elevated PID concentrations of up to 30.1 ppm, and lead and B(a)P TEQ concentrations exceeding the human health criteria. The absence of elevated concentrations of petroleum hydrocarbons in groundwater (refer Section 9) suggest that leaching of hydrocarbons from impacted fill material at that location is unlikely to be significant.
- Volatile hydrocarbons (BTEX and TRH (C₆-C₁₀)) were less than the PQL in all remaining samples.
- Sample BH32_0-0.1 m also exceeded the ecological site assessment criteria for TPH (C₁₀-C₁₄ and C₁₅-C₂₈ fractions) and the Management Limit (ML) for TRH (C₁₆-C₃₄) (measured as TPH (C₁₅-C₂₈ fraction (NEPM, 1999))). Sample BH32_0.5-0.8 exceeded the ESL criteria for TPH (C₁₅-C₂₈ fraction (NEPM, 1999)) with a concentration of 420 mg/kg. The only other heavy end TRH exceedance location was BH36 at a depth of 0.9-1.0 m, where the concentration of the TPH (C₁₅-C₂₈ fraction (NEPM, 1999)) exceeded the ESL at a depth of 0.9-1.0 m with a concentration of 820 mg/kg.
- Exceedances in human health and ecological site assessment criteria for lead, B(a)P, carcinogenic PAHs (as B(a)P (TEQ)) and TPHs that have been observed at several locations across the site are generally associated with fill materials and not underlying natural sandy soils.
- Although analysed in samples from a limited number of locations, all other contaminants (phenols, PCBs, OCPs and OPPs) were generally below the PQL or the adopted site criteria.

Five detections of the OCP Chlordane were made with a maximum concentration of 0.5 mg/kg. These detections are well below the HIL-A of 50 mg/kg.

8.3 Auditor's Opinion

In the Auditor's opinion, the soil analytical results are consistent with the site history and field observations.

The results indicate a localised area of TPH and lead impact exceeding human health criteria in shallow fill at BH32/MW5. This impact could be coincident with the former boiler house in the northwest of the site. The absence of petroleum hydrocarbon impact to groundwater at MW5 suggests that significant leaching of hydrocarbons has not occurred, however TCLP testing has indicated potential for leaching of lead from this material (although the TCLP procedure is noted to be an acidic leach and not representative of site conditions). The RAP has recommended further leach testing to assess the risk associated with leaching of lead from this material.

More widespread impacts by B(a)P, lead and asbestos were detected in fill with exceedance of the human health criteria for B(a)P and lead in around 10% of samples. Ash and slag were identified in fill material in which elevated non-leachable PAH and metal concentrations were recorded, which suggests that ash and slag inclusions are likely to represent a source of these contaminants in fill material on the site in addition to other sources from previous industrial site uses.

The RAP (refer to Section 11) has proposed removal of the lead hotspot (if required based on leaching results) and onsite containment of fill materials to address the identified impacts. The RAP also identifies locations BH32 and BH36 as TPH hotspots although localised remediation is not explicitly discussed. Outside the TPH hotspot at BH32, the leachability of lead and B(a)P has been demonstrated as low, consequently, the proposed retention of impacted fill material above the groundwater table is considered acceptable.

The site characterisation has been adequate for remediation planning purposes, with the primary data gaps remaining discussed in Section 10 of this IAA, including the USTs, building footprints and the leachability of lead in fill material remaining in situ.

9. EVALUATION OF GROUNDWATER RESULTS

An evaluation of historical groundwater results for the former RSSH site was undertaken in the previous site audit report by Enviroview (2018), concluding that these previous assessments did not encounter any significant or widespread groundwater contamination on-site and, as such, groundwater was not subject to additional remedial works or further validation. The previous Auditor (Enviroview, 2018) concluded:

"Based on available groundwater quality information, groundwater in the vicinity of the site was considered to not be significantly contaminated and did not present an unacceptable risk to future site users or down-gradient ecosystems where beneficial use of groundwater is prevented on the site in the future."

A high level review of groundwater results from previous investigations in the Contamination Report Review (EIS, 2018) indicated that groundwater results for volatile contaminants were below the site assessment criteria. The Contamination Report Review identified that recent groundwater data was not available for the site and that potential exists for groundwater conditions to have changed over time particularly as a result of altered hydrogeological regimes in the region due to development and temporary construction dewatering. Consequently, groundwater sampling was subsequently undertaken during the PSI, comprising groundwater sampling and analysis from three new groundwater monitoring wells.

The PSI was undertaken as described in Section 6 and groundwater monitoring locations are shown in Attachment 4. Groundwater samples were collected from monitoring wells MW2, MW5 and MW9 in February 2018 and the samples were analysed for metals, TRH/BTEX, PAHs, VOCs, chloroform, pH, EC, and hardness (mgCaCO₃/L). MW5 was sampled by JBS&G in July 2012 and this sample was analysed for metals, BTEX, TPH and PAHs. The analytical results from one round of sampling at the four wells located on site are summarised below in Table 9.1.

Table 9.1: Evaluation of Groundwater Analytical Results – Summary Table (µg/L)

Analyte	n	Detections	Maximum	n > HSL A&B sand, 2-<4 m NEPM (2013)	n > Marine water ANZG (2018)
TRH C ₆ -C ₁₀ less BTEX (F1) or TPH (C ₆ -C ₉)	4	0	<10	0 above HSL A&B of 1000 µg/L	-
TRH >C ₁₀ -C ₁₆ less naphthalene (F2) or TPH (C ₁₀ -C ₁₄)	4	0	<50	0 above HSL A&B of 1000 µg/L	-
TRH >C ₁₆ -C ₃₄ or TPH (C ₁₅ -C ₂₈)	4	0	<100	-	-
TRH >C ₃₄ -C ₄₀ or TPH (C ₂₉ -C ₃₆)	4	0	<100	-	-
Benzene	4	0	<1	0 above HSL A&B of 800 µg/L	0 above DGV of 700 µg/L
Toluene	4	0	<1	NL	0 above DGV of 180 µg/L
Ethylbenzene	4	0	<1	NL	0 above DGV of 80 µg/L
Xylenes	4	0	<2	NL	0 above DGV of 75 µg/L ^a
Naphthalene	4	0	<0.2	NL	0 above DGV of 50 µg/L ^b
Benzo(a)pyrene	4	0	<0.1	-	0 above DGV of 0.2 µg/L
Anthracene	4	0	<0.1	-	0 above DGV of 0.01 µg/L ^b
Fluoranthene	4	0	<0.1	-	0 above DGV of 1.0 µg/L ^b
Phenanthrene	4	1	0.1	-	0 above DGV of 0.6 µg/L ^b
Arsenic as As(V)	4	1	3	-	-
Cadmium	4	0	<0.1	-	0 above DGV of 5.5 µg/L
Chromium as Cr(III)	4	0	<1	-	0 above DGV of 27 µg/L
Copper	4	0	<1	-	0 above DGV of 1.3 µg/L
Lead	4	0	<1	-	0 above DGV of 4.4 µg/L
Mercury (inorganic)	4	0	<0.05	-	0 above DGV of 0.4 µg/L
Nickel	4	0	<1	-	0 above DGV of 70 µg/L
Zinc	4	4	18	-	1 above DGV of 15 µg/L
Chloroform	3	1	5	-	0 above DGV of 770 µg/L ^b

Analyte	n	Detections	Maximum	n > HSL A&B sand, 2-<4 m NEPM (2013)	n > Marine water ANZG (2018)
Other VOCs	4	0	<PQL	-	0 above DGV

n number of samples

- No criteria available/used

<PQL Less than the practical quantitation limit

NL non limiting

^aDGV for m-Xylene for slightly to moderately disturbed ecosystems.

^bDGV for 99% species protection for marine water for slightly to moderately disturbed ecosystems)

In assessing the analytical results, the Auditor makes the following observations:

- Concentrations of analytes were reported below PQLs or below the adopted human health criteria for vapour intrusion.
- Zinc in MW9 exceeded the ANZG (2018) criterion for marine water (95% species protection) of 15 mg/L. Other metals were less than the ANZG criteria and typically less than the detection limit.
- No detections were made of petroleum hydrocarbon (TRH, BTEXN) or lead.
- Phenanthrene and Chloroform were detected above the PQL but below the environmental quality criteria in one sample (MW9).
- No detections were made of other PAH or VOCs.

9.1 Auditor’s Opinion

In the Auditor’s opinion, the previous groundwater assessment undertaken during the previous investigations across the wider RSSH site, supplemented by the PSI, was adequate to assess the risk to onsite and offsite receptors.

The groundwater results indicate some slightly elevated zinc concentrations, likely to be due to regionally elevated concentrations in a moderately disturbed urban environment. Groundwater sampling did not identify significant petroleum hydrocarbon impact, however sampling immediately downgradient of the UST was not undertaken. The potential for localised groundwater impact in this area can be assessed when the UST is removed.

Concentrations of VOCs were less than the detection limit, with the exception of one low concentration detection of chloroform, indicating that the former laundry was not a source of significant impact by chlorinated hydrocarbons.

Overall, the groundwater results do not indicate the need for groundwater remediation in the context of the proposed land use.

10. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the contaminant source, pathway and receptor linkages at a site. A CSM was developed in the historical site investigations and developed iteratively throughout these site assessments to inform decisions around investigation and management requirements. EIS provided a CSM as part of the PSI and JBS&G refined this for the RAP.

Table 10.1 provides the Auditor’s review of the CSM presented in the RAP.

Table 10.1: Review of the Conceptual Site Model

Element of CSM	Consultant Discussion	Auditor Opinion
Contaminant source and mechanism	<p>JBS&G identify carcinogenic PAHs (as B(a)P TEQ), TRHs, lead, and asbestos (occurring as fragments of ACM and free asbestos fibres (fibrous asbestos)) in fill material on the site to be the primary contaminants of concern.</p> <p>Fill material across the site contains elevated non-leachable PAH and metal concentrations and fill comprises heterogeneous, brown gravelly sand and brown gravelly clayey sand containing anthropogenic materials, including bricks, concrete, tile, glass, metal, ash and slag. Consequently, JBS&G considered it appropriate to conservatively consider that fill material as a whole across the site is impacted with PAHs rather than referring to the presence of hotspots.</p> <p>Similarly, ACM (or asbestos as loose fibre bundles) was observed at a number of sample locations during historical investigations and was placed in the southern portion of the site during the Childcare Centre and the Community and Cultural Precinct redevelopment works. Therefore, JBS&G considered it appropriate to identify the fill material (to the top of the natural/undisturbed soil profile) across the site as asbestos impacted.</p> <p>Natural sandy soils that underlie the fill material across the site are not considered to be impacted based on the site investigation data.</p> <p>Based on existing analytical data from soils and TCLP leach testing undertaken in historical site assessments, the majority of contaminants in soil have been found to be non-leachable. An exception, and an identified data gap in the RAP, includes the observed elevated leachability of lead from fill material at sample location BH32 at a depth of 0.5 to 0.8 mbgl. Further assessment of the lateral and vertical extent of the leachability of fill material at BH32 will be assessed as part of a data gap assessment prior to site remediation.</p> <p>Groundwater contamination has not been identified as an issue of concern with respect to human health and/or sensitive groundwater receptors. Although groundwater has been found to be characterised with levels of heavy metals above the ANZG (2018) criteria, the metal concentrations reported in soil have been found to be non-leachable, with the exception of lead at location BH32.</p> <p>JBS&G considered that the observed groundwater impact with a range of heavy metals was not posing a potential human health or ecological risk where beneficial use of groundwater is prevented on the site in the future, consistent with the requirements of the Botany Sands Embargo Area.</p>	<p>The primary contaminants and associated fill material source have been appropriately identified with the exception of the following.</p> <p>TPH impacts at BH32 and BH36 are not discussed in the CSM although these are identified as hotspots requiring remediation in Table 3.1 of the RAP.</p> <p>The primary metal of concern with respect to human health impacts is lead.</p>
Affected media	<p>Heterogeneous fill material containing anthropogenic materials (bricks, concrete, tile, glass, metal, ash, slag) has been identified as the main affected medium, although groundwater has been found to contain elevated levels of heavy metals, in particular zinc.</p>	<p>The affected media have been appropriately identified. The Auditor considers the affected media to be fill soils, as identified by JBS&G, however it is acknowledged that asbestos fibres in fill material have the potential to become airborne.</p> <p>It is noted that underlying natural sandy soil was assessed and found not to be significantly contaminated.</p>

Element of CSM	Consultant Discussion	Auditor Opinion
		Minor groundwater contamination by zinc is considered to be due to regionally elevated concentrations in a moderately disturbed urban environment.
Receptor identification	<p>JBS&G stated in the RAP that potential receptors of environmental impact within the site that will require to be addressed with the proposed site remediation and management include:</p> <ul style="list-style-type: none"> - Future site occupants and users of the non-paved areas of the site who may potentially be exposed to contaminants of potential concern (COPCs) through direct contact with impacted soils and/or inhalation of dusts and fibres from impacted soils - Excavation/construction/maintenance workers conducting activities at the site, who may potentially be exposed to COPCs through direct contact with impacted soils present within excavations and/or inhalation of dusts/fibres/vapours from impacted soils - Nearby sensitive receptors at the adjoining Childcare Centre who may potentially be exposed to COPCs through inhalation of dusts and fibres from impacted soils - Flora species to be established within landscaped and vegetated areas of the site including potential large tree plantings - Ecological receptors within the downgradient surface water environment (Shea’s Creek and Alexandra Canal) 	The human and ecological receptors have been appropriately identified.
Exposure pathways	<p>JBS&G stated in the RAP that the potential exposure pathways include:</p> <ul style="list-style-type: none"> - Potential dermal and oral contact to impacted shallow soils through service excavations - Potential oral and dermal contact to groundwater through service excavations and construction of basements - Potential inhalation of impacted dust from site soil by future site occupants and visitors - Potential inhalation of impacted soil vapours - Potential contaminant uptake by vegetation proposed to be established in the vegetated areas of the site, potentially including large tree plantings. <p>The RAP states that while temporary dewatering may be necessary to achieve construction requirements, it is not anticipated that any ongoing groundwater extraction will occur following completion of construction works. The site is located within the Botany Aquifer Groundwater Management Zone 2 which restricts groundwater removal and disturbance.</p>	The exposure pathways have been appropriately identified.
Presence of preferential pathways for contaminant movement	<p>JBS&G state in the RAP that man-made preferential pathways are present throughout the site associated with:</p> <ul style="list-style-type: none"> - Areas of disturbed fill material, service infrastructure and stormwater easements. Fill materials are anticipated to have a high permeability 	The potential preferential pathways have been appropriately identified.

Element of CSM	Consultant Discussion	Auditor Opinion
	<ul style="list-style-type: none"> - Generally higher permeability backfill used to re-instate services trenches - Adjoining established road network and associated service easements 	
Evaluation of data gaps	<p>Data gaps identified in the RAP are:</p> <ul style="list-style-type: none"> - Presence of USTs - Leachability of lead - Existing building footprints <p>The RAP states "<i>Review of existing contamination investigations in the context of the proposed development has not identified any data gaps pertaining to the determination of the most suitable means to manage the identified contamination at the site</i>".</p>	<p>The data gaps have been appropriately described and the significance of those data gaps considered. Proposed methodology to address these data gaps have been outlined in the RAP and will be addressed as soon as access to the site is available and prior to the commencement of the remediation works. Decommissioning of USTs will be required as part of the development works. Previous soil sampling has shown that hydrocarbon and lead impacts to fill materials in the vicinity of the UST are likely to be low. If significant soil contamination is identified further assessment of groundwater may be required.</p>
Potentially complete SPR linkages	The RAP did not clearly define the potentially complete SPR linkages.	The Auditor's summary of the potential risks is provided in Section 10.1 below.

10.1 Auditor's Opinion

In the Auditor's opinion, the CSM presented in the RAP is adequate for remedial planning and represents a reasonable representation of the contamination at the site. The Auditor considers the following:

- With the potential exception of location BH32, risk via the vapour inhalation pathway is low based on the previous site investigation data, which showed that fill materials across the site contained low volatile hydrocarbon concentrations and a consequently low potential exposure to elevated hydrocarbon vapour levels.
- The proposed development plans indicate that almost the entire site will be covered by the proposed building and/or a hardstand surface, which indicates that risk to future site users from oral and dermal contact with soil or exposure via dust inhalation is low provided the site is appropriately managed. These risk would be present during construction works or for future intrusive works and would require management measures to mitigate the risk.
- The proposed development plans indicate that there will be limited vegetation and plantings of trees across the site, indicating that the ecological risks to plants across the site as part of the proposed development are low.
- There is limited potential for interaction with groundwater given the groundwater depth (3-4 mbgl) and restriction on groundwater extraction. Contaminant concentrations in groundwater are unlikely to present a risk to human health or the environment.

11. EVALUATION OF PROPOSED REMEDIATION

11.1 Data Gap Investigation

The RAP proposes the following investigations prior to, or during, the commencement of remediation works (further details provided in Section 3.15 of the RAP):

- *Potential Presence of Underground Storage Tanks:* Previous investigations reported the potential presence of up to three USTs to the north of the Naomi Wing Rehabilitation Building. Works documented in the AECOM Validation Report comprised investigation of soil around a UST to the north of the Naomi Wing Rehabilitation, generally consistent with the potential UST location identified in previous reports. Field observations and soil analytical data from inside and to the west, east and north of the UST did not identify petroleum hydrocarbon impacts. The extent of further investigations to be completed within the potential petroleum storage area will be determined based upon visual inspection of the area following removal of infrastructure. Therefore, the details of further investigation work will be developed at the time of the investigation and with regard to the overall remedial objectives. The outcomes of the above will guide application of the remedial works as outlined in Section 11.3 of the RAP. Should contaminant conditions be identified that are significantly different to those documented herein, the RAP proposes further consideration of remedial requirements via implementation of an Unexpected Finds Protocol (UFP) (Section 8 of the RAP).
- *Leachability of Lead:* Elevated concentrations of lead exceeding the site assessment criteria were identified in fill material and in TCLP leachates of the fill material at sample location BH32 (0.5-0.8). The RAP states that it is anticipated that management of fill material with elevated leachable lead concentrations may potentially comprise a delineation and excavation of the lead impact and subsequent offsite disposal to a licensed landfill facility. Alternatively, onsite retention of this material through the implementation of a cap and containment strategy may be considered. The data gap assessment will include the collection of additional data to define the extent of leachable lead to remain in-situ and/or define the extent of leachable lead impacted soil that will require offsite disposal. The additional targeted data gap assessment will include the placement of one test pit or borehole at BH32, the collection of soil samples at 0.5 m depth intervals to a maximum depth of 4 mbgl, and the analysis of soil samples for lead and leachable lead (TCLP and ASLP). Environmental data generated during the data gap investigation will be assessed against the site validation criteria established in the RAP. If removal of lead impacted material is required, validation of excavation walls and the base of the excavation at BH32 would be undertaken to demonstrate the successful separation of the impacted material from the balance of site fill material.
- *Existing Building Footprints:* Uncertainties associated with the condition of fill material underlying existing building footprints at the Naomi Wing Rehabilitation Building, the Community Hall building and the substation kiosk will be addressed through further data gap investigations following demolition in order to appropriately characterise underlying soil. The additional targeted data gap investigations will include the advancement of 4 test pits/boreholes within the Naomi Wing Rehabilitation Building footprint, including 1 sample location within the proposed playground area on the eastern margin of the building footprint, 2 test pits/boreholes within the Community Hall building footprint, and 1 test pit/borehole within the substation footprint. Soil samples will be collected at 0.5 m depth intervals to a maximum depth of 4 mbgl and analysed for metals, TRH, BTEX, PAHs, OCPs, PCBs and asbestos (500 mL sample). Environmental data generated during the building footprint data gap investigation will be assessed by comparison with the site validation criteria established in the RAP.

Auditor's Opinion

The proposed data gap investigation is considered appropriate. The Auditor notes that sampling beneath the substation kiosk and the playground dedication area are the primary building data gaps to confirm remediation requirements. Sampling in remaining building areas will inform waste management requirements but should not alter the proposed remediation works. Further assessment of groundwater in the vicinity of the USTs will be addressed via the UFP if conditions encountered differ significantly from those documented herein.

The RAP does not discuss the nature of further remediation planning documentation that may be required based on the results of the data gap investigation. The results and any changes to the proposed remediation works should be reviewed by the Auditor. A Remedial Works Plan or an amended RAP may be required to document the changes.

11.2 Remediation Required

Soil on the site has been impacted with PAHs, heavy metals (in particular lead), TRH and asbestos. The proposed redevelopment comprises demolition of existing site structures and construction of the Green Square Public School. A 276 m² parcel located within the site and currently occupied by the existing structures is proposed to be dedicated as part of development works to the Waranara Early Education Centre located to the southeast of the site for playground use following remediation.

JBS&G determined remedial requirements based on review of investigation results against screening criteria and consideration of aesthetic issues. The Auditor has summarised the issues identified as requiring remediation and the preferred options considered in the RAP in Table 11.1.

Table 11.1: Remediation Required and Preferred Options

Description	Extent of Remediation Required	Preferred Options
Potential USTs	The extent of remediation to be completed will be subject to evaluation based upon visual inspection of the area following removal of on site infrastructure.	Decommissioning/removal of potential USTs, any associated infrastructure, tank backfill material and any petroleum and lead impacted soils. Excavation and offsite disposal.
Fill impacted by carcinogenic PAH compounds (as B(a)P TEQ), lead and asbestos.	The final extent of fill material retained within the development will be dependent on conditions encountered during remediation and development works. Based on the proposed development, for planning purposes, the anticipated maximum extent of retained fill material is considered to be the entire site development area.	Excavation and off-site disposal of impacted fill material as required to achieve proposed development subgrade levels and onsite retention of all remaining in-situ fill material via implementation of a cap/cover remedial strategy based on physical separation and the implementation of a long-term environmental management plan (LTEMP) for the site. Offsite disposal of impacted fill material from BH32 (if lead is leachable) and onsite cap and contain of impacted fill material from BH32 (if lead is not leachable)
Proposed playground dedication area	276 m ² comprising eastern portion of Naomi Wing Rehabilitation Building	JBS&G note in the Response to Auditor Comments that " <i>It is the intention following demolition for this area to be validated as suitable for the proposed childcare centre use. If impacts are identified, it is anticipated the material would be excavated and placed within the main site, with this section validated</i> ".

Auditor’s Opinion

The identified remediation extent and proposed remedial options are considered appropriate for the USTs and general fill, however the following is noted:

- The RAP (Table 3.1) identifies TRH impacted hotspots at BH32 and BH36 however does not discuss the proposed remediation in these areas. JBS&G advised that these areas are intended to be addressed as per potential hydrocarbon impacted soils associated with the USTs. However, the proposed additional testing in the vicinity of BH32 has the objective of determining whether the material can remain on site with respect to lead leachability. The information presented in the RAP is therefore conflicting with respect to proposed remediation with respect to TPH at BH32 and BH36. In my opinion, further investigation and potentially remediation of the petroleum hydrocarbon impact at BH32 is required. The investigation can be incorporated with the proposed lead leachability investigation. Retention of the BH32 materials would require further consideration of the risk associated with volatile petroleum hydrocarbons which exceed the human health criteria in this material.
- Given the assumption that asbestos is present in all fill, the single data gap location proposed in the playground dedication area will not be sufficient for complete characterisation of this material. Therefore, if it is proposed to retain fill in this area, a more detailed characterisation than is currently proposed would be required to validate the material as suitable for the proposed childcare centre use.

11.3 Evaluation of RAP

The Auditor has assessed the RAP by comparison with the checklist included in NSW EPA (2020) *Consultants Reporting on Contaminated Land* [replaces OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites*]. The RAP was found to address the required information, as detailed in Table 11.2, below.

Table 11.2: Evaluation of Remedial Action Plan

Remedial Action Plan	Auditor Comments
<p><i>Remedial Goal</i></p> <p>The goal of the remediation is to: "address the contamination impacts at the site, ensuring the protection of human health and the surrounding environment, such that the impact is remediated/managed in a manner as to make the site suitable for the proposed land use"</p>	<p>Appropriate.</p>
<p><i>Discussion of the Extent of Remediation Required</i></p> <p>The complete historical soil sample data set is summarised in Table A of the RAP.</p> <p>The statistical analysis of the soil data set in the RAP (Section 3.14 of the RAP) determined the hotspots requiring remediation which comprised:</p> <ul style="list-style-type: none"> • Lead and TPH in fill material at location BH32 in the north-western corner adjacent to the Naomi Wing Rehabilitation • TPH in fill at location BH36 in the western portion of the site. <p>For the purpose of the RAP, asbestos was considered to be present within fill material across the entire site. Due to the heterogeneity of the fill material, the RAP adopted a conservative approach to consider fill material across the site to be impacted with PAH.</p> <p>Remediation of the USTs is also required.</p>	<p>The general extent of remediation required was appropriately identified or is subject to further investigation to address data gaps (discussed in Section 11.1 above), although the proposed remediation of TPH hotspots is not clear as discussed above.</p>

Remedial Action Plan	Auditor Comments
<p><i>Remedial Options</i></p> <p>Remedial options were assessed in Section 5.4 of the RAP and included onsite treatment, offsite treatment, landfill disposal and consolidation and onsite in situ management of impacted fill materials by physical separation, and ongoing management.</p>	<p>The Auditor considers that an adequate range of remedial options were considered.</p>
<p><i>Selected Preferred Strategy</i></p> <p>The preferred option was discussed within Section 5.5 of the RAP and included (refer also Table 11.1 above):</p> <ul style="list-style-type: none"> • Excavation and off-site disposal of potential petroleum infrastructure including the USTs, associated pipework and other associated infrastructure remaining • Excavation of tank pit backfill and associated impacted soil (where present) to the extent practicable and (subsequent to stockpiling and characterisation in accordance with the requirements for offsite disposal), offsite removal of the excavated material • Excavation and offsite disposal of lead impacted soil at BH32, if required, subsequent to stockpiling and characterisation and offsite removal of the excavated material • Excavation and offsite disposal of impacted fill material as required to achieve proposed development subgrade levels. Excavation and offsite removal of fill material will be undertaken under the supervision of the Remediation Consultant. • Onsite retention of all remaining in situ fill material via implementation of a cap/cover remedial strategy based on physical separation, with the implementation of a LTEMP. 	<p>The preferred remedial strategy for the site is generally appropriate. Removal of fill from the playground dedication area is proposed based on correspondence from JBS&G.</p>
<p><i>Rationale</i></p> <p>The remedial options assessment considered a range of factors in determining the suitability of each option.</p>	<p>The rationale presented in the RAP for the preferred options is considered acceptable. The combined remedial strategy of offsite disposal and capping/containment is considered a practical and cost-effective solution which is suitable for the proposed development which will largely comprise buildings and hardstand.</p>
<p><i>Containment</i></p> <p>Subsequent to grading works required to achieve construction objectives, fill material underlying the site areas is proposed to be retained in situ through a 'cap and containment' management protocol with the following minimum requirements:</p> <ul style="list-style-type: none"> • Permanent concrete ground slabs, asphalt surfaced pavement, mortared stone/concrete pavers or similar. The pavement base course shall be underlain by a visual marker layer; or • Minimum soil cover thickness of 0.5 m underlain by a 'marker layer' in areas of exposed site soil. <p>Suitable backfill material may comprise one or a combination of imported virgin excavated natural material (VENM) sourced from a site that has been validated as suitable for beneficial reuse and/or imported material nominated via a beneficial reuse exemption (e.g. Excavated Natural Material (ENM), drainage aggregate, growing media).</p>	<p>The Auditor considers the containment strategy proposed in the RAP to be adequate, including the retention of material within a "borrow pit" provided it is more than 1 m above the groundwater table.</p>

Remedial Action Plan	Auditor Comments
<p>Where underground services are required to be installed, excavation of impacted material from the services alignment will be undertaken, followed by lining of the resulting trench with a visual marker layer and then service installation and backfilling with appropriate engineered material (VENM, imported recycled glass sand, aggregate or similar).</p> <p>The RAP notes that where excavation of fill material is required, consideration may be given to the overall cut/fill balance associated with the proposed development. Where achievable, excavated material may be placed in other areas of the subject site which require filling, alternatively following validation of the successful removal of the fill material, underlying natural sand soil may be preferentially excavated and removed from site as VENM to enable retention of impacted fill material at the site. Where such a borrow pit is proposed to be completed, with consideration to the identified groundwater table elevations and the sand nature of the soil potentially necessitating excavation retention measures, the borrow pit should be designed to have a base no greater than 2 m below current ground levels, providing as a minimum a 1 m clearance of non-saturated sand above the groundwater table. Detailed design of the borrow pit may enable greater depth should specific data on groundwater levels be collected.</p>	
<p><i>Proposed Validation Criteria</i></p> <p>The validation assessment criteria proposed are consistent with those identified in Section 7 of this SAR and include criteria from NEPC (2013) relevant to low density residential land use and coarse soil. Where there are no NSW EPA endorsed thresholds the laboratory LOR has been adopted as an initial screening value for the purpose of validation.</p>	<p>The proposed validation criteria are considered acceptable.</p>
<p><i>Proposed Validation Testing</i></p> <p>Table 7.4 of the RAP details the validation requirements for various aspects, including:</p> <ol style="list-style-type: none"> 1. Excavation formed by the removal of petroleum storage infrastructure: <ul style="list-style-type: none"> - 1 sample per UST, or a minimum of 1/25 m² for one large excavation for excavation base - 1 sample per wall per media, with minimum spacing of one per 5 linear metres for excavation walls - Sampling at 1/25 m³, with analysis at 1/100 m³ based on PID screening for materials - Samples analysed for TRH, BTEX, lead and PAH 2. Excavation formed by the removal of lead impacted soils: <ul style="list-style-type: none"> - 1 sample per 25 m² for excavation base - 1 sample per 5 linear metres for excavation walls - Samples analysed for lead and TCLP/ASLP (lead) 3. Characterisation of excavated materials requiring offsite disposal (excluding bulk basement excavation): <ul style="list-style-type: none"> - Sampling at 1/100 m³, with a minimum of 3 samples 	<p>The validation requirements documented in the RAP are generally acceptable although they do not specifically identify validation requirements for the identified TPH hotspots (if remediation is proposed) or for material within the playground dedication area.</p> <p>The Auditor notes that imported material must either be VENM, ENM or be classified under a Resource Recovery Exemption (RRE). The density of testing would need to be commensurate with the documentation provided and the consistency of the results, as well as the requirements of the resource recovery order.</p>

Remedial Action Plan	Auditor Comments
<ul style="list-style-type: none"> - Samples analysed for metals, TRH, BTEX, PAHs, OCPs, PCBs, asbestos (absence/presence), TCLP (metals and PAH) <p>4. In the event bulk excavation works are proposed for a basement, additional sampling/analysis will be undertaken as appropriate to close any data gaps to enable a defensible waste classification for fill material to be removed during such works. Validation of VENM material will be completed as appropriate following removal of fill material with a sampling density to be decided based on statistical principles.</p> <p>5. Imported VENM (other than sourced from a licensed quarry)</p> <ul style="list-style-type: none"> - Minimum of 5 samples per material types/source site - Samples analysed for metals, TRH, BTEX, PAHs, OCPs, PCBs, asbestos (500 mL) <p>6. Imported material subject of a resource recovery exemption (RRE)</p> <ul style="list-style-type: none"> - As per exemption requirements, plus minimum of 5 samples per material type/source site - Samples analysed for metals, TRH, BTEX, PAHs, asbestos (500 mL) in addition to suite as required by exemption <p>7. Growing media</p> <ul style="list-style-type: none"> - Minimum 1 sample per 70 m³ with a minimum of 3 samples per source/end location - Samples analysed for metals, TRH, VOCs, PAHs, OCPs, PCBs, asbestos (500 mL), pH, cation exchange capacity (CEC) and percentage clay <p>8. Excavation formed by removal of unexpected finds</p> <ul style="list-style-type: none"> - 1 sample 25 m² (5 m grid) with a minimum of 1 sample per excavation - 1 sample per wall per media, with minimum spacing of one sample per 5 linear metres - Samples analysed for appropriate COPC (may include but not limited to metals, TRH, BTEX, PAHs, OCPs, PCBs, asbestos (500 mL and 10L asbestos quantification samples) <p>9. Tankpit/Excavation Water</p> <ul style="list-style-type: none"> - 1 sample per excavation/pump out event and a minimum of 1 sample per 10,000 L - Samples analysed for metals, TRH, BTEX, low level PAHs, EC, pH 	
<p><i>Interim Site Management Plan (before remediation)</i></p> <p>Not discussed in RAP</p>	<p>The majority of the site area is currently sealed or covered with buildings which limit the potential for contaminants to present a risk to current site users and neighbouring site users. The southern portion is capped and subject to an existing LTEMP.</p>
<p><i>Site Management Plan (operation phase) including stormwater, soil, noise, dust, odour and OH&S</i></p> <p>A Construction Environmental Management Plan (CEMP) is required to be prepared by the Principal Contractor/Remediation Contractor documenting the environmental monitoring and management measures to be implemented during remediation and construction. The RAP identifies a list of minimum requirements to be addressed in the CEMP. In addition, the following plans are required to be prepared:</p> <ul style="list-style-type: none"> • A standalone Asbestos Management Plan (AMP) will be prepared based on the requirements provided for asbestos-related works in <i>How to Manage and</i> 	<p>The identified minimum requirements for the CEMP and other proposed plans are appropriate.</p>

Remedial Action Plan	Auditor Comments
<p><i>Control Asbestos in the Workplace Code of Practice, 2018</i> (Safe Work Australia, 2018). This will include an asbestos removal control/management plan.</p> <ul style="list-style-type: none"> • A Work Health and Safety Management Plan (WHSP) will be prepared by the Remediation Contractor prior to commencement of remediation works, which will contain procedures and requirements that are to be implemented as a minimum during the works. • Material shall be moved as per a material tracking plan (MTP). The MTP shall be developed prior to movement of material and will address material characteristics and tracking (quantity, movement and locations). 	
<p><i>Unexpected Finds</i></p> <p>An unexpected finds procedure (UFP) is presented in Section 8.1 of the RAP. Potential unexpected finds are identified as:</p> <ul style="list-style-type: none"> - Presence of significant aggregates of friable asbestos materials (visible) as opposed to minor occurrences of fragments or fibre bundles in soil - Excessive quantities of Construction/Demolition Waste (visible) - Hydrocarbon impacted materials (visible/odorous) - Drums, waste pits, former pipework or USTs (visible) - Tarry like impacted soil/fill material (visible/odorous) - Potential chlorinated hydrocarbon impact (sweet odour soils). <p>Actions include ceasing works, assessing the find and remediation of the find if required. The procedure includes notification of the site Auditor following the environmental consultant’s inspection.</p>	<p>The procedure for handling unexpected finds is appropriate and practical and can be implemented within the proposed remediation strategy. Further assessment of groundwater in the vicinity of the USTs would be addressed via the UFP if warranted.</p>
<p><i>Contingency Plans to Respond to Site Incidents</i></p> <p>The RAP includes contingency plans for a range of potential situations in Section 8, including change in development plans, material storage breach, emissions complaints and various potential unexpected finds as listed above.</p>	<p>In the Auditor’s opinion, the range of contingency situations and proposed contingency actions are considered appropriate.</p>
<p><i>Remediation Schedule and Hours of Operation</i></p> <p>Section 9.1.4 of the RAP states that Remediation works shall be completed in accordance with the permissible hours of work as nominated in the Development Consent.</p> <p>The Remediation Contractor will be required to include a proposed schedule of remediation works within the CEMP.</p>	<p>Adequate.</p>
<p><i>Licence and Approvals</i></p> <p>The RAP includes details of regulatory requirements and approvals.</p> <p>Materials to be disposed offsite shall be classified in accordance with EPA (2014) Waste Classification Guidelines or an appropriate exemption as created under the Protection of the Environment Operations (Waste) Regulation 2014.</p>	<p>The relevant licenses and approvals have generally been appropriately identified in the RAP although the RAP does not specify the Class of asbestos licence required by the Remediation Contractor.</p> <p>Material at the site is provisionally classified as asbestos contaminated soils until deemed otherwise by further assessment which is considered appropriate.</p>

Remedial Action Plan	Auditor Comments
<p>Imported materials will only be accepted to the site if they are a quarried product or if they meet the restrictions placed on these materials and meet the definition of:</p> <ul style="list-style-type: none"> • Virgin Excavated Natural Material (VENM) as defined in the Protection of the Environment Operations Act (1997) Schedule 1; • Excavated Natural Material (ENM) as defined in EPA (2014); or • Recycled materials as per an EPA exemption. 	
<p><i>Contacts/Community Relations</i></p> <p>Contacts are not provided in the RAP but will be included in the CEMP.</p>	<p>Acceptable.</p>
<p><i>Long Term Environmental Management Plan</i></p> <p>The LTEMP will identify capped asbestos and PAH-impacted areas, and details for requirements for excavations within the capping layer as well as appropriate OH&S requirements.</p>	<p>The LTEMP will be required to maintain the integrity of the cap and manage risks associated with any potential future disturbance of fill material across the site.</p> <p>Future development consents should include a condition requiring the conditions of any SAS to be conditions of the development to assist with the enforceability of the LTEMP.</p> <p>It is not stated who will be responsible for ensuring implementation of the EMP.</p> <p>If the cap and containment remediation strategy is extended to the playground dedication area, the existing LTEMP for the adjacent Green Square Childcare Centre (JBS&G, 9 June 2017) will require to be updated to include the proposed playground area and ensure an ongoing management of the playground area under the LTEMP for the Childcare Centre.</p>

Auditor’s Opinion

The remediation approach recommended in the RAP is considered adequate to remediate the USTs and manage the identified fill material contamination, subject to successful implementation of the strategy and preparation of a validation report and an appropriate LTEMP. Clarification of the proposed remediation and validation of the TPH impact at BH32 and the playground dedication area is required. Auditor review of any addition to or alteration of remediation requirements is required following completion of the data gap investigation.

12. CONCLUSIONS AND RECOMMENDATIONS

The RAP proposes a data gap investigation followed by remediation of the site by a combination of offsite disposal of UST impacts (and potentially contamination hotpots) and consolidation and capping of impacted fill, subject to ongoing management with a suitable LTEMP. The LTEMP will be required to maintain the integrity of the cap and manage risks associated with any potential future disturbance of fill material across the site.

Based on consideration of historical data reviewed in previous site audits, the information presented in the PSI (EIS, 2018) and the AECOM Validation Report (AECOM, 2018) and observations made onsite, competent implementation of the data gap investigation and the RAP should ensure that the site is suitable for its proposed use as a primary school. The following is noted in making this consideration:

- The RAP identifies TRH impacted hotspots at BH32 and BH36 however does not discuss the proposed remediation in these areas. JBS&G advised that these areas are intended to be addressed as per potential hydrocarbon impacted soils associated with the USTs, however, this conflicts with the proposal to retain the material on site if the leachability of lead is assessed as acceptable and needs to be clarified. Further investigation and potentially remediation of the petroleum hydrocarbon impact at BH32 is required. The investigation can be incorporated with the proposed lead leachability investigation. Retention of the BH32 materials would require further consideration of the risk associated with volatile petroleum hydrocarbons which exceed the human health criteria in this material.
- The RAP does not identify an alternate remediation approach for the playground dedication area although it was advised in the Response to Auditor Comments that *"It is the intention following demolition for this area to be validated as suitable for the proposed childcare centre use"* without cap and containment of fill. Given the assumption that asbestos is present in all fill, the single data gap location proposed in the playground dedication area will not be sufficient for complete characterisation if it is proposed to retain fill in this area. Clarification of the proposed remediation and validation in this area as suitable for the proposed childcare centre use is required.
- The RAP does not specify the Class of asbestos licence required by the Remediation Contractor.
- The RAP does not discuss the nature of further remediation planning documentation that may be required based on the results of the data gap investigation. The results of the data investigation and any changes to the proposed remediation works should be reviewed by the Auditor. A Remedial Works Plan or an amended RAP may be required to document the changes.
- Auditor review of the detailed design of the borrow pit will be required if this strategy is proposed.
- Further assessment of groundwater in the vicinity of the USTs may be required if significant soil contamination is identified and will be addressed via the UFP.
- After successful implementation of the RAP and any addendums, a Site Audit Statement and accompany Site Audit Report will be prepared assessing the suitability of the site for the proposed use, as well as the long-term management requirements.
- With respect to the proposed LTEMP, it is recommended that future development consents should include a condition requiring the conditions of any Site Audit Statement to be conditions of the development to assist with the enforceability of the LTEMP.

* * *

Consistent with the NSW EPA requirement for staged 'signoff' of sites that are the subject of progressive assessment, remediation and validation, I advise that:

- This advice letter does not constitute a Site Audit Report or Site Audit Statement.
- At the completion of the remediation and validation I will provide a Site Audit Statement and supporting documentation.
- This interim advice will be documented in the Site Audit Report.

Yours faithfully
Ramboll Australia Pty Ltd

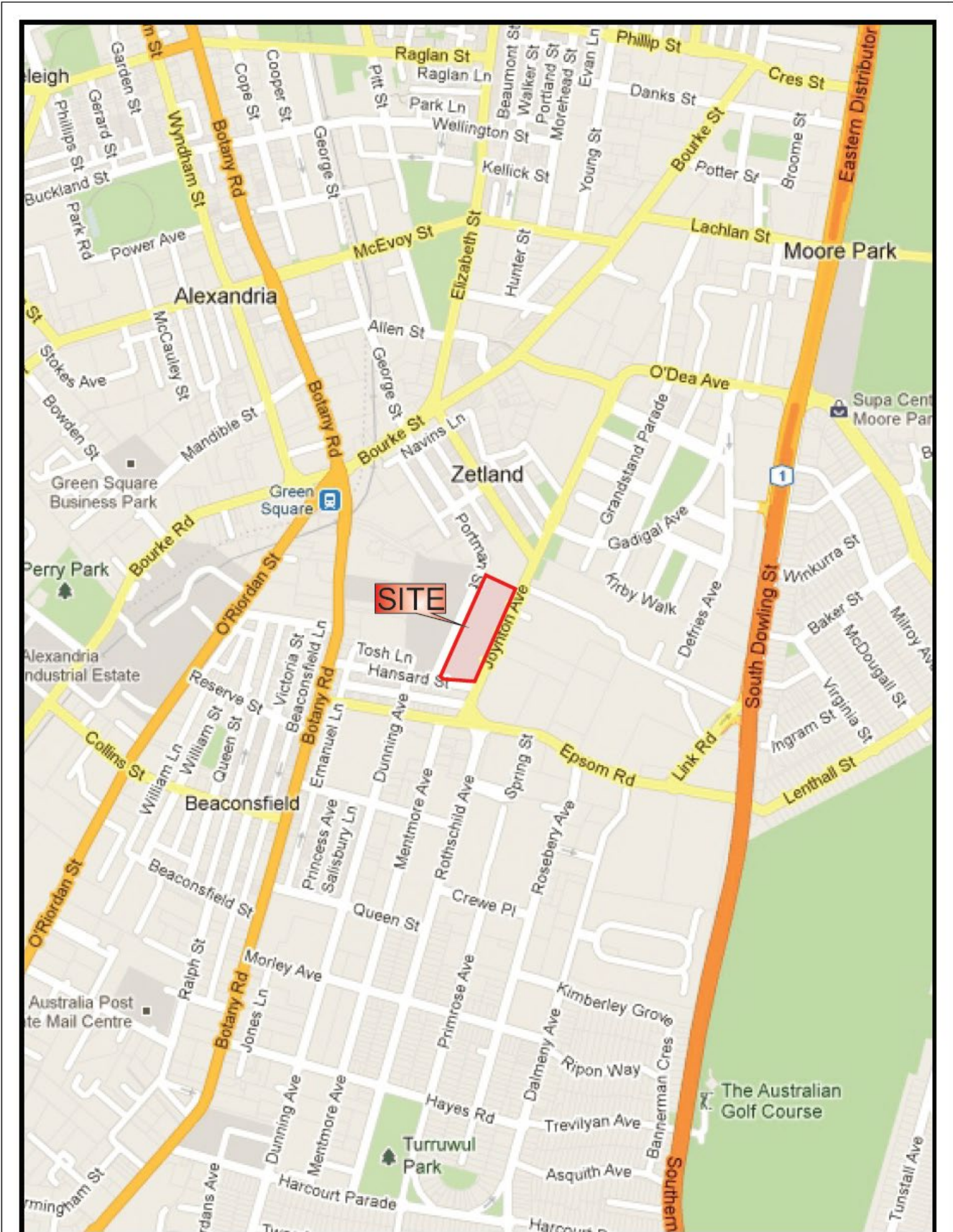


Rowena Salmon
EPA Accredited Site Auditor 1002

Attachments:

- Attachment 1: Former Royal South Sydney Hospital Site Location
- Attachment 2: Site Locality Plan
- Attachment 3: Site Layout
- Attachment 4: Historical Sample Locations

Attachment 1: Former Royal South Sydney Hospital Site Location



Source: Base Image - Google Maps www.maps.google.com 04-07-2012

© 2012 JBS Environmental Pty Ltd

0 100 200 400 m		
Scale: Approximate		
Datum: MGA94 Zone 56 - AHD		
A4		
0	Original Issue - R03	SE 04-07-2012
Rev	Description	Dm. Date

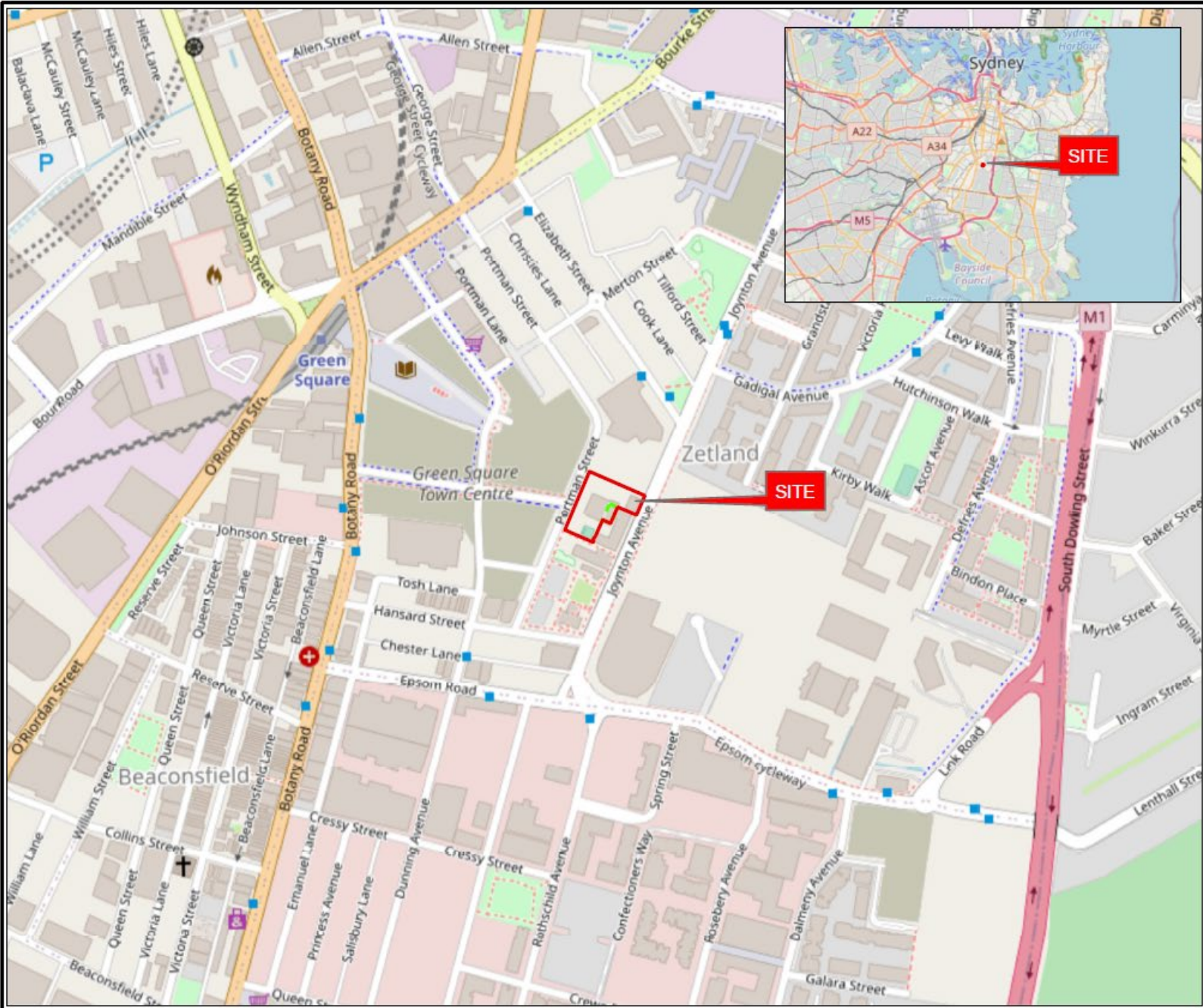
Legend:
■ Approximate Site Boundary



Figure 1: Site Location

Client: City of Sydney Council
 Project: South Sydney Hospital, NSW - RAP
 Job No: 42180 File Name: 42180_01

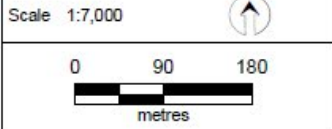




- Legend:**
- Approximate Site Boundary
 - Approximate Childcare Centre Playground Boundary



Job No: 58719
 Client: NSW Department of Education (Schools Infrastructure)
 Version: R01 Rev A Date 21/05/2020
 Drawn By: RH Checked By: JR



Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue,
 Zetland, NSW

SITE LOCATION

FIGURE 1



- Legend:**
- ▭ Approximate Site Boundary
 - ▭ Proposed Childcare Centre
 - ▭ Playground Boundary
 - ▭ Cadastre (NSW LPI, 2020)



Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A Date 21/05/2020

Drawn By: RH Checked By: JR

Scale 1:600



Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue,
Zetland, NSW

CURRENT SITE LAYOUT

FIGURE 2

Attachment 4: Historical Sample Locations

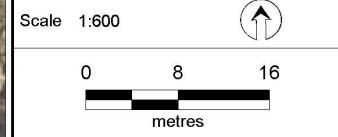


- Legend:**
- Approximate Site Boundary
 - Approximate Childcare Centre Playground Boundary
 - Site Features
 - Cadastre (NSW LPI, 2020)
- Historical Sample Locations**
- DP 1998
 - ✕ GA 2000
 - ▲ DP 2007
 - JBS 2012
 - EIS 2014
 - AECOM 2018
 - EIS 2018
 - JBS&G 2018
- Cross Section (A-A1) (See Fig 6)



Job No: 58719
 Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 18/06/2020
Drawn By: RH	Checked By: SG



Coord. Sys. GDA 1994 MGA Zone 56

**3 Joynton Avenue,
 Zetland, NSW**

HISTORICAL SAMPLE LOCATIONS

FIGURE 4

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\R01 RAP\58719_04_HistoricalSampleLoc.mxd
 Reference: Nearmap (www.nearmap.com.au) 18-04-2020