Kambala School
c/- Carmichael Tompkins Property Group

Remedial Action Plan

Kambala School Sports Precinct

794 New South Head Road,
Rose Bay, NSW
25 September 2020

58081/130541 (Rev 0)

JBS&G

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material
ACD	Asbestos Containing Dust
AEC	Areas of Environmental Concern
AF/FA	Asbestos Fines / Fibrous Asbestos
ASS	Acid Sulfate Soils
B(a)P	Benzo(a)pyrene
B(a)P TEQ	Carcinogenic PAHs as benzo(a)pyrene toxicity equivalent quotient
Bgs	Below Ground Surface
BTEX	Benzene Toluene Ethylbenzene and Xylenes
CLM Act	Contaminated Land Management Act
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
EIL/ESL	ecological investigation/screening level
ENM	Excavated Natural Material
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority
ESD	Environmentally Sustainable Development
GSW	General Solid Waste
HIL/HSL	Health-based investigation/screening level
HMBS	Hazardous Material Building Survey
JBS&G	JBS&G Australia Pty Ltd
LAA	Licensed Asbestos Assessor
LCD	Lead Containing Dust
LP	Lead containing Paint
LEP	Local Environmental Plan
LPI	NSW Land Property Information
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
OCPs	Organochlorine Pesticides
OEH	NSW Office of Environment and Heritage (includes EPA)
PAHs	Polycyclic aromatic Hydrocarbons
PARCCS	Precision, accuracy, representativeness, comparability, completeness and sensitivity
PCBs	Polychlorinated biphenyls

Term	Definition
PID	Photoionization detector
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance / Quality Control
RAP	Remedial Action Plan
RPD	Relative Percentage Difference
RSW	Restricted Solid Waste
SWNSW	SafeWork NSW
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SMF	Synthetic Mineral Fibre
TCLP	Total Characteristic Leaching Procedure
TEQ	Toxicity Equivalent Quotient
TPH/TRH	Total Petroleum/Recoverable Hydrocarbons
UCL	Upper Confidence Limit
VENM	Virgin Excavated Natural Material

1. Introduction

1.1 Background

JBS&G Australia (JBS&G) was engaged by Kambala School (the client) via Carmichael Tomkins Property Group (CTPG) to prepare a Remedial Action Plan (RAP) to guide management of potential contamination during development of the proposed Sports Precinct at Kambala School, 794 New South Head Road, Rose Bay, NSW (the site). The site comprised the proposed Sports Precinct redevelopment in the north-eastern portion of the school and is legally defined as part Lot 67 in Deposited Plan (DP) 2538 and Lots 1 to 7 and 9 to 12 in DP1116858. The site has an area of approximately 9000 m^2. The site location is shown in **Figure 1** and the site layout is shown in **Figure 2**.

The site currently comprises a grass sports field, hardcourt tennis courts, concrete and garden embankments adjacent to New South Head Road and a number of structures, the most significant of those being the Hawthorn Building. It is understood that the proposed development will comprise a Sports Precinct which includes, underground change rooms, sports hall and associated sports facilities.

JBS&G have previously conducted works at the site as documented in Preliminary Site Investigation (PSI) JBS&G (2020a[1]) and Detailed Site Investigation (DSI) JBS&G (2020b[2]). The works included background review and comprehensive intrusive soil sampling within the proposed redevelopment area. The investigations identified potential contamination risks associated with polycyclic aromatic hydrocarbons (PAHs) and lead concentrations above adopted health-based assessment criteria. Additionally, two fragments of non-friable asbestos containing material (ACM) were identified and collected from the north-western portion of the site, adjacent to the site boundary on Bayview Hill Road.

Based on the findings of the previous reports, preparation of a RAP was recommended to remediate or manage the impacted soils identified to make the site suitable for the proposed use in accordance with *State Environmental Planning Policy 55 – Remediation of Land* (SEPP 55) guidance. It is noted that this RAP has been prepared based on currently available development plans and with the understanding that significant excavation will be required to construct the multi story sports buildings as part of the proposed redevelopment. The final capacity for materials to be retained on site and consequently the amount of materials which will require disposal offsite, may need to be confirmed based on finalised development plans including cut to fill plans and logistics regarding time, costs and space.

This RAP has been completed in general accordance with guidelines made or approved by the NSW Environment Protection Authority (EPA) and relevant Australian Standards.

1.2 Objectives

The objectives of this RAP are to:

- Define the conceptual site model (CSM) of the proposed site development including identification of potential areas of impacted soils;
- Define the extent of remedial works required to make the site suitable for the proposed redevelopment and ongoing primary and secondary school use;

[1] *Preliminary Site Investigation – Kambala School Sports Precinct, 794 New South Head Road Rose Bay, NSW* (Rev A) JBS&G Australia Pty Ltd 17 March 2020 (JBS&G 2020a)

[2] *Detailed Site Investigation – Kambala School Sports Precinct, 794 New South Head Road Rose Bay, NSW* (Rev A) JBS&G Australia Pty Ltd 25 June 2020 (JBS&G 2020b)

- Establish a framework and methodologies to validate the removal of site contamination as identified as posing a potential risk; and
- Include provision for management of environmental and safety risks during the implementation of the remedial works, and guidance for the any requirements of ongoing management of impacted materials retained on the site.

2. Site Condition & Surrounding Environment

2.1 Site Identification

The location of the site is shown in **Figure 1**, and the current layout is shown in **Figure 2**. The site details are summarised in **Table 2.1**.

Table 2.1: Site Details

Lot / DP Number	Part Lot 67 DP 2538 Lots 1 to 7 and 9 to 12 DP1116858
Street Address	794 New South Head Road, Rose Bay, NSW
Local Government Authority	Woollahra Municipal Council
Site Area	Approximately 0.9 ha
Current Zoning	SP2 Infrastructure (Educational Establishment) Woollahra Local Environmental Plan (LEP) 2014
Geographic Coordinates	E: 340202.464 (GDA94-MGA56) N: 6251480.779 (GDA94-MGA56)
Previous Land Use	School since 1913
Current Land Use	School

2.2 Site Description

A detailed site inspection was undertaken on 7th, 20th and 21st April 2020 by an experienced JBS&G environmental. The layout of the site was observed to be consistent with that described in the PSI (JBS&G 2020a). Site features observed during site inspections are shown on **Figure 2**.

The site was observed to comprise a well maintained grass sports field, with hardcourt tennis courts to the north-west. An embankment was observed on the north-eastern and eastern boundary of the site adjacent New South Head Road. The embankment comprised of sealed concrete in the north-eastern portion and of well-maintained gardens on the eastern boundary. The embankment was observed as over 5 m in height at its highest point. Use of garden products such as fertilisers and mulch was apparent in the garden embankment.

Additionally, a sports equipment store was located on the eastern end of the grass sports field and a hydrant booster and associated shed was observed in the southern corner of the site. The sports equipment store was surrounded by garden areas comprising trees, plants and rock.

The northern portion of the Hawthorn Building and the adjacent toilet block were also understood to be part of the proposed redevelopment works. The structures were still present at the time of inspection and as such investigation of surfaces and soil beneath the structures was not possible at this time. A Hazardous Building Material Survey (HMBS) was conducted on the structures and reported in JBS&G (2020c[3]).

No staining, odours or ACM was observed on accessible site surfaces at the time of inspections. It is noted that ACM was observed within near surface soils at locations HA11 and HA12 north of the tennis courts and near the School boundary with Bayview Road.

2.3 Surrounding Land Use

The surrounding land uses have been identified as follows:

[3] *Hazardous Building Materials Survey – Kambala School, 794 New South Head Road, Rose Bay, NSW (Rev 1*) JBS&G Australia Pty Ltd 7 April 2020 (JBS&G 2020c)

- North – Immediately north of the site is Bayview Hill road, followed by low-density residential properties and two schools, Kincoppal-Rose Bay School and Kincoppal-Rose Bay Junior School.
- East – Immediately east of the site is New South Head Road, followed by low-density residential properties.
- South – The majority of Kambala School buildings are located immediately south of the site. A UST was identified south of the site and adjacent to a school entrance on New South Head Road. New South Head road and low-density residential properties were located further South.
- West – Immediately west of the site is occupied by residential housing. This is followed by Rose Bay/Sydney Harbour.

Based on the general observations of surrounding properties, it was considered the potential for contamination to be migrating onto the site from surrounding areas is low. Impact to the site associated with the UST is considered unlikely as surrounding topography and the anticipated flow of groundwater direction is anticipated to be away from the site. It is further noted that the tank is understood to be empty based on information provided by the school.

2.4 Topography

A review of the regional topographic maps using SIX maps[4] indicated that the site has an elevation of approximately 30 to 40 m Australian Height Datum (AHD). The site and surrounding area generally slopes to the south-west and towards Sydney Harbour.

The site itself is relatively level, the sportsfield, tennis courts and buildings have been levelled flat through historical construction. The concrete and garden embankment adjacent to New South Head Road on the sites north-eastern and eastern boundaries consist of steep slopes with New South Head Road located up to 5 m higher than the sportsfield in some areas.

2.5 Geology

Based on the Sydney 1:100 000 Geological Map[5], the site was located in an area underlain by Hawkesbury sandstone of the Wianamatta Group. This is typically formed in middle Triassic period and characterised by medium to coarse-grained quartz sandstone with very minor shale and laminate lenses.

Based upon the Sydney 1:100 000 Soil Landscape series[6] the site is located within the Hawkesbury soil landscape group. The landscape is generally characterised by rugged, rolling to very steep hills on Hawkesbury Sandstone with local relief between 40 – 200m. Soils in this landscape are characteristically (>50 cm), discontinuous lithosols/siliceous sands associated with rock outcrops, earthy sands, yellow earths and some yellow podzolic soils along joints and fractures, localised yellow and red podzolic soils associated with shale lenses and siliceous sands and secondary yellow earths along drainage lines. Limitations of the Hawkesbury group include extreme soil erosion hazards, steep slopes, rock outcrops, shallow, stony, highly permeable soil and low soil fertility.

During previous works as summarised in **Section 3.5**, soils at the site were observed to comprise dark brown to grey sandy fill soils with inclusions of mulch and garden mixes within the embankment. Brown to yellow-brown and grey sand fill soils with inclusions of coarse gravel, glass and plastic was observed within the sports field. It is noted inclusions were generally observed in deeper fill at depths of 1 m or more below the surface.

[4] SIX Maps http://maps.six.nsw.gov.au/ (accessed 22 March 2017)
[5] Sydney 1:100 000 Geological sheet 9130, 1st Edition (1991)
[6] Sydney 1:100 000 Soil Landscapes Series Sheet 9130, Soil Conservation Service of NSW (1990)

Fill soils were underlain by natural yellow to orange and red sandstone with natural yellow brown sands and clayey sands observed at isolated locations.

2.6 Acid Sulfate Soils

Based on review of Department of Land and water Conservation acid sulfate soil risk map of Sydney Heads (DLWC 1997) there are no known occurrences of acid sulfate soils (ASS) at the site.

Review of the Acid Sulfate Soils Maps in Woollahra LEP (2014) indicate the site is located within a Class 5 area for ASS. Based on this class, any works within 500 m of adjacent Class 1, 2, 3 or 4 land that is below 5 m Australian height datum required development consent.

The site is located well above 5 m AHD and development works are not anticipated to involve working down to this depth.

Based on the assessment of risk maps and observations made in JBS&G (2020b), ASS conditions have not been mapped or encountered at the site. It is further noted that development works are not proposed to a depth where potential ASS would exist.

2.7 Hydrology

No surface water bodies are located on the site. The nearest surface water body to the site is Rose Bay to the west of the site. This bay is directly part of the greater Sydney Harbour.

Rainfall that falls onto the site is likely to infiltrate into vegetated or unsealed surfaces. Rainfall which falls onto buildings or paved surfaces is anticipated to be captured in stormwater infrastructure within or adjacent to Kambala School. Surface water flow is anticipated to be to the southwest following the local topography of the area.

2.8 Hydrogeology

Registered groundwater monitoring well data was obtained from the NSW Office of Water groundwater database[7] and is provided in JBS&G (2020a).

Review of the NSW Office of Water's Groundwater database revealed there are six registered groundwater wells within 500m of the site. All wells were located southwest and downgradient of the site. Groundwater Bore information is summarised in **Table 2.2** below.

Table 2.2: Registered Groundwater Bore Search

Bore ID	Use	Property	Standing Water Level (mbgs)	Well Depth (m)	Distance from Site
GW106127	Domestic	-	2.0	4.0	168.474m
GW106407	Domestic	Collier 8 Dumaresq Road, Rose Bay	2.0	4.0	195.591m
GW107663	Domestic	-	7.625	11.59	210.332m
GW107986	Domestic	-	1.83	6.33	225.376
GW108824	Domestic	Haralambis 3 Collins Avenue, Rose Bay	2.745	6.10	398.444m
GW110857	Domestic	-	2.0	4.0	472.71m

Based on the reported geology, topography and depth to groundwater, groundwater migration is expected to be to the southwest and towards Sydney Harbour. Based on the groundwater bore search it is considered that depth of groundwater increases with distance from the Harbour. Based on this assumption and noting observation from the investigation works, the depth of groundwater at the site is anticipated to be between 7 to 10 m at the site and flow to the south-west.

[7] Office of Water's Groundwater Monitoring Overview Map http://allwaterdata.water.nsw.gov.au/water.stm (accessed 22 March 2017)

3. Site History

3.1 Summary Site History

Based on the desktop review including Council records, aerial photographs and EPA registers as conducted in JBS&G (2020a), the site was understood to have been used as a school since 1913. Kambala school was also noted to be an item of general heritage under Woollahra LEP 2014.

Historically buildings, embankments and sports fields within the school have remained relatively consistent. Development of additional buildings, tennis courts and an underground music hall are noted historical developments at the site.

3.2 Contamination Assessment Letter – Kambala Sports Precinct (JBS&G 2019)

JBS&G conducted a contamination assessment within the Kambala Sports Precinct in January and February 2019. The assessment was limited in nature and included soils sampling from 8 borehole locations conducted for a geotechnical assessment. A further 5 sample locations were conducted using a hand auger. The objective of the assessments was to assess the site for potential contamination whilst also preliminarily characterising materials encountered for potential offsite disposal in accordance with NSW EPA *Waste Classification Guidelines* (EPA 2014).

The site inspection and soil sampling were conducted on the 8th and 9th February 2019. The site was observed to comprise a well maintained sports field and surrounding gardens and embankments. No staining, odours or ACM was observed on the surface. Collected soil samples were analysed for a range of potential contaminants of potential concern (COPC) including heavy metals total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), PAHs, organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and asbestos.

Based on the results of the investigation**,** soils analytical concentrations were generally reported at concentrations within the criteria adopted. Elevated PAH concentrations associated with carcinogenic PAHs as benzo(a)pyrene toxicity equivalent quotient (B(a)P TEQ) and Total PAHs that exceeded the adopted health based criteria was identified at location HA01-0-0.1. Elevated B(a)P TEQ concentrations that exceeded the adopted health based criteria was identified at locations HA01_0.9-1.0, HA02_0-0.1 and BH07_1.5-1.6.

The concentrations were reported to present a potentially unacceptable health risk to site users through dermal contact and/or ingestion if soils are reused within the school grounds or within the sports fields and other open space areas such as gardens, particularly if they are used at or near the surface.

The concentrations were not considered to represent a potential health risk to workers (i.e. excavation and working within the impacted soils). As reduced exposure times in this scenario and added safety measures including personal protective equipment and safe working practices mean that risk to worker exposure to soils is mitigated during excavation and redevelopment works.

Potential ecological risk (to plant growth) was identified at locations HA01, HA02, HA03 and HA07, due to elevated, zinc, TRH and B(a)P. Consideration of depth and surrounding plants would need to be considered if reusing these materials.

Waste classification of site materials identified that fill materials fall within the General Solid Waste (non-putrescible) (GSW) category with the exceptions of soils at locations BH07_1.4-1.5 and HA01_0-0.1 which fall within Restricted Solid Waste (RSW) without the use of any EPA immobilisations.

It was noted that the EPA general immobilisation approval for ash may be able to be implemented, in particular at BH07_1.4-1.5 and HA01_0-0.1 subject to confirmation of suspected ash in fill. This would allow these soils to be classified as GSW based on current non-detected TCLP results.

Natural materials were encountered beneath fill materials and consisted of yellow/orange/red sand and sandstone consistent with Virgin Excavated Natural Material (VENM).

It was recommended that further assessment should be conducted prior to development works proceeding to confirm the assessment and waste classification results and aid appropriate onsite and offsite management of fill and natural soils. These further assessments are considered in the conclusions of this report.

3.3 Preliminary Site Investigation (JBS&G 2020a)

JBS&G was engaged by the client to conduct a PSI at the proposed Sports Precinct redevelopment at the site.

The PSI was a requirement to address Secretary's Environmental Assessment Requirements (SEARs) regarding soil and groundwater contamination and used data obtained from JBS&G (2019) discussed in **Section 3.2**. It is further noted that contamination assessment in accordance with SEPP 55 guidelines was required to demonstrate that the site is suitable or can be made suitable for the proposed use.

As such, comprehensive review of the site history and available records was completed, and the data and assessment compiled in JBS&G (2019) was utilised for preparation of the PSI in accordance with SEPP 55.

Based on the desktop review including Council records, aerial photographs and EPA registers, the site was understood to have been used as a school since 1913. Kambala school was also noted to be an item of general heritage under Woollahra LEP 2014.

Areas of environmental concern (AECs) identified at the site were mostly associated with significant filling to create the current levels and the garden embankment. Additionally, potential for inclusions of anthropogenic waste and ACM were also considered. Lower risk AECs identified included building footprints, a UST located south of the site and the pumping station and shed located in the southern portion of the site.

The detailed site inspection was undertaken on 8th and 9th January 2019 by an experienced JBS&G environmental consultant, with additional observations made during a Hazardous Material Survey conducted on 11th February 2019. No staining, odours or ACM was observed on the surface. Intrusive works and associated soil sampling was completed from 8 borehole locations and 5 handauger location from accessible areas within the site. Fill materials were observed to comprise dark brown to grey sandy fill soils with inclusions of mulch and garden mixes within the embankment and brown to yellow-brown and grey sand fill soils within the sports field with inclusions of coarse gravel, glass and plastic observed at depth. Selected soil samples collected from the sampling locations conducted were analysed for a range of COPC including Heavy metals, TRH, BTEX, PAHs, OCPs, PCBs and asbestos.

Based on the soil analytical results reported**,** concentrations were generally reported at concentrations within the criteria adopted. Elevated PAH concentrations associated with B(a)P TEQ and Total PAHs that exceeded the adopted health based criteria were identified at locations HA01-0-0.1, HA01_0.9-1.0, HA02_0-0.1 and BH07_1.5-1.6. Additionally, potential ecological risk (to plant growth) was identified at locations HA01, HA02, HA03 and HA07, due to elevated lead, zinc, TRH and B(a)P.

Reported soil analytical concentrations including TCLP analysis, suggested that fill materials fall within the GSW (non-putrescible) category with the exceptions of soils at locations BH07_1.4-1.5 and HA01_0-0.1 which fall within RSW without the use of any EPA immobilisations. EPA immobilisation for BH07_1.4-1.5 and HA01_0-0.1 may be possible subject to confirmation of ash in fill materials.

Based on the findings of the PSI it was considered that the site can be made suitable for the proposed redevelopment in accordance with SEPP 55 subject to the following actions:

- A DSI is conducted, including soil sampling and investigation beneath current building/structures following demolition and additional works to verify the extent of potential PAHs impact identified including identifying whether ash is present within fill materials;
- The additional works should be conducted via the testpit method using an excavator to complete comprehensive inspection and characterisation of fill materials including visual identification for the presence/absence of ash and ACM;
- Assessment of soils within the south-eastern corner of the site to identify if any impact from the nearby UST has occurred will also be included; and
- Following completion of the DSI, a RAP can be prepared based on the findings, if required. The RAP will also detail any management requirements based on assessment results to ensure potential health and ecological risks identified are appropriately removed or managed. The additional works will also allow Waste Classification of soils to be confirmed.

3.4 Hazardous Material Survey – Kambala Sports Precinct (JBS&G 2020c)

JBS&G conducted a hazardous building materials survey (HBMS) at the site.

The scope of the HBMS was limited to the northern portion of the Hawthorne Building and the structures on the sports field, that are proposed to be demolished to facilitate the Sports Precinct redevelopment. No other areas of Kambala School were surveyed as part of this HBMS.

The structures were inspected for the following hazardous materials:

- ACMs;
- Asbestos containing dust (ACD);
- Lead based paints (LP);
- Lead containing dust (LCD)
- Synthetic mineral fibres (SMF); and
- PCB.

Based on the assessment completed the following conclusions were made:

<u>Asbestos Containing Materials</u>

Suspected non-friable ACM were identified at the site. Prior to the demolition of the structures it was recommended that the following work are undertaken:

- A Class A or B licensed asbestos removalist shall be engaged to remove all asbestos containing materials as identified in the Hazardous Materials Register included in JBS&G (2020b). Removal and disposal of non-friable asbestos materials shall be undertaken in accordance with the *Work Health and Safety Act* 2011, *Work Health and Safety Regulation 2017* and SafeWork NSW *Code of Practice How to Safety Remove asbestos* (SWNSW 2019).
- While not mandatory during the removal of non-friable ACM, it is considered best practice and recommended that asbestos air monitoring is undertaken during any non-friable asbestos removal works.

Following removal works, a clearance inspection shall be completed by a competent person or Licensed Asbestos Assessor (LAA) to ensure that the asbestos materials identified at the site have

been removed to a satisfactory standard. Following the completion of the clearance inspection, a clearance certificate shall be issued by the competent person or LAA to confirm that the ACM has been successfully removed and that the site is suitable for planned demolition works to commence.

Lead Containing Dust

Levels of lead in dust were identified slightly above the adopted site criteria within the roof void of the Hawthorne Building. A conservative approach was recommended to be implemented to manage this identified hazard during demolition and refurbishment works.

A suitably experienced hazardous materials removal contractor should be engaged to remove the lead containing dust prior to demolition. Lead dust waste removed from education facilities is pre-classified as GSW (non-putrescible) in accordance with the EPA (2014) *Waste Classification Guidelines – Part 1: Classifying Waste.*

The roof void should remain restricted from general access until the lead dust hazard is removed.

Should the lead containing dust remain on site for an extended period of time, a lead management plan or similar should be prepared detailing the procedures and requirements to reduce the potential for lead dust exposure if site workers are required to access the hazardous area.

Lead Based Paints

Lead based paints identified in the Hazardous Materials Register should be managed in accordance with the AS4361.2-2017. If peeling or deteriorated they should be removed under controlled conditions by an experienced contractor prior to demolition. Stable lead based paints adhered to building fabric can be removed as GSW provided care is taken to minimise any potential for paint flakes to be dispersed onto ground surfaces.

Any lead paint waste removed from an education facility is pre-classified as GSW (non-putrescible) (EPA 2014).

Polychlorinated Biphenyls

No PCB materials were identified at the time of inspection.

Synthetic Mineral Fibres

SMF encountered during the inspection were generally contained and deemed to be low risk, and can be removed with the building and demolition waste with care taken not to generate fibres. Appropriate PPE was recommended including the use of P2 respirator as minimum and appropriate removal methodology as outlined in [NOHSC: 1004(1990)] and [NOHSC: 2006(1990)].

Inaccessible Areas

Areas inaccessible during the HBMS should be inspected by a suitably qualified competent person prior to any works commencing. Suspected ACM should be sampled by a suitably qualified competent person prior to any works commencing.

Unexpected Finds

Any materials deemed to be consistent with those detailed in the Hazardous Materials Register that have not been previously identified should be assumed to have the same content and be treated accordingly.

Should any additional suspected hazardous materials be observed during or prior to demolition works, works should cease until a suitably qualified occupational hygienist can assess the suspected hazardous material and provide appropriate recommendations for management and/or removal.

3.5 Detailed Site Investigation (JBS&G 2020b)

JBS&G was engaged by the client via CTPG to conduct a DSI at the proposed Sports Precinct redevelopment at the site.

The DSI was required to complete the recommendations of the PSI (JBS&G 2020a) as detailed in **Section 3.3**, and to address SEARs for contamination assessment in accordance with SEPP 55 guidelines.

JBS&G conducted the DSI field works on 7th, 20th and 21st of April 2020, which included soil sampling from 21 intrusive investigation locations using hand methods and mechanical excavation methods to observe and sample soils. Comprehensive inspection of fill soils including for the presence or absence of visible ACM or aesthetically impacted materials was also conducted.

Based on observation made from the DSI works including the PSI (JBS&G 2020a) observations, fill materials were observed as brown to brown-yellow and grey sands and silty sands with occasional inclusions of grass and rootlets within the sports field. Inclusions of coarse gravels, glass and plastic were observed in deeper areas of the sports field. Depth of fill within the sports field was observed as varying between 0.5 m and 5.2 m bgs. Fill within the embankments was observed to comprise sandy soils blended with organic materials such as foliage and planting soil mixes with inclusions of geofabric and rootlets varying in depth between 0.2 m and 1.0 m bgs.

Fill soils were underlain by natural materials comprised of yellow-brown sands and clayey sands or yellow/red/orange sandstone.

Fill soils and site surfaces were observed to be free of any staining or odorous soils and also free of any significant amount of inclusions such as building rubble. While no obvious ash was observed within fill soils, potential charcoal was observed within location TP2. The reported PAH concentrations within the sports field and within the embankment including the immobile nature of the concentrations confirmed through TCLP testing suggest that the PAHs may be sourced from ash and or charcoal.

Two isolated fragments of ACM were identified at locations HA11 and HA12 within a narrow garden strip north of the tennis courts and on the north-western boundary of the site as shown on **Figure 3**. No further ACM fragments in fill material was identified at the site.

Samples collected from the investigation were subsequently analysed for a range of contaminants of potential concern and were compared against *National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended 2013* (NEPC 2013) health and ecological criteria for residential with gardens/accessible soils land use which includes child care centres, preschools and primary schools.

Based on soil analytical results reported, elevated lead, carcinogenic PAHs as B(a)P TEQ and Total PAHs were identified to exceed the adopted health-based criteria. The elevated concentrations were generally limited to the following areas:

- The eastern garden embankment adjacent with the site's eastern boundary adjacent to the bend on New South Head Road; and
- The south-eastern portion of the sports field within locations BH07, BH12 and TP2. It was further noted that impact within the sports field was identified at a depth of 1.5 m or more from the surface.

Contaminant concentrations that could present a potential ecological risk were also identified. However, noting there are no ecological receptors at or nearby the site such as creeks or habitats for native flora and fauna species, protection of ecological receptors was not considered relevant for the site.

Total Characteristic Leaching Procedure (TCLP) was conducted on the highest reported concentrations of lead and PAHs. The reported results demonstrated that the lead would leach at trace concentrations and all TCLP PAHs concentrations were reported below the laboratory limit of reporting. The results suggest that migration of elevated PAHs and lead is not occurring.

Based on comparison of reported contaminant concentrations, TCLP and 95% UCLs, fill soils within the sports field and the embankment are likely to fall within the GSW (non-putrescible) category. Should asbestos be encountered, material would also require classification as Special (Asbestos) Waste. Should presence of ash or charcoal be identified, application of EPA immobilisation approvals may be applied.

Based on the findings of this investigation, the following findings were made:

- Contamination issues associated with Total PAHs and B(a)P TEQ were identified within the eastern garden embankment at locations HA01 to HA03 and HA06 to HA08. Elevated concentrations of B(a)P TEQ and lead were identified at depth within the south-eastern portion of the sports field at locations BH07, BH12 and TP2 also;
- Given no areas of ecological significance were located at or nearby the site, protection of ecology was not considered relevant to the site. Reported TRH concentrations within embankment areas are considered related to natural organic material in mulch/vegetation and not petroleum impact and does not pose an unacceptable risk;
- Two fragments on non-friable ACM at locations HA11 and HA12 were identified and removed for testing. No other asbestos as AF/FA or visible ACM was identified at the site, however there is potential for ACM to be present in fill in other areas of the site; and
- Despite the contamination issues identified, it was noted that there is no unacceptable risk to current users of the playing field areas as the contamination in this area was at depth where there is no existing pathway whereby site users come into contact with these soils under normal surface usage. Impacted soils within the embankments are not considered to be regularly occupied by site users other than gardeners and/or maintenance works, and COPCs concentrations in this area do not pose an unacceptable risk to current workers under a commercial worker scenario.

Based on the DSI conclusions it was considered that the site can be made suitable for the proposed redevelopment in accordance with SEPP 55 subject to preparation and implementation of a RAP including an unexpected finds protocol.

4. Conceptual Site Model

Based on the findings of JBS&G (2020b) the following conceptual site model (CSM) has been developed for the site.

4.1 Potential Areas of Environmental Concern

Based on the objectives of the assessment, desktop review and observations made during the site inspection, AECs and COPCs have been identified and are presented in **Table 5.1**.

Table 4.1 Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern (AEC)	Contaminants of Potential Concern (COPCs)
In situ Fill materials within the sports field	Heavy metals, TRH/BTEX, PAHs, OCPs, PCBs and Asbestos
Building Footprints	Heavy metals, TRH/BTEX, PAHs, OCPs, PCBs and Asbestos
Garden embankment landscaped materials	Heavy metals, TRH/BTEX, PAHs, OCPs, PCBs and Asbestos
Pumping station and associated storage of chemicals for ground maintenance equipment	Heavy metals, TRH/BTEX, PAHs, OCPs, PCBs and Asbestos

4.2 Potentially Contaminated Media and Migration

Each of the AECs and corresponding COPCs identified in **Table 4.1** have the potential to impact soil, groundwater and/or soil vapour underlying the site.

The highest contamination risks at the site are considered to be within fill materials of unknown origin historically used to construct the sports field and surrounding embankments. Fill materials were identified as variable in depth. Fill was considerately deeper on the south-western side of the sports field where it was encountered at a depth of up to 5.2 m below the surface. The depth of fill within the embankment was generally observed from the surface to between 0.2 and 0.9 m bgs.

Fill materials have been identified as impacted with B(a)P TEQ, lead and TRH. Impacts identified within fill materials in the eastern embankment are considered to be associated with gardening blends. Impacted fill materials within the south-eastern end of the sports field, were generally encountered at depths between 1.5 and 3.5 m below the surface.

Fill materials within the remaining areas of the site were generally free of chemical contamination exceeding adopted assessment criteria based on the investigations completed. Two fragments of non-friable ACM were observed on the surface at the north-western site boundary and in the vicinity of HA11 and HA12.

Natural materials underlying fill materials were observed to comprise sandstone and silty sand soils at depths varying between 0.9 m and more than 5.2 m bgs. Sampling of natural materials did not identify any contamination. Additionally, leachate testing suggests that contaminants within fill soil are unlikely to be leachable and therefore migration of contaminants from fill soils and into other media is considered unlikely. Natural materials underlying the site are not considered a contaminated media and can potentially be characterised as VENM subject to confirmation inspection and sampling by an environmental consultant during earthworks,

Groundwater was not encountered during the investigations conducted. Based on the anticipated depth to groundwater at the site, between 7 and 10 m bgs, and noting the non-mobile and non-leachable contaminant concentrations identified within fill soils, groundwater is not considered to be a contaminated media at the site. It is further noted that given the urban setting of the site, groundwater is unlikely to be used as a resource anyway.

Potential groundwater impact from the UST identified south of the site has been ruled out given its distance from the site and given its downgradient position from the site.

4.3 Potential for Migration from Site

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (stockpiled materials, surface soils around the site or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants of concern identified from the investigation works are mostly limited to solids and non-mobile contaminants including asbestos (non-friable), anthropogenic materials, heavy metals, and B(a)P. Further to this leachability of heavy metals and B(a)P were confirmed to be non-leachable through TCLP analysis. As such, contaminants within fill soils are considered unlikely to migrate offsite.

The ground surface of the site is well vegetated and/or maintained or covered in handstand. As such, there is a low potential for windblown contaminants to migrate from the site.

4.4 Receptors

Potential receptors of environmental impact present within the site include:

- Future commercial/industrial workers and school students and staff who may potentially be exposed to COPCs through direct contact with impacted soils and/or ingestion and/or inhalation of dusts / fibres associated with impacted soils; and/or
- Excavation / construction / maintenance workers conducting activities at or in the vicinity of the site, who may potentially be exposed to COPCs through direct contact with impacted soils present within excavations and/or inhalation of dusts / fibres associated with impacted soils.

4.5 Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or man-made pathways that results in the preferential migration of COPCs as either liquids or gases.

Man-made preferential pathways may be present at the site, generally associated with fill materials at near surface depths. Fill materials are anticipated to have a higher permeability than the underlying natural soil and/or bedrock.

5. Remedial Action Plan

5.1 Remediation Objectives

The remediation objectives are outlined as follows:

- Remove or manage potentially unacceptable risks to human health associated with PAH and lead impacted soils for the proposed development works to be undertaken;
- Manage identified potential findings of ACM and/or other unexpected contamination via implementation of an unexpected finds protocol;
- Validate the remedial works in accordance with the relevant NSW EPA guidelines and with reference to the site specific criteria; and
- Document the validation process.

The RAP has been prepared with reference to the following guidelines and legislation:

- *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land*; (DUAP 1998).
- *Contaminated Sites: Sampling Design Guidelines*, September 1995 (EPA 1995).
- Contaminated Land Guidelines: Consultants Reporting on Contaminated Land, NSW EPA, May 2020 (EPA 2020).
- *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, October 2017, NSW EPA (EPA 2017).
- *National Environment Protection (Assessment of Site Contamination Measure) Measure 1999, as amended 2013*, National Environment Protection council (NEPC 2013);
- *Waste Classification Guidelines. Part 1: Classifying Waste*, NSW EPA, November 2014 (EPA 2014).

5.2 Extent of Remediation

Based on the DSI (JBS&G 2020b) identified remediation areas are shown on **Figure 3**, and are detailed as follows:

- Fill materials impacted with total PAHs and B(a)P TEQ concentrations that exceeded the site adopted criteria within the eastern embankment. The impacted fill in this area is considered to extend the entire fill stratum to a depth of between 0.2 to 1.0 m bgs. The areas lateral extent is from the School entrance on New South Head Road to where the sealed concrete embankment begins as shown on **Figure 3**.
- Impact identified within the sports field was identified at the following locations and at the following depths:
    - B(a)P TEQ impact and lead impact identified at location BH12 at a depth of 2.5 to 3.5 m bgs;
    - B(a)P TEQ impact at location BH07 at a depth of 1.5-1.6 m bgs; and
    - B(a)P TEQ impact at location TP2 at a depth of 1.5-2.0 m bgs.

Based on previous investigations, shallower fill soils within the sports field between the surface to approximately 1.0 m bgs reported low concentrations of COPC and were mostly observed to be free of any inclusions such as anthropogenic materials. As such, soils between 0 and 1.0 m bgs within the sports field are considered to have low risk of contamination and would be potentially suitable for reuse at the site without ongoing management. Indicative areas within the southern

portion of the sports field below 1 m bgs where potential impact is identified including the locations above is shown on **Figure 3**.

Potential for further impacted fill soils at a depth of 1 m or more within the southern portion of the sports field is considered possible given the spatial separation between data points at depth and given that inclusions of gravel and charcoal were observed.

5.3 Remedial Options Assessment

The *Contaminated Land Management Guidelines for the NSW Auditor Scheme* (EPA 2017) adopts the National Environment Protection Measure (NEPC 2013) preferred remediation hierarchy as follows:

- On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
- Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;
- Consolidation and isolation of the soil on-site by containment within a properly designed barrier; and
- Removal of contaminated soil to an approved site or facility.

The remedial options evaluated in **Table 5.1** below.

Table 5.1: Remedial Options Matrix

Remedial Option	Discussion	Conclusion
Option 1: On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level.	Metals Metals are unable to be destroyed. However, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified inorganic contaminants of concern (e.g. cement stabilisation). PAHs PAH present in site soils are typically restricted to heavier non-volatile constituents. These can be remediated by thermal processes. However, this requires substantial investment in plant and equipment and substantial energy use. As with heavy metals, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified organic contaminants of concern (e.g., cement stabilisation). Requires proof-of performance to ensure contaminant is effectively immobilised long-term, and would result in presence of additional materials on-site (e.g. concrete) that may not be appropriate for the sensitive land uses.	Not suitable options Not cost effective for the volume of material involved. Timeframes unsuitable given need to prove long-term stabilisation.
Option 2: Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.	Metals Metals are unable to be destroyed. However, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified inorganic contaminants of concern (e.g. cement stabilisation). PAHs PAHs present in site soils are typically restricted to heavier non-volatile constituents. These can be remediated by thermal processes. However, this requires substantial investment in plant and equipment and substantial energy use. As with heavy metals, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified organic contaminants of concern (e.g., cement stabilisation). There are no proximal licensed off-site treatment facilities.	Not a suitable option. Lack of off-site treatment facilities to perform the treatment cost-effectively. Energy / resource use associated with the transport and return of materials is not considered cost effective.
Option 3: Consolidation and isolation of the soil on-site by containment within a properly designed barrier.	Fill Materials Fill materials have been found to contain concentrations of compounds that are able to be readily managed at the site and which have been shown not to be leaching. On this basis, the impacted soils are suitable for retention on the site in areas where human/ecological exposures can be restricted. The redevelopment works are understood to require significant excavation and construction of underground multi-story sports facilities building where the sports field is currently located. Fill materials could be retained beneath the building and below capping soil layers in perimeter areas which would create a physical separation between the materials and site users, eliminating any exposure pathway. Underlying natural soils could be excavated to create a borrow pit for	Suitable option. **The preferred option.** Retention of the materials will reduce waste generation which is a preferred outcome consistent with waste reduction and environmentally sustainable development (ESD). Ongoing management may be required for impacted soils retained on site.

	containing impacted soils, potentially reducing offsite disposal costs for fill offset by export from site of VENM.	
Option 4: Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill	Fill Materials A surplus of soils is understood to be generated as part of the development. There are also suitably licensed waste facilities in the Sydney Metropolitan region capable of accepting the identified contaminants within fill materials. As such excavation and disposal of impacted soils to a suitably licensed facility is a suitable option where on-site containment is not feasible for all impacted materials identified.	Suitable option. Not preferred. Given the high costs associated with offsite disposal and noting the potential for impacted soils to be potentially retained at the site as per Option 3, this is not the preferred option, but could be suitable as a contingency where Option 3 is not able to be applied for all materials.

5.4 Proposed Remedial Approach

Potential remedial options have been outlined in **Table 5.1.** Based on assessment of those options, and consideration of the proposed redevelopment plans, the preferred remediation strategy for the site is:

- Consolidation and isolation of fill materials beneath the proposed multi-story sports facilities building and landscaped areas. Ongoing management may be required for retained impacted soils.

Given the volume of fill materials anticipated to be encountered at the site and noting the redevelopment will likely result in surplus excavated soils, it is acknowledged that it may not be practical to retain all impacted fill soils within the site. As such, remedial requirements for offsite disposal of fill materials including classification of various waste streams where applicable is included in sections following. Confirmation of the balance of fill materials for containment or offsite disposal will be confirmed subject to finalisation of development plans.

5.5 Regulatory and Planning Requirements

The following planning requirements for the proposed remedial works are presented.

Environment Planning and Assessment Act 1979/SEPP 55

With reference to Clause 9 of *State Environmental Planning Policy 55 – Remediation of Land* (SEPP 55), including consideration of State environmental planning policy and local government planning guidelines which identifies the site as an item of general heritage, the remediation works are classified as Category 1 Remediation Works and will require development consent under the *Environmental Planning and Assessment Act 1997*.

It is considered that the remedial works are ancillary to the proposed redevelopment works. As such, it is considered that consent for remediation works can be included in the same development application as the proposed redevelopment.

Notification of remediation works will be required to be given to council at least 30 days prior to commencement, and council requires notification within 30 days from completion of remediation works, consistent with SEPP 55 requirements.

Environment Planning and Assessment Regulation 2000 – Schedule 3 Designated Development

The proposed remediation works do not constitute designated development.

It is anticipated that the proposed remediation works will not incorporate any on-site treatment of soil. However, in the unlikely event that soil is required to be pre-treated prior to off-site disposal, an assessment of potential triggers for the works to be designated development as presented in Schedule 3 – Clause 15 will be required to be completed.

Protection of the Environment Operations Act 1997

The proposed remediation/validation activities are not required to be licensed under the Protection of the Environment Operation Act 1997 since the works do not involve:

- treat otherwise than by incineration and store more than 30 000 cubic metres of contaminated soil originating exclusively from the site, or
- disturb more than an aggregate area of 3 hectares of contaminated soil originating exclusively from the site.

Protection of the Environment Operations (Waste) Regulation 2014

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not require to be licensed.

Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

The proximity principle from POEO (2014) states that it is an offense for waste to be transported more than 150 km from its place of generation.

Waste Classification Guidelines (EPA 2014)

All wastes generated shall be assessed, classified and managed in accordance with this guideline, and the POEO (Waste) Regulations.

Waste Avoidance and Resource Recovery Act 2001

This RAP has been prepared with consideration to the Waste Avoidance and Resource Recovery Act 2001 (WARR 2001) hierarchy in regards to waste:

To ensure that resource management options are considered against hierarchy of the following order

(i) avoidance of unnecessary resource consumption,

(ii) resource recovery (including reuse, reprocessing, recycling and energy recovery),

(iii) disposal,

Work Health and Safety Act 2011 No 10 and Work Health and Safety Regulation 2017

The information and data provided in this RAP should be considered by the Principal/Remediation Contractor in preparation of its health and safety plans for the remedial works.

If asbestos is encountered as an unexpected find, the removal and disposal of asbestos will be managed in accordance with the WHS Act and WHS Regulation, *How to Safely Remove Asbestos: Code of Practice* (SafeWork NSW 2019), *How to Manage and Control Asbestos in the Workplace Code of Practice* (SafeWork NSW 2019), the NSW WorkCover *Managing Asbestos in or on Soil Guidelines*, the NSW EPA (2014) *Waste Classification Guidelines*, and requirements under the POEO (Waste) Regulation for asbestos waste monitoring.

In the event asbestos impacts are identified, a licensed asbestos removalist and SafeWork NSW notification regarding the scope of the removal works is required. If >10 m^2 non-friable (bonded) ACM is identified at the site, the appointed remediation contractor is required to obtain a site-specific permit approving the asbestos works from SafeWork NSW. A permit will not be granted without a current licence and the permit application must be made at least seven days before the work is due to commence. Removal of non-friable ACM (>10 m^2) is required to be conducted by a contractor holding at least a Class B licence. No friable ACM has been encountered at the site to date, as such asbestos-related works do not require a Class A licence unless friable asbestos is unexpectedly encountered.

5.6 Remedial Scope of Works

The proposed scope of remedial works includes management of contaminated soils via on-site management of the soil by physical separation, and ongoing management. Requirements for disposal of soils offsite is also included to allow for surplus soils where generated as part of the development.

5.6.1 Site establishment

All safety and environmental controls are to be implemented as the first stage of remediation works. These controls will include, but not be limited to:

- Locate and isolate all required utilities in the proximity of the works;
- Assess need for traffic and pedestrian controls;
- Work area security fencing;
- Site signage and contact numbers;
- Stabilised site entry gate;
- Sediment fencing (attached to security fencing); and
- Stormwater runoff sediment controls.

Environmental controls are outlined in **Section 8**.

5.6.2 Onsite Soils Management (Physical Separation Remedial Strategy)

The impacted soils on the site can be retained within the proposed site development with appropriate physical separation to remove exposure pathways, and subject to ongoing management controls where required.

The principle of the on-site management approach is to reduce waste disposal and better achieve ESD outcomes by retaining impacted fill materials ion site by providing physical separation between impacted fill/soil materials and receptors (e.g. site users). Based on provided development plans (**Appendix A**), permanent pavement at the base of the proposed sports facilities building can prevent direct contact (i.e. physical separation) to impacted soils provided they are placed beneath it. Adequate physical separation may also be possible in landscaped areas around the proposed building perimeters where adequate protective cover soil and other materials can be placed over impacted soils. The strategy may also require implementation of a long-term EMP to maintain the physical separation arrangements.

In order to achieve physical separation, the following procedure is required:

- Cover of fill materials by permanent paved areas (includes concrete, asphalt, pavers and synthetic grass areas) – installation of a marker layer underlying the depth of the pavement and overlying potentially contaminated material;
    - To allow for this containment approach, excavation of natural soils to create a borrow pit to place potentially impacted fill materials may be required, to reduce/offset disposal of surplus fill through export of excavated natural soils as VENM;
- Cover of fill materials by a minimum cover of non-impacted soil or other suitable material – installation of a marker layer over potentially contaminated material below the cover material;
    - Cover thickness may vary depending on landscaping requirements but should be a minimum of 0.3 to 0.5 m beneath grassed areas or low vegetation or 0.7 to 1.2 m for shrubs and trees depending on root depths;

- The marker layer shall consist of contrasting brightly-coloured (e.g. orange) geofabric of suitable tensile strength and durability to ensure it remains intact upon completion of development works and into the future.

Installation of physical separation arrangements shall be defined by survey as completed by a registered surveyor and/or building as-built drawings sufficient to identify:

- The lateral extent and upper depth height of known environmentally impacted materials (i.e. residual fill materials underlying the cover);
- The lateral extent and type of cover (e.g. permanent pavement, etc) within the remediation area; and
- Confirmation, by photos or otherwise, of the installation of the 'marker layer' underlying the cover (as required).

5.6.3 Excavation and Offsite Disposal of Fill Materials and VENM

It is anticipated that there will be significant excavation of site materials to enable construction of the proposed multi-story sports facilities building.

Where excavation of fill material is required and there is surplus material that is not able to be reused with a physical separation strategy as per **Section 5.6.2**, the material shall be disposed of off-site to an appropriately licensed facility. Following confirmation on the balance of materials proposed for reuse/physical separation and offsite disposal, a review of the existing data will be completed to identify whether a waste classification based on existing available data may be prepared for the material, or alternatively additional sampling and laboratory analysis will be implemented to appropriately characterise the material prior to off-site disposal.

Where VENM soils, which underlie fill materials, are excavated and require disposal offsite, they shall also require confirmation inspection by the environmental consultant to confirm the materials are consistent with definition of VENM as per the POEO Act. Additionally, sampling may be required if insufficient or no existing data is present so as the VENM status can be chemically confirmed and documented.

All materials requiring offsite disposal will require to be assessed in accordance with the *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA 2014) and be disposed at a facility lawfully able to accept such wastes, or assessed consistent with an appropriate general or site-specific waste resource recovery order/exemption where applicable.

The material will be excavated under the supervision of the Remediation Consultant with the material stockpiled on hardstand/durable plastic, placed in a skip bin or alternatively directly loaded onto a haulage vehicle for off-site disposal, to avoid cross-contamination with any underlying soil materials.

5.6.4 Validation

Validation of the remedial works will be conducted to demonstrate the remediation objectives have been achieved. Details of the validation program are provided in **Section 7**.

5.6.5 Offsite Disposal of Material

Any contaminated or other soils to be disposed off-site shall be assessed in accordance with **Section 5.6.3** and **7.3.1** with relevant waste classification provided by the environmental consultant.

5.6.6 Site Dis-establishment

On completion of the remediation works all plant/equipment and safety/environmental controls shall be removed from the site. Details are provided in **Section 8**.

6. Contingency Plan

A review of remediation works has been undertaken to identify potential risks to meeting the specified site validation criteria. A number of potential risks have been identified. These are listed following with contingencies that will be implemented to ensure that validation criteria are met.

Additionally, the associated remedial works health and environmental risks/hazards and their minimisation/mitigation are further discussed in **Sections 8** and **9**.

6.1 Unexpected Finds Protocol

It is acknowledged that previous investigations of the site have been undertaken to assess contaminants of potential concern. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations during remediation. The nature of any residual hazards which may be present at the site are generally detectable through visual or olfactory means, for example and shown in **Appendix B**:

- Bonded ACM or FA encountered outside the extent of known asbestos impacted fill materials;
- bottles / containers of chemicals (visible);
- construction / demolition waste (visible);
- substantial ash and/or slag contaminated soils / fill materials (visible);
- petroleum contaminated soils (staining / discolouration visible); and
- volatile organic compound contaminated soils (odorous).

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances be identified (or any other unexpected potentially hazardous substance), the procedure summarised in **Table 6.1** and detailed in the following sections is to be followed.

An enlarged version of the unexpected finds protocol, suitable for use on site, should be posted in the site Office and referred to during the Site Specific Induction by the Principal Contractor.

6.2 Contingency Scenarios

6.2.1 ACM present within Fill soils

Fill materials within the site are not considered to be contaminated with asbestos. However, noting that two fragments of non-friable ACM were identified and subsequently removed during the DSI works, site personnel will require to be made aware of the potential for ACM / asbestos impact to be present on the site. If unexpected asbestos is identified during works, the following should be considered.

Asbestos contaminated soil (if identified) necessitating management for potential asbestos exposure is defined in *Code of Practice: How to Manage and Control Asbestos in the Workplace*, August 2019, (SafeWork NSW 2019) as:

- Soil that contains visible asbestos as determined by a competent person; or
- Soil that contains asbestos fibres at quantities exceeding trace levels (considered to be the analytical detection limit in lieu of alternate guidance) as reported by analysis undertaken in accordance with AS4964:2004 *Method for the qualitative identification of asbestos in bulk samples*.

Environmental, health and safety management requirements for the handling of these materials will be based on the requirements provided for asbestos-related works in SafeWork NSW (2019). This

will include preparation of an asbestos register and associated asbestos removal control or management plan as outlined in SafeWork NSW (2019).

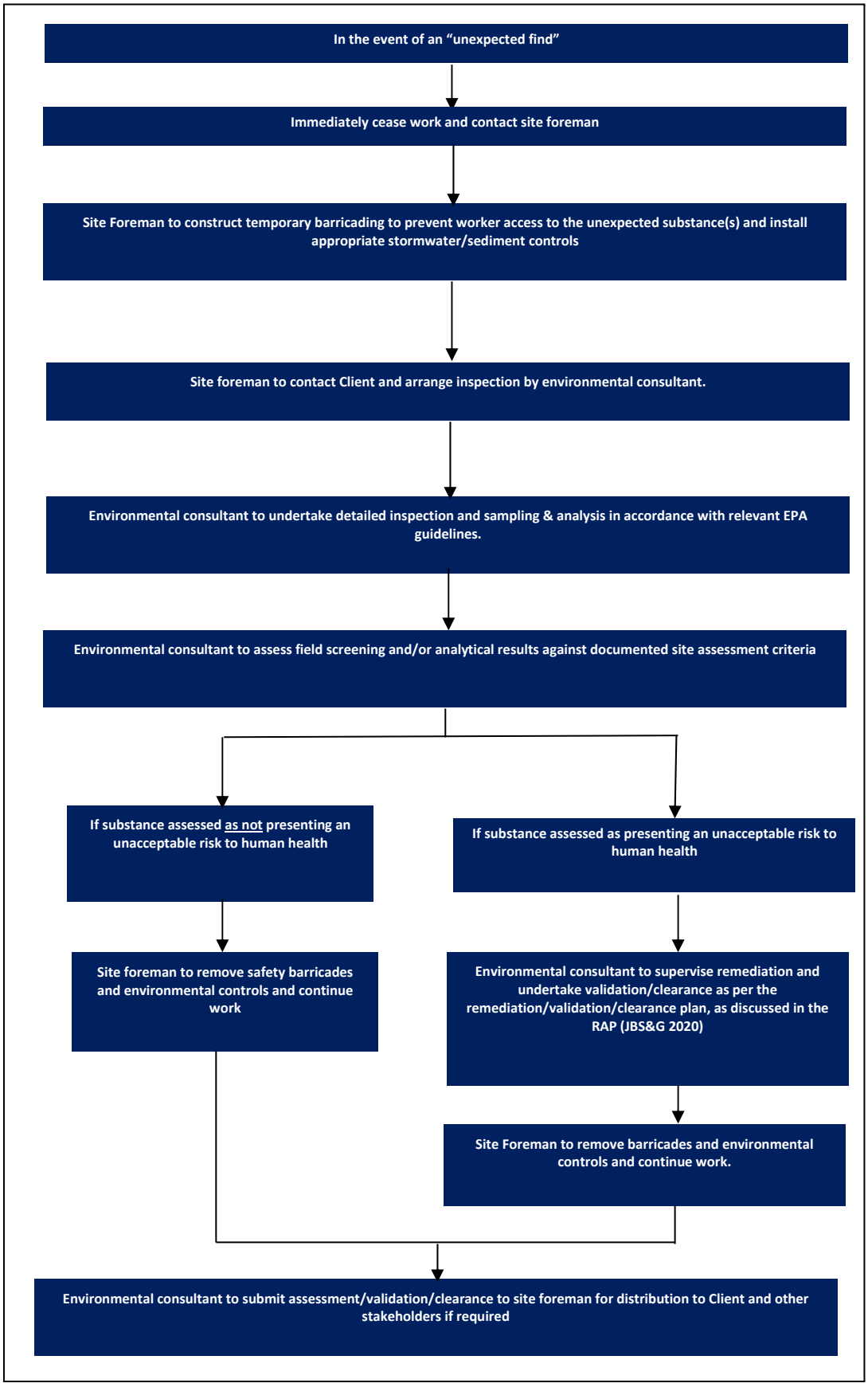
If areas of the site are unexpectedly found to be affected by asbestos impacted soils either as ACM and/or asbestos fines (AF) or fibrous asbestos (FA) at concentrations which exceed adopted Health Screening Levels (HSL A) criteria, these soils may be excavated and disposed to an appropriately licensed facility, or may be retained at the site and appropriately managed as part of the on-site containment strategy documented in **Section 5.6.2**, which is also appropriate for asbestos impacted soils. Should asbestos-impacted soils be retained at the site, the impacted materials will be retained beneath the marker-layer and capping, and may be subject to ongoing management, and the locations and extents of any identified impacts will be entered into an Asbestos Register.

6.2.2 Remedial Strategy Failure

In the event that the proposed remediation works do not meet the validation criteria, or if the selected remedial strategy is not able to proceed, the following actions will be considered to ensure firstly the safety and health of people and the environment and secondly that the overall project objectives are achieved.

1. Reassessment of remedial and validation options for the proposed development area.
2. Continued controlled excavation until validation is achieved.

Table 6.1 – Unexpected Finds Protocol



7. Validation Plan

7.1 Overview

Validation data is required to be collected to verify the effectiveness of the remedial works and document the final site conditions as being suitable for the proposed development.

The following sections establish the DQOs to be adopted during validation of the site remediation works.

7.2 State the Problem

The site has historically been used as a school with associated buildings, access roads/paths, gardens and sporting facilities. During various development and maintenance activities, fill materials of unknown source have been used in areas such as the sports field and the eastern garden embankments. Contaminant concentrations in fill within the eastern embankment and at the sports field at a depth of 1 m or more requires remediation so that the site can be considered suitable for use as a primary and secondary education facility. It is preferred these be managed by on-site containment below proposed structures and landscaped areas as part of redevelopment works, which will involve substantial excavation and soil management.

During remediation activities, sufficient validation of the site is required to demonstrate that the identified environmental and health-based risks to future user(s) of the site, as summarised in **Sections 4** and **5.2**, have been adequately managed to render the site suitable for the proposed land use.

7.2.1 Identify the Decision

The decisions which are required to be made for validation of the site are:

1. Have physical separation arrangement layers been installed appropriately and final placement verified in accordance with the RAP requirements?
2. Have materials removed from the site been appropriately classified in accordance with the EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* and/or other regulatory requirements and disposed of at facilities lawfully able to accept such waste?
3. Where unexpected finds are identified, has assessment of potential risks been undertaken in accordance with the RAP and any additional remediation and validation been completed in accordance with the RAP objectives?
4. Are imported soils environmentally suitable for their proposed use?
5. Is the site suitable for the proposed use, without ongoing management?

7.2.2 Identify Inputs to the Decision

Inputs to the decisions are:

- Detailed development plans to be provided by the client;
- Waste classification and/or material characterisation data obtained during assessment of fill materials/soils or natural materials/soils.
- Materials tracking records.
- Importation assessment criteria.
- Disposal dockets and relevant documents in relation to appropriate disposal of material to be removed from site/site as part of the remediation works (landfill dockets, beneficial reuse/recycling dockets).

- Survey data in areas of fill retention, marker layer installation (in areas not capped by a concrete slab and external to basement) to validate physical separation from site users to in-situ/retained fill.
- Data quality indicators as assessed by quality assurance/quality control (QA/QC).

Specifically, sufficient data needs to be collected from each of the identified potentially impacted media (e.g. fill material) across the site for associated COPC.

7.2.3 Define the Study Boundaries

The property is legally identified as Part Lot 67 Deposited Plan (DP) 2538 and Lots 1 to 7 and 9 to 12 of DP 1116858 and comprises an area of approximately 9,000 m^2. A plan showing the location of the site is provided as **Figure 1**, and a plan showing the boundaries of the site is provided as **Figure 2**.

The vertical extent of the works will be the maximum depth of excavation works required to facilitate the remediation and construction requirements of the site.

7.2.4 Develop a Decision Rule

Decision rules are provided following for each of the decisions:

- Decision 1: Have physical separation arrangement layers been installed appropriately and final placement verified in accordance with the RAP requirements?
    - Decision Rule: The marker layer must be installed to the RAP requirement. The vertical and lateral extents of the marker layer must be surveyed (**Section 5.6.2**), along with consistent and comprehensive photographic evidence.
    - Physical Separation arrangements are discussed in **Section 5.6.2**.
    - If the marker layer and physical separation arrangements have been installed with the requirements of the RAP, then the answer will be 'Yes'.
    - Otherwise, the decision will be 'No' and additional assessment and/or remediation is required to demonstrate the objectives of the RAP have been achieved.
- Decision 2: Have materials removed from the site been appropriately classified and disposed from the site in accordance with the *Waste Classification Guidelines, Part 1: Classifying Waste* and/or other regulatory guidance and disposed of at facilities lawfully able to accept such waste?
    - Decision Rule: If materials have been appropriately assessed and appropriate waste classification documentation provided, and waste disposal dockets show materials were disposed of at a facility lawfully able to accept such wastes, then the answer is 'Yes'.
    - Otherwise, the decision is 'No'.
- Decision 3: Where unexpected finds are identified, has assessment of potential risks been undertaken in accordance with the RAP and any additional remediation and validation been completed in accordance with the RAP objectives?
    - Decision Rule: If unexpected finds have been suitably characterised such that determinations on the required remediation/management can be undertaken, and remediation actions have included suitable validation such that the unexpected find does not inhibit the ability to draw conclusions regarding site suitability, then the answer is 'Yes'.
    - Otherwise, the decision is 'No'.
- Decision 4: Are imported soils environmentally suitable for their proposed use?

- Decision Rule: If imported soils are comprised of VENM or ENM or another suitable material covered by a NSW EPA Resource Recovery Order and Exemption, and used in accordance with the relevant exemptions, and analyte levels within the soils meet all the adopted human and ecological criteria (**Section 6.3**) for accessible soils on the site then the decision will be Yes.

  Otherwise the decision will be No.

- Decision 5: Based on the above decisions and an assessment of risk, is the site suitable for the proposed use without ongoing management?
  - Decision Rule: If the answer is yes, the site is suitable and ongoing management is not considered necessary.
  - Otherwise, the decision will be No and the requirements for further remediation of the site and / or implementation of ongoing management measures enforceable by an EMP will be require so that the answer to the decision can be Yes.

7.2.5 Specify Limits of Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013), appropriate indicators of data quality (DQIs used to assess QA/QC) and standard JBS&G procedures for field sampling and handling.

The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters), and are shown in **Table 7.2**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** - is the ability for laboratory methods to reliably measure and detect concentrations in the analytical process.

If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

Table 7.2 Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<50% RPD1
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD1
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes		-
Samples extracted and analysed within holding times.	-	organics (14 days), inorganics (6 months)
Trip spike (for volatiles)	1 per sampling event when sampling for volatile or semi-volatile COPC	70-130% recovery
Trip blank	1 per sampling event for ambient air sampling	<LOR
Rinsate	1 per sampling event where reusable sampling equipment used	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		
Satisfactory laboratory detection limits to identify potential contaminants of concern within the criteria values adopted	All samples	All samples

1. Relative per cent difference

7.2.6 Optimise the Design for Obtaining Data

The validation sampling design is summarised for each specific type of validation works as follows. The validation/characterisation sampling and analytical program for the site is outlined in **Table 7.2** below.

7.2.6.1 Installation of the Physical Barrier

Installation of physical separation arrangements shall be defined by survey as completed by a registered surveyor and/or building as-built drawings sufficient to identify:

- The lateral extent and upper boundary of known environmentally impacted materials (i.e. residual fill materials underlying the cover) within the remediation area;
- The lateral extent and type of cover (e.g. permanent pavement, soil thickness) within the remediation area;

- Survey of the marker layer and finished ground surface to allow for the assessment of capping layer depth. The survey plan shall show the extent of the capped fill materials and should also show the containment area in relation to the site; and
- Confirmation, by photos or otherwise, of the installation of the 'marker layer' underlying the cover (as required).

Physical separation arrangement requirements (i.e. thickness etc.) are detailed in **Section 5.6.2**.

7.2.6.2 Waste Classification

Materials sampled for waste classification in accordance with the *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA 2014) shall be sampled at an appropriate rate to characterise the materials prior to office-site disposal.

Table 7.2 Remediation and Validation Sample Plan

Item	Sampling Frequency			Analytes
	Excavation floors	Excavation walls	Materials	
Excavation formed by the removal of impacted soil	1 / 100 m^2	1 / 10 m (from each distinct horizon / material type / 1 m vertical soil profile)	N/A	PAHs Lead
Waste classification of material requiring off-site disposal, if required in lieu of existing characterisation data.	1 / 25m^3 with a minimum 3 samples per stockpile where <75m^3. Above 75m3, NEPC (2013) guidance applies.			Heavy metals TPH/BTEX PAHs OCPs/PCBs Asbestos TCLP
VENM for offsite disposal	If adequate documentation is available, then no sampling is required, beyond visual inspection by environmental consultant. In the event that no chemical data is available, samples at a ratio of one per 1,000 m^3 will be collected to a maximum of 10 samples.			Heavy metals TPH/BTEX PAHs OCPs/PCBs Asbestos

7.2.7 Soil Sampling Methodology

7.2.7.1 Sample Handling

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination shall be noted on field reporting sheets/field logs.

Collected soil samples shall be immediately transferred to sample containers of appropriate composition (glass jars) fitted with Teflon sealed lids. Where asbestos analysis is required samples shall be collected and placed in new 500 mL zip lock bags. Sample labels shall record sample identification number and date and time of sampling. Sample containers shall be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form shall be completed and forwarded with the samples to the testing laboratory, containing the following information:

- Sample identification;
- Signature of sampler;
- Date of collection;
- Type of sample;

- Number and type of container;
- Inclusive dates of possession; and
- Signature of receiver.

7.2.7.2 Field Duplicate and Triplicate Preparation

Field soil duplicate and triplicate samples for the validation assessment will be obtained during sampling using the procedures outlined above at a frequency of 1 in 20 primary samples for both field intra-laboratory duplicates and field inter-laboratory duplicates. The soil samples will be divided laterally into three samples with minimal disturbance to reduce the potential for loss of volatiles and placed in three clean glass jars and/or plastic bags. All jars will be filled with no headspace to reduce the potential for loss of volatiles and separately labelled as the primary, duplicate and triplicate samples before being placed in the same chilled esky for laboratory transport.

7.2.8 Laboratory Analysis

NATA accredited laboratories shall be used for all analysis of samples. Appropriate methods and LORs are required for comparison to relevant criteria.

7.3 Soil Validation Criteria

Based on the proposed land use and in accordance with the decision process for assessment of urban redevelopment sites (EPA 2017), concentrations in the soil will be compared against published levels as presented in **Table 7.2,** sourced from the following:

- Health based Investigation and Screening Levels for Residential with gardens and accessible soils land use which includes child care centres, preschools and primary schools – NEPM 2013, HIL A and HSL A;
- Health Screening Levels (HSLs) for vapour intrusion, coarse grained soil for residential use at 0-1 m depth; and
- Ecological Screening Levels (ESLs) and Ecological Investigation Levels (EILs) are not relevant for the proposed development.

Where there are no NSW EPA endorsed thresholds, the laboratory limit of detection has been adopted as an initial screening value for the purposes of this assessment.

Consideration is also given to aesthetic aspects, consistent with EPA (2017) and NEPC (2013) guidance.

Table 7.2 Health Based Soil Validation Criteria (all units mg/kg)

	Limit of Reporting	Laboratory Method	Health Investigation/ Screening Levels Residential A (includes primary schools)
METALS			
Arsenic	2.0	ICP-AES (USEPA 200.7)	100
Boron	10.0	ICP-AES (USEPA 200.7)	4500
Cadmium	0.4	ICP-AES (USEPA 200.7)	20
Chromium	5.0	ICP-AES (USEPA 200.7)	100[1]
Chromium (VI)	1.0	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)	100
Copper	5	ICP-AES (USEPA 200.7)	6,000
Nickel	5.0	ICP-AES (USEPA 200.7)	400
Lead	5.0	ICP-AES (USEPA 200.7)	300
Zinc	5.0	ICP-AES (USEPA 200.7)	7,400
Mercury (inorganic)	0.05	Cold Vapour ASS (USEPA 7471A)	40[2]

	Limit of Reporting	Laboratory Method	Health Investigation/ Screening Levels Residential A (includes primary schools)
POLYCYCLIC AROMATIC HYDROCARBONS			
Carcinogenic PAHs (as B(a)P TPE)[3]	0.028	GCMS (USEPA8270)	3
Naphthalene	0.1	GCMS (USEPA8270)	5[6]
Total PAHs[4]	0.4	GCMS (USEPA8270)	300
BTEX			
Benzene	1.0	Purge Trap-GCMS (USEPA8260)	0.7[6]
Toluene	1.0	Purge Trap-GCMS (USEPA8260)	480[6]
Ethylbenzene	1.0	Purge Trap-GCMS (USEPA8260)	NL[6]
Total Xylenes	3.0	Purge Trap-GCMS (USEPA8260)	110[6]
TOTAL RECOVERABLE HYDROCARBONS			
F1 C_6-C_{10}	10	TPH Purge Trap-GCMS (USEPA8260)	45[6,]
F2 >C_{10}-C_{16}	50	TPH Purge Trap-GCMS (USEPA8260)	110[6]
F3 >C_{16}-C_{34}	100	Purge Trap-GCFID (USEPA8000)	-
F4 >C_{34}-C_{40}	100	Purge Trap-GCFID (USEPA8000)	-
ORGANOCHLORINE PESTICIDES			
DDT + DDD + DDE	0.3	GCECD (USEPA8140,8080)	240
Aldrin + Dieldrin	0.2	GCECD (USEPA8140,8080)	6
Chlordane	0.1	GCECD (USEPA8140,8080)	50
Endosulfan	0.3	GCECD (USEPA8140,8080)	270
Endrin	0.1	GCECD (USEPA8140,8080)	10
Heptachlor	0.1	GCECD (USEPA8140,8080)	6
HCB	0.1	GCECD (USEPA8140,8080)	10
Methoxychlor	0.1	GCECD (USEPA8140,8080)	300
PHENOLS			
Phenol	5	Distillation-Colorimetric (APHA 5530)	3000
PCBs			
Total PCBs	0.7	GCECD (USEPA8140,8080)	1
Asbestos			
Asbestos (<0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	No asbestos capable of being detected via the investigation, which comprises both visual identification and sample analysis by a NATA accredited laboratory
Asbestos FA/AF (>0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	0.001%
Bonded ACM (>0.1 m)	0.1 g/kg	PLM / Dispersion Staining	0.01%
Asbestos Fibres	0.1 g/kg	PLM / Dispersion Staining	No respirable asbestos fibres of being detected via sample analysis by a NATA accredited laboratory

Notes:

1. Guideline values presented are for Chromium (VI) in absence of total Chromium values. Where total Chromium results are elevated, samples will be analysed for Chromium (VI).
2. Guideline values are for inorganic mercury. Where elevated mercury concentrations are encountered and/or site information suggests the potential presence of elemental mercury and/or methyl mercury, consideration of applicability would be needed.
3. Carcinogenic PAHs calculated as per Benzo(a)pyrene Toxicity Equivalent Factor requirements presented in NEPC 2013
4. Total PAHs calculated as per requirements presented in NEPC 2013.
6. Soil Health Screening Levels for Vapour Intrusion: Clay Soils. Values presented are those for 0 to <1 m bgs for residential land use. Reference should be made to results tables for further detail of levels at greater depths.

7.3.1 Offsite Disposal Criteria

Contaminated soils requiring disposal off-site shall be assessed in accordance with EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*. Including use of NSW EPA orders and exemptions such as 'The excavated natural material exemption' (EPA 2014[8]) if applicable.

7.3.2 Imported Soil Criteria

Importation of soil is not anticipated as part of the remediation works. However, if soils are imported it must be done in accordance with current EPA policy, only material that does not represent an environmental or health risk at the receiving site may be considered for resource recovery. In accordance with this, only VENM as defined in the POEO Act or any other suitable material granted an applicable EPA Exemption under the POEO (Waste) Regulation may be imported to reinstate remediation excavations.

7.3.3 Validation of Marker Layer and Physical Barrier

For impacted fill soils retained on site, validation of the marker layer and cover will be required to satisfy the requirements of **Section 5.6.2**, as summarised below:

- Cover of fill materials by marker layer and permanent pavement or suitable soil or other material in landscaped areas. Installation of the marker layer underlying the depth of the pavement and overlying potentially contaminated material. As-built survey of structures, landscaping and marker-layer placement is required to show lateral and vertical distribution;

7.3.4 Material Tracking

Soils/materials which are to be moved and placed at the site will be subject to the following data recording process for future reference purposes, and will be included in the Validation Report to be prepared following remediation:

- A location plan of the placed materials with co-ordinates based on an agreed grid system (e.g., GPS or relative to the lot boundaries);
- The levels in m AHD of the base of the placement location(s) prior to the material placement;
- The levels in m AHD of the placement locations once all materials have been placed;
- The levels in m AHD of any defining layers and capping layers; and
- Subsequently, the estimated total placed volume of materials.

7.4 Validation Reporting

At the completion of the remedial works a Validation Report will be prepared in general accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (EPA 2020), documenting the works as completed. This report will contain information including:

- Details of the remediation works conducted;
- Information demonstrating that the objectives of the RAP has been achieved, in particular the validation sample results and assessment of the data against both the pre-defined DQO and the remediation acceptance (validation) criteria;
- Information demonstrating compliance with appropriate regulations and guidelines;
- Any variations to the strategy undertaken during the implementation of the remedial works;

[8] *The excavated natural material exemption - Resource Recovery Exemption under Part 9 of the POEO Act*, NSW EPA (EPA 2014)

- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents; and
- Other information as appropriate, including requirements (if any) for ongoing monitoring / management.

The report will serve to document the remediation works for future reference.

7.5 Environmental Management Plan (if required)

The validation of the site as suitable for the proposed use may be contingent upon the implementation of an EMP to manage residual risks posed by potentially contaminated material to future site users.

Where required, the EMP shall contain the following elements:

- A statement of the objectives of the EMP – i.e., to ensure continued suitability of the site after it has been remediated;
- Identification of residual environmental contamination issues at the site that require ongoing management/monitoring to meet the EMP objectives, including the type of contamination and location within the site (including survey plans);
- Documentation of environmental management measures which have been implemented to address the identified environmental issues within the site;
- Description of management controls to limit the exposure of the site users to known areas of contamination to acceptable levels;
- Description of responsibilities for implementing various elements of the provisions contained in the EMP;
- Timeframes for implementing the various control/monitoring, etc. elements outlined in the EMP;
- Environmental monitoring and reporting requirements (if required) for the future management of environmental impact underlying the site;
- Corrective action procedures to be implemented where EMP assessment criteria are breached.

8. Remediation Site Management Plan

8.1 Hours of Operation

Remediation works shall only be permitted during the following hours:

- Monday to Friday: 7:00 am to 6:00 pm
- Saturdays: 7:00 am to 1:00 pm
- Sundays and Public Holidays: No work permitted.

Emergency work is permitted to be completed outside of these hours.

8.2 Soil and Water Management

All works shall be conducted in strict accordance with the soil and water management measures outlined in this section.

To prevent the migration of impacted soil/sediment off site, silt fences shall be constructed at the down-gradient works area, as per the specifications contained in *Managing Urban Stormwater – Soil and Construction Volume 1, 4th Edition,* NSW Government, March 2004. Any material which is collected behind the sediment controls shall be treated as potentially contaminated and will be suitably managed.

In a storm event, the sediment controls located on-site will need to be monitored and replaced or altered if necessary. Collected material will need to be suitably managed in accordance with remediation works.

8.2.1 Site Access

During remediation works, perimeter fencing will be maintained to restrict access to the works area. Only authorised persons will be able to enter the works area.

Vehicle access to the works area shall be stabilised to prevent the tracking of soil around the site and the adjoining driveway/access point to the road will be swept or cleaned on an as-needed basis. Any collected materials shall be treated as potentially contaminated and will be suitably managed.

Site specific worker requirements such as working with children checks will also be required.

8.2.2 Stockpiles

The following procedures will be implemented:

- No stockpiles or other materials shall be placed on footpaths or roadways and will be away from all stormwater infrastructure (including drainage lines, stormwater pits, gutters, etc) where possible. Where this is not possible, sediment controls will be placed over stormwater grates to prevent ingress of sediment to stormwater drainage lines.
- Stockpiles shall be formed with sediment control structures placed immediately down slope to protect other lands and waters from sediment pollution.
- All asbestos impacted soils will be covered with plastic.

8.2.3 Excavation Pump out

Excavation pump out water (if any) shall be pumped from the excavation by a licensed contractor and disposed of off-site as “liquid waste” in accordance with EPA (2014).

8.3 Noise

The remediation works shall comply with the NSW EPA’s *Environmental Noise Control Manual* for the control of noise from construction sites.

All machinery and equipment used on site will be in good working order and with the fitted with appropriate silencers when necessary.

8.4 Air Quality

8.4.1 Air Monitoring

If non-friable ACM is encountered during the works air monitoring may be required during removal subject to client preference. If friable asbestos is encountered air monitoring is mandatory during removal works.

If required, airborne asbestos fibre monitoring will be conducted in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC*) Asbestos Code of Practice and Guidance Notes*, in particular the Guidance note for the estimation of airborne asbestos dust [NOHSC 3002:2005]. The airborne asbestos fibres monitoring at a minimum of four static locations daily during remediation works that will disturb asbestos impacted or contaminated materials. Monitoring locations will include site perimeter locations and downwind locations. If friable asbestos is encountered, the monitoring is required to be conducted by a licensed asbestos assessor (LAA).

Air filters shall be analysed by a NATA accredited laboratory and results shall be required to be below 0.01 fibres/mL. All detections of fibres shall be further analysed by scanning electron microscope (SEM) to confirm the fibres are asbestos.

If respirable asbestos fibres are confirmed and present between 0.01 and 0.02 fibres/ml, the following controls must be implemented by the licensed asbestos removalist, in accordance with SafeWork NSW (2019);

- Review control measures;
- Investigate the cause; and
- Implement controls to eliminate or minimise exposure and prevent further release.

If respirable asbestos fibres are confirmed and present above 0.02 fibres/mL, the following controls must be implemented by the licensed asbestos removalist, in accordance with SWA 2011;

- Stop removal work;
- Notify SafeWork NSW by phone, then by fax or written statement that work has ceased;
- Investigate the cause;
- Implement controls to eliminate or minimise exposure and prevent further release; and
- Do not recommence removal work until further air monitoring is conducted and fibre levels are detected below 0.01 fibres/ml.

A daily report air monitoring report will be prepared documenting the previous/same days airborne asbestos fibre air monitoring results. This report will be made available to all relevant stakeholders and site workers.

8.4.2 Dust Control

During the remediation, dust levels will be monitored and minimised by using mist sprays as necessary. Dust shall also be controlled by ensuring vehicles leave via the designated (stabilised) site access point.

8.4.3 Odour

No odours should be detectable at the site boundary. Appropriate actions will be taken to reduce the odours, which may include: increasing the amount of covering of excavations / stockpiles; mist sprays; odour suppressants; or maintenance of equipment.

Records of volatile emissions and odours shall be kept by the remediation manager. Equipment and machinery will be adequately maintained to minimise exhaust emissions. No materials shall be burnt on the site.

8.5 Groundwater

No groundwater remediation or dewatering is proposed as part of the works. No approvals are required under the *Water Management Act 2000*.

Seepage water controls may be required to prevent shallow seepage water accumulation.

8.6 Material Transportation

The transporting contractor shall ensure there is no material tracked out onto the street and that the load is securely covered. In addition, all site vehicles must leave the site in a forward direction.

All appropriate road rules shall be observed and state roads will be selected as far as practicable over local roads when deciding on the transport route to the off-site material disposal location.

Where material is to be imported, controls are to be implemented to maintain separation between contaminated and non-contaminated materials.

8.7 Hazardous Materials

All hazardous and/or intractable wastes (if any) shall be removed and disposed of in accordance with the relevant regulatory requirements. In particular, any hazardous wastes will be transported by a licensed transporter.

8.8 Disposal of Contaminated Soil

All soil will be classified, managed and disposed in accordance with the *Waste Classification Guidelines Part 1: Classifying Waste* (EPA 2014), and POEO waste regulations.

8.9 Site Signage and Contact Numbers

Throughout the duration of the works appropriate signage shall be erected around the remediation area and stockpiles with the contact details of the remediation contractor and project manager.

8.10 Complaint Reporting and Resolution

Complaints from adjoining site occupants or workers on site will be directed initially to the civil/remediation contractor on site. Following that, discussion with the environmental consultant and the complainant will investigate the issue and remedy it as required or applicable.

9. Remediation Health and Safety Plan

This health and safety plan contains procedures and requirements that are to be implemented as a minimum during the remediation works.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the above works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards and mandatory safety practices and procedures; and
- Provision for contingencies that may arise while operations are being conducted at the site.

This health and safety plan does not provide safety information specific to construction or excavation activities carried out by contractors, such as the safe operation, maintenance and inspection of plant, etc. Contractors will be required to prepare their own Safe Work Method Statements for their work activities. All parties working on the site shall comply with all applicable Health and Safety legislation, regulations, codes and guidelines.

9.1 Responsibilities

Remediation Supervisor

The remediation supervisor is responsible for ensuring that the work is carried out in accordance with the health and safety plan. This will include:

- Ensuring a copy of the health and safety plan is available at the site during the remediation/validation activities;
- Confirming individuals are competent in performing allotted tasks;
- Liaison with the contractor representatives, as appropriate, regarding safety matters; and
- Investigation and reporting of incidents and accidents.

Other Members of the Site Workforce

Every individual worker is responsible for conducting their allocated tasks in a safe manner and in accordance with their training and experience. They must give due consideration to the safety of all others in their proximity and cooperate in matters of health and safety. All workers must leave their work areas in such a condition that the location will not be hazardous to others at any time.

9.2 Hazards

Job Risk Assessments (JRAs) and Safe Work Method Statements (SWMS) will need to be supplied by the Remediation Contractor and incorporated into the Health and Safety plan detailing all the known or potential hazards associated with the work activities some are listed below.

The known or potential hazards associated with the work activities are listed below:

- Physical hazards, including:

- work in or near excavations;
- operating machinery;
- heat stress and UV exposure;
- underground or overhead services;
- manual handling; and
- noise.

In the event of the discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, or of any new hazard that could potentially cause serious harm to personnel or the environment, work will be suspended until the Project Manager has been notified and appropriate instructions have been provided to field personnel.

9.2.1 Inhalation Hazards

The main inhalation hazards from the remediation/validation works are consequent of the presence of asbestos. Measures are required to be put in place to prevent/ minimise the generation of airborne fibres. These have been described in the environmental controls for the works. Where there is a potential for airborne emissions to be generated, PPE shall be required to be worn to prevent potential exposure, as described in **Section 9.3**.

9.2.2 Chemical Hazards

The main chemical hazards associated with the remediation/validation works are B(a)P impacted soils. When working with contaminated materials in general, care must be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption. PPE and decontamination requirements related to the remedial works are summarised in **Sections 9.3** and **9.5**.

9.2.3 Physical Hazards

Operating Machinery

Heavy plant and equipment operating in the vicinity of field personnel presents a risk of physical injury. Personnel should be cognisant of their position in relation to operating machinery at all times.

Never walk behind or to the side of any operating equipment without the operator's knowledge. Do not assume that the operator knows your position. Personnel should stay at least 1 m from the operational area of heavy equipment and should not stand directly below any load or piece of equipment (e.g. backhoes).

Work In or Near Excavations

All excavations shall be shored, sloped or otherwise constructed so as to minimise the potential for collapse. Appropriate physical barriers should be erected during and on completion of excavations to prevent any personal entering the excavation area.

Cuts and Abrasions

The manual work associated with the remediation works may give rise to the risk of cuts and abrasions to personnel working in the area. As well as the direct consequences of any cut or abrasion, such injuries can lead to the possibility of exposure to contaminants through the wound as well as diseases such as tetanus. To minimise the risk of direct or indirect injury, personnel will wear the personal protective equipment described in **Section 9.3**.

Heat Stress and UV Exposure

Site personnel may experience heat stress due to a combination of elevated ambient temperatures and the concurrent use of personal protection equipment; this depends in part on the type of work and the time of year.

In addition to heat stress, overexposure to UV radiation in sunlight can result in sunburn to exposed skin. The use of a high protection sunscreen (SPF15 or greater) on all exposed skin is recommended. Hats (including hard hats in specified areas) will also provide additional sun protection during the peak (i.e. 10:00 am to 3:00 PM) sun period. Sunglasses should be worn (where appropriate) to protect eyes from effects of UV exposure.

Underground Services

There is the potential for underground services (electricity, natural gas lines, water, telephone, sewer, and stormwater) to be present beneath the work area. The remediation contractor shall ensure that appropriate procedures will be taken to minimise the risk associated with excavation near services.

Aboveground Electrical Hazards

All electrical plant and equipment must comply with the requirements of Australian Standard AS 3000. Hand held portable tools shall comply with AS/NZS 3160 "hand-held portable electric tools" and shall be double insulated. Cord connected portable hand lamps shall comply with AS/NZS 3118. A Residual Current Device (RCD) shall protect plug-in portable equipment, which is connected to a supply above Extra Low Voltage - 12-24volts (including equipment supplied from a generator or welding set). RCD protection shall be provided during maintenance of portable electrical equipment at all times while the equipment is connected to a power supply above Extra Low Voltage, irrespective of whether power is switched ON or OFF. RCD's shall comply with AS 3190 and shall be type II units, rated to trip at or below 30 milliamps within 40 milliseconds.

No excavator, drill rig or crane may work within 6 m of overhead distribution power lines.

Manual Handling

When lifting or handling heavy objects, use correct lifting techniques, bending the knees not the back. If the item to be lifted is too heavy or awkward for one person to lift, seek assistance from other company employees or use mechanical help.

Noise

Long-term exposure to high levels of noise is unlikely. However, operating machinery may cause significant noise exposures for short periods. Earplugs or earmuffs should be worn in any situation where noise levels make normal conversation difficult.

9.3 Personal Protective Equipment

All workers who may come into direct contact with contaminated soil will wear the following personal protective equipment:

- Overalls or long sleeved collared shirt;
- Heavy duty outer gloves (eg. leather) where there is a risk of cuts or abrasions, otherwise PVC outer gloves if in direct contact with contaminated soil;
- Steel capped boots;
- Safety glasses;
- High visibility vest or jacket; and
- Hard hat.

9.3.1 Asbestos PPE

If asbestos is encountered during works, the following items of PPE are required in addition to any standard PPE required for the specific task, and applies for any ground workers within the asbestos work zone:

- Disposable coveralls must be worn (Type 5, Category 3 or better);
- Disposable gloves – non disposable gloves must be cleaned within the decontamination unit in accordance with SafeWork NSW (2019);
- P2 class respirator or higher – non disposable respirators must be cleaned in the decontamination unit in accordance with SafeWork NSW (2019); and
- Laceless steel capped rubber soled work shoes or gumboots.

Plant operators undertaking sub-surface intrusive works must close cabin doors and windows and set air conditioning to re circulate when operating within the asbestos work zone or wear PPE as listed above.

Further information on PPE requirements for asbestos removal works is provided in SafeWork NSW (2019).

The contractor shall supply and keep in good order, two complete sets of protective clothing and respirators for authorised inspection personnel. These will remain the property of the contractor at the end of the contract.

Employees must receive instruction in the correct method of using the respirator and on the importance of correct facial fit and maintenance. No person with a beard shall be allowed within the asbestos work area except using an approved positive pressure continuous airflow hood.

It is further noted that, as part of the SafeWork NSW permitting process, additional PPE may be required. If this occurs, then the above PPE requirements will be upgraded to reflect SafeWork NSW requirements.

9.4 Decontamination Procedures

The decontamination procedures specified below will be followed whenever personnel, plant or equipment leave the remedial area.

1. Wash boots in clean water
2. Remove outer gloves and dispose of appropriately;
3. Wash hands and face.

If any part of a worker's body comes into direct contact with any potentially contaminated material, the affected part(s) should be immediately washed with clean water.

Vehicle, Plant and Equipment

All equipment, including personal protective equipment, will be washed or otherwise cleaned to ensure that contaminated soil, water or dust is removed before it leaves the remediation area. All plant and equipment will have their outer bodies thoroughly cleaned of soil and sediment before moving off the site.

In the event asbestos contamination is identified, the following procedures will be required in addition to those mentioned above;

- Decontamination unit will be required to be set up at the entry/exit to the remedial works area;

- Disposable overalls, googles and respirator will be required for those working within the asbestos contaminated area, the overalls, googles and respirator to be disposed or decontaminated prior to exiting the decontamination station; and
- Equipment to be disposed of appropriately as asbestos waste when discarded.

9.5 Emergency Response

The remediation contractor will be responsible for preparing an emergency response plan, which will provide details on appropriate action and evacuation procedures in the event of an emergency.

In the event of an emergency arising on the site, appropriate action should be taken. Site evacuation procedures should be followed, as necessary.

In the event of an accident: evaluate the seriousness of the injury, and contact emergency services, if necessary; provide first aid, as appropriate, and if safe to do so evacuate the injured person via the Decontamination Zone; make the area as safe as possible without jeopardising safety.

If a serious accident occurs, do not disturb the scene, except to make safe and prevent further injury or damage, and keep all unauthorised people out, and report all accidents to the Project Manager.

10. Conclusions and Recommendations

Subject to the successful implementation of the measures detailed in this RAP and subject to the limitations in **Section 11**, it is considered the site can be made suitable for the proposed land use in accordance with the proposed development plan.

10.1 Recommendations

In addition to implementing the requirements of this RAP it is recommended that:

- Final design plans and construction requirements are consulted to verify the appropriate remedial strategies outlined in this RAP; and
- A remedial works plan is prepared to detail specific excavation, soils management and soil characterisation requirements to achieve the objectives of the RAP and to enable soils to be segregated on site as separate waste streams to achieve cost effective outcomes for offsite disposal.

Upon completion of the remediation works, a Validation Report is required to be prepared to verify remedial works were completed in accordance with the RAP.

11. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquiries.

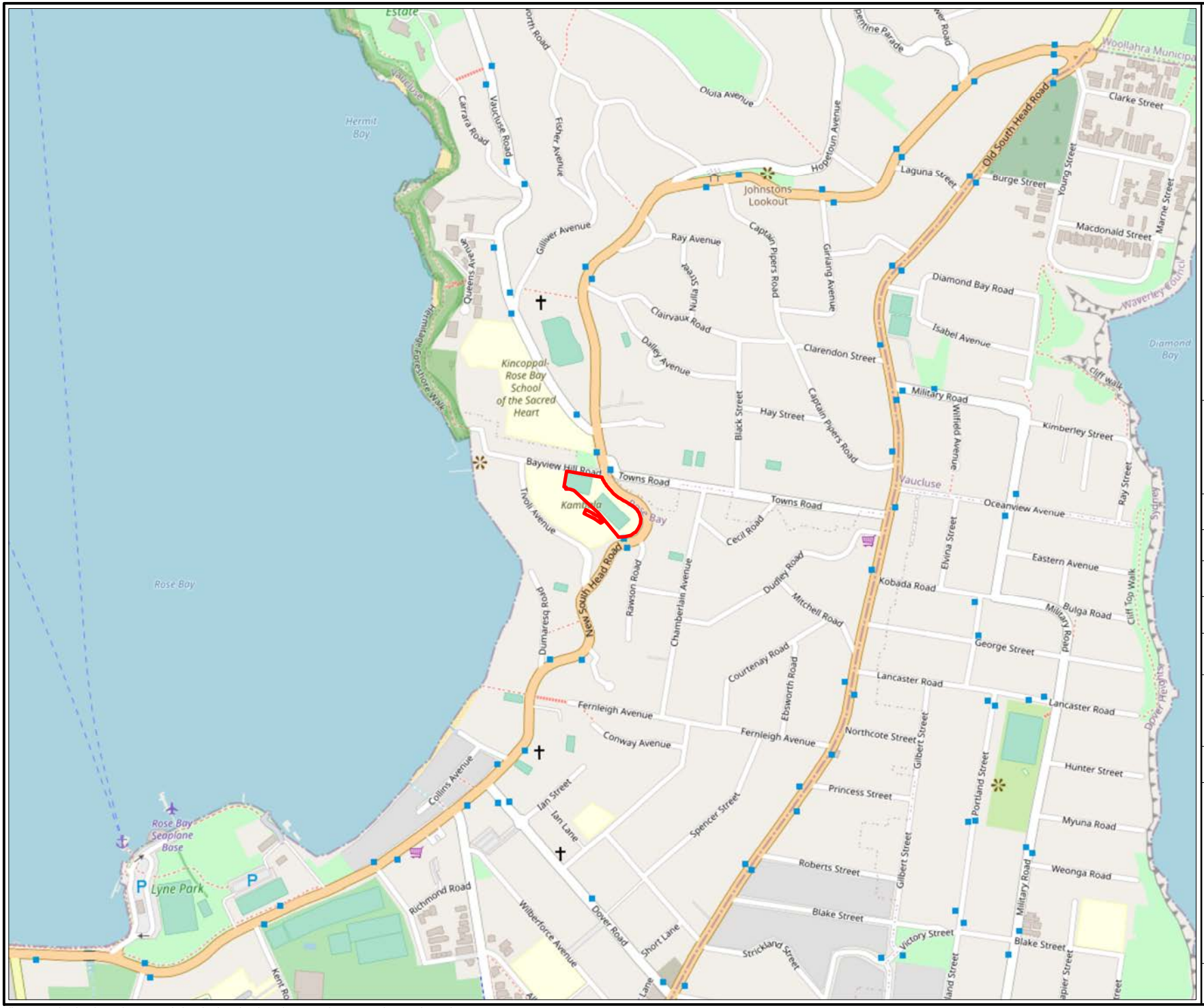
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Figures



Legend:
Approximate Site Boundary

JBS&G

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Client: CTPG	
Version: R04 Rev A	Date 30/06/2020
Drawn By: AS	Checked By: GB

Scale 1:10,000

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metres

Coord. Sys. GDA 1994 MGA Zone 56

Kambala
794 New South Head Rd,
Rose Bay NSW 2029

SITE LOCATION

FIGURE 1

File Name: N:\Projects\CTPG\58081 Kambala School ESA\GIS\Maps\R04 Rev A\58081_01_Site_Location.mxd

Legend:
- Approximate Site Boundary
- Approximate Diesel UST Location

JBS&G

Job No: 58081	
Client: CTPG	
Version: R04 Rev A	Date 30/06/2020
Drawn By: JA	Checked By: GB
Scale 1:1,000	

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metres

Coord. Sys. GDA 1994 MGA Zone 56

Kambala
794 New South Head Rd,
Rose Bay NSW 2029

SITE LAYOUT

FIGURE 2

File Name: N:\Projects\CTPG\58081 Kambala School ESA\GIS\Maps\R04 Rev A\58081_02_SiteLayout.mxd
Reference: Nearmap Imagery - 21-01-2020

Legend:

- Approximate Site Boundary
- Potential Remedial Area within the Sportsfield at a depth of 1m or more
- Remedial Area within Embankment

Sample Locations (JBS&G 2019)

- Borehole
- Hand Auger

Sample Locations (JBS&G 2020)

- Borehole
- Hand Auger
- Test Pit

JBS&G

Job No: 58081	
Client: CTPG	
Version: R04 Rev A	Date 9/07/2020
Drawn By: JA	Checked By: GB
Scale 1:1,000	

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metres

Coord. Sys. GDA 1994 MGA Zone 56

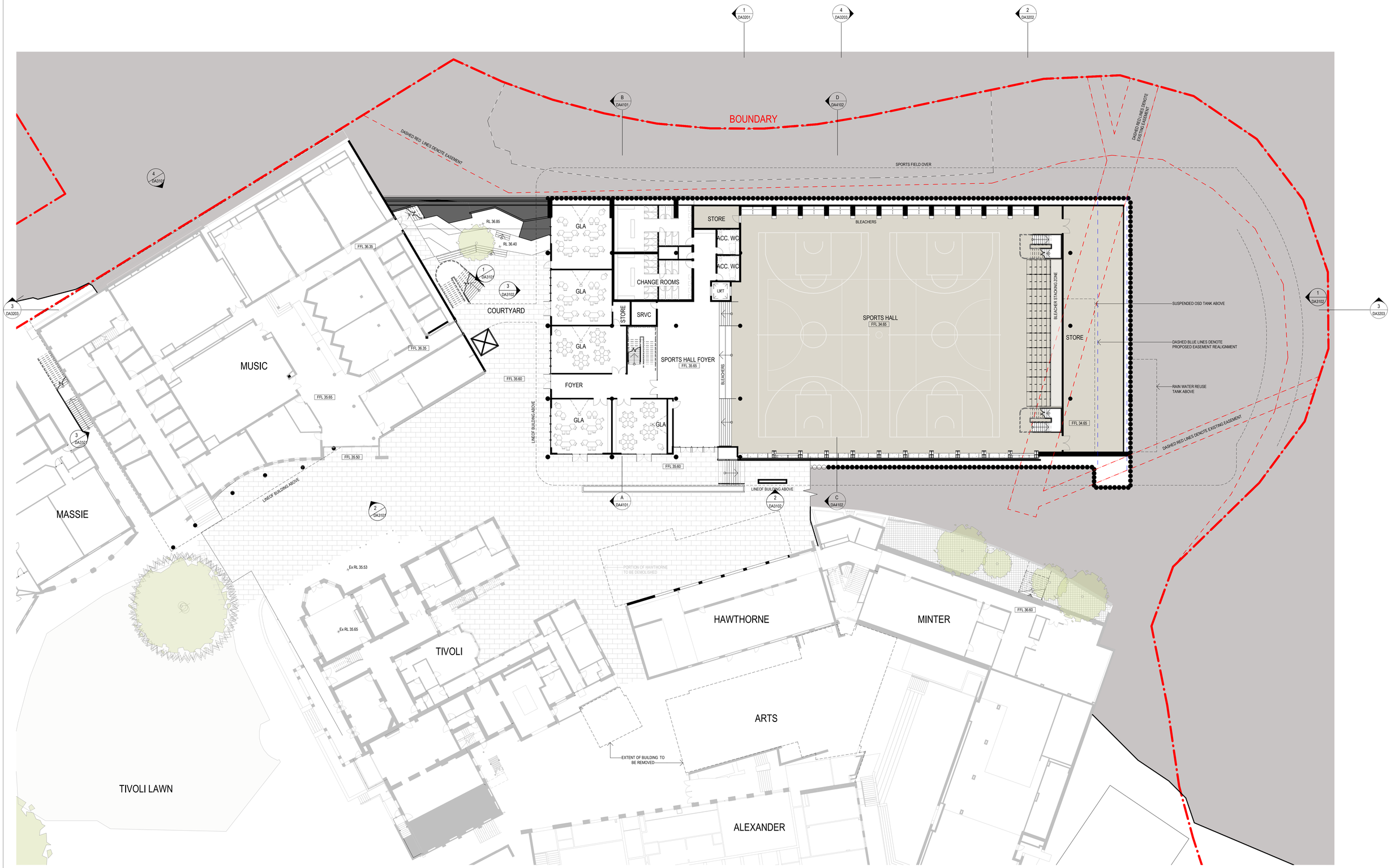
Kambala
794 New South Head Rd,
Rose Bay NSW 2029

REMEDIAL AREAS

FIGURE 3

File Name: N:\Projects\CTPG\58081 Kambala School ESA\GIS\Maps\R04 Rev A\58081_03_RemedialAreas.mxd
Reference: Nearmap Imagery - 21-01-2020

Appendix A Proposed Development Plan



Revisions			
No.	Date	Description	Ver App'd
1	13/05/2020	ISSUED TO CONSULTANTS FOR UPDATE	
2	15/05/2020	ISSUED TO RMS FOR UPDATE	
3	22/05/2020	ISSUED TO CONSULTANTS FOR UPDATE	

Key

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Project
KAMBALA SPORT, WELLBEING AND SENIOR LEARNING PRECINCT

794 NEW SOUTH HEAD ROAD
ROSE BAY NSW 2029

Proj. No. 18049

Drawing Title
LEVEL 1 PLAN

Project Status
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Issue: 3

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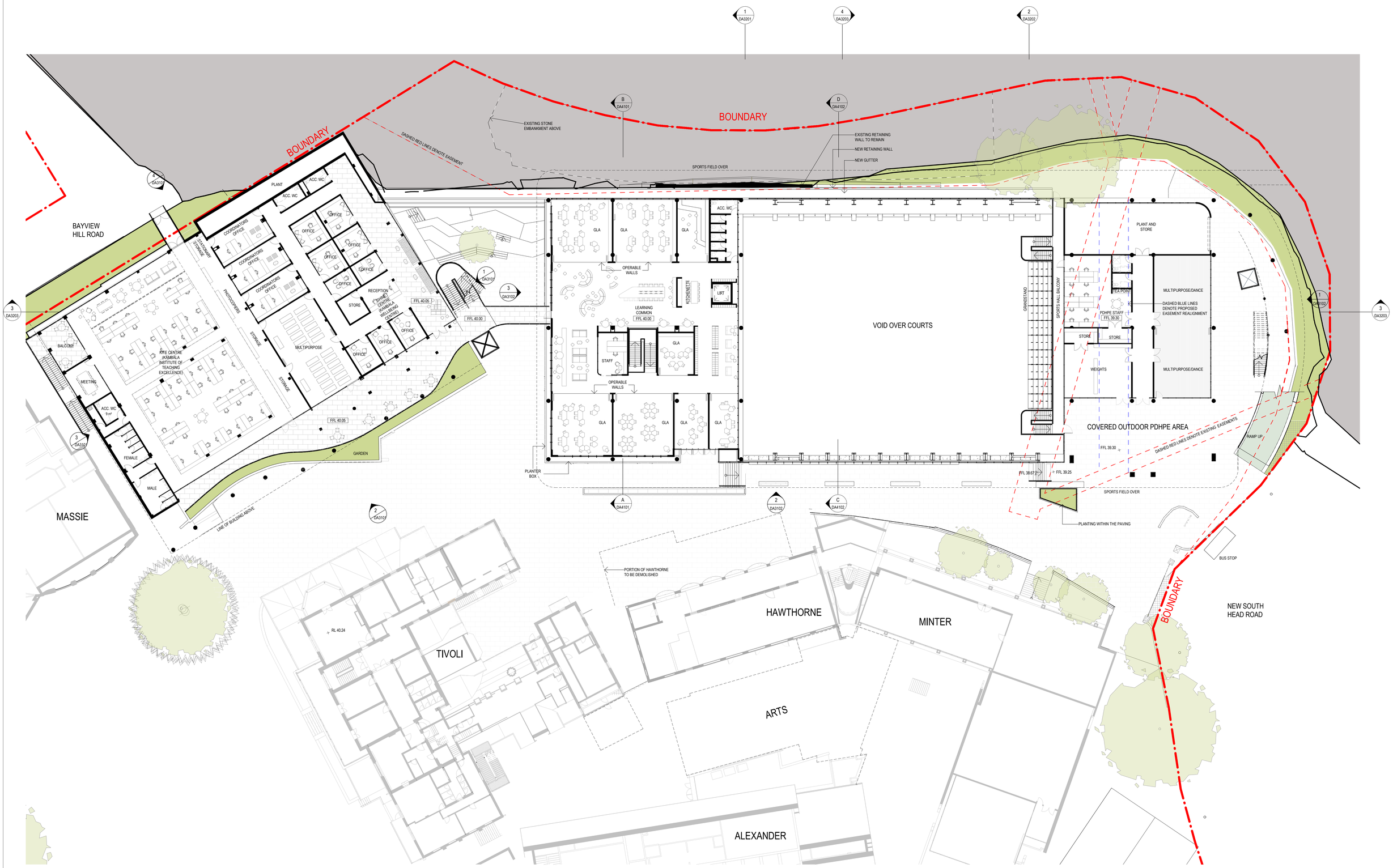

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Proj. No. 18049

Drawing Title
LEVEL 2 PLAN

Project Status
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Issue: 3

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Revisions

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3	22/05/2020	ISSUED TO CONSULTANTS FOR UPDATE		

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Proj. No. 18049

Drawing Title
LEVEL 3 PLAN
Project Status
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Issue: 3

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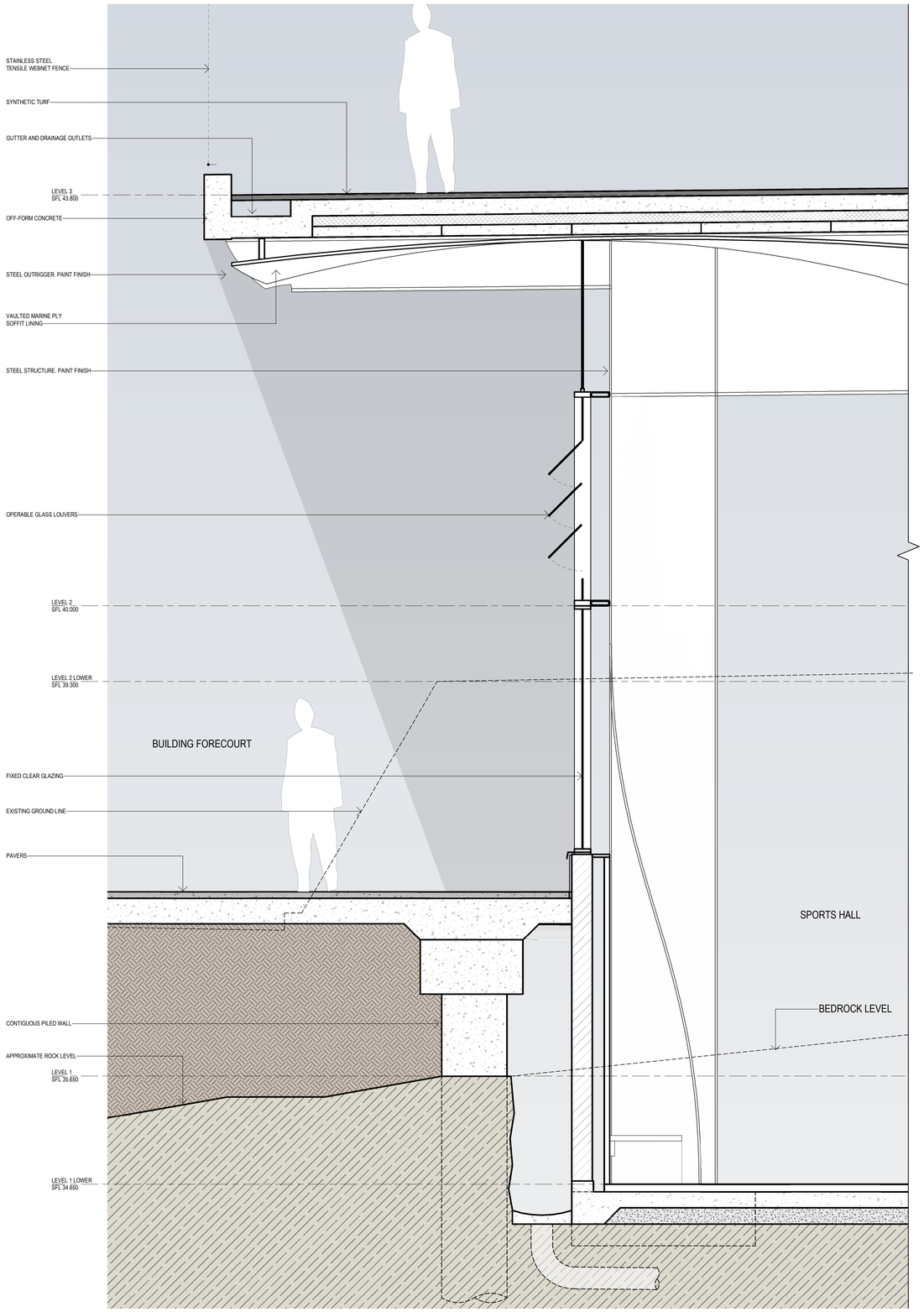

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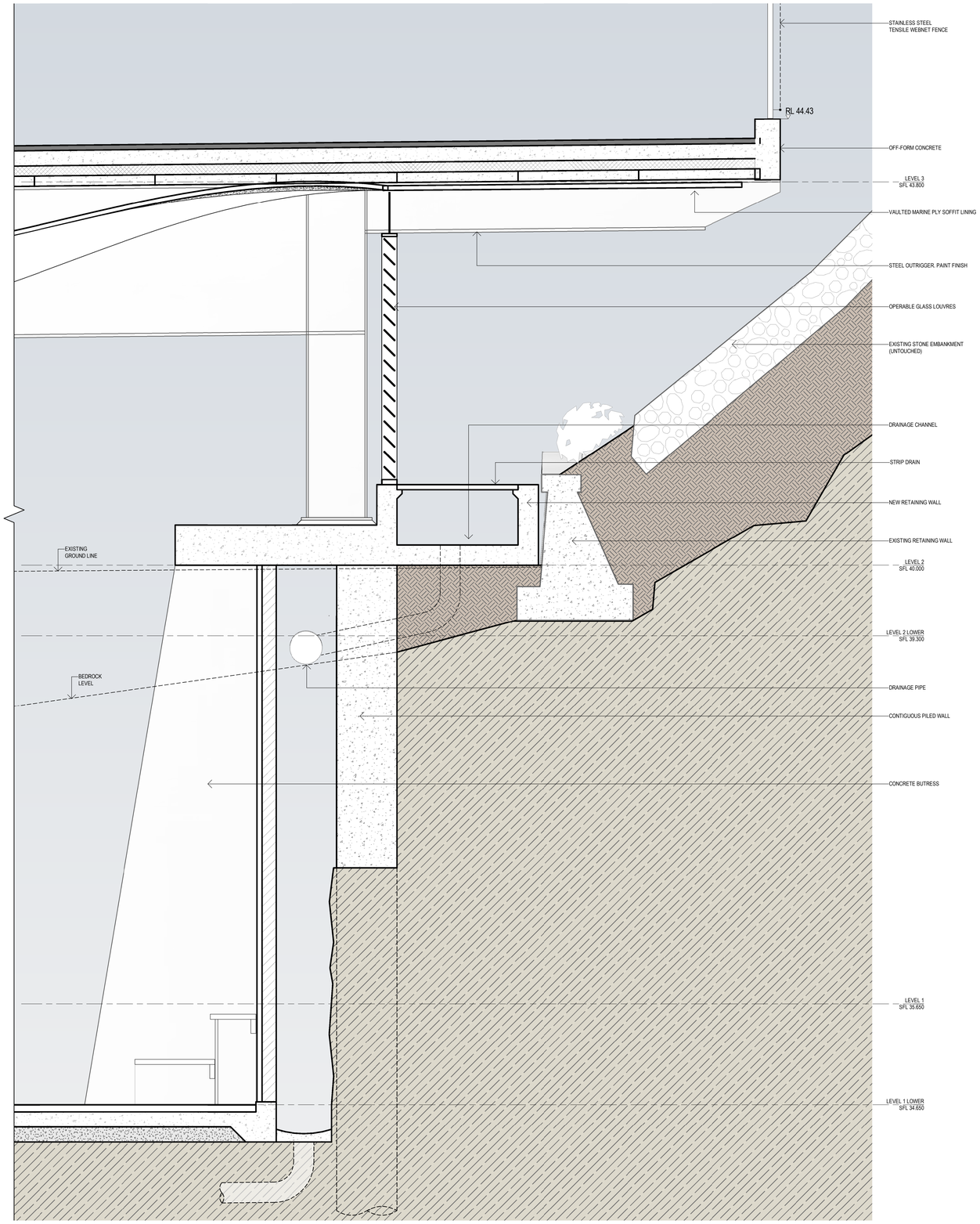

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Proj. No. 18049

Drawing Title
WALL SECTIONS - SHEET 2

Project Status
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Appendix B Unexpected Finds Protocol

Unexpected Finds

BE AWARE

UNEXPECTED HAZARDS MAY BE PRESENT

drums

asbestos

chemical bottles

staining

odour

ash / slag

demolition waste

if you <u>SEE</u> or <u>SMELL</u> anything unusual

<u>STOP WORK</u> & contact the Site Foreman

do not restart working before the area has been investigated and cleared by an Environmental Consultant

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Document Status

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		Name	Name	Signature	Date
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0	George Black	Matt Bennett	Matt Bennett		25/09/2020

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