Regional
EnviroScience
Hazardous Materials Laboratory and Consultancy

CONTAMINATED SOIL VALIDATION REPORT
STAGE 3 ENABLING WORKS
WAGGA WAGGA BASE HOSPITAL
260-280 Edward Street,
Wagga Wagga, NSW, 2650

Report No: 17910C02

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CONTAMINATED SOIL VALIDATION REPORT, STAGE 3 ENABLING WORKS – WAGGA WAGGA BASE HOSPITAL

January 2019

Report No: 17910C02

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EXECUTIVE SUMMARY

As part of the Wagga Wagga Base Hospital Redevelopment, Regional EnviroScience Pty Ltd was engaged by Richard Crookes Constructions to review the remediation works that have been undertaken. The objective of this validation report is to confirm that all contaminants that were identified have been successfully remediated so that the site is suitable for the proposed usage as a health care facility.

The consultants involved on the project and their responsibilities are listed below;

- Remedial Works Plan and Remediation Action Plan completed by JBS&G
- Destructive testing completed by Regional EnviroScience
- Removal of all asbestos containing materials, asbestos air monitoring and clearances completed by SERS & Demex Pty Ltd
- Overall site soil sampling (5m x 5m grid) validation sampling completed by Regional EnviroScience
- Data Gap analysis and sampling undertaken by Regional EnviroScience.
- This Validation Report which brings all the above scopes together in a unified and single clearance/validation document completed by Regional EnviroScience.

The initial assessment of the site by JBS&G and other consultants identified asbestos (non-friable and friable) both in the buildings and in the soils under the footprints of the buildings and in the soil surrounding the buildings planned to be demolished (Old Hospital Building, Robinson House, Built Structure Southern Portion Stage 3). Additional chemicals of concern were identified namely Lead and Benzo[a]pyrene.

JBS&G prepared a Remedial Works Plan (RWP - 19th October 2018) and a Remediation Action Plan (RAP - 9th May 2018), which detailed the methodologies to effectively demolish the super structures, remediate, appropriately classify and dispose of contaminated waste from demolition and excavation

activities. The reports also identified gaps in the assessment where further sampling and soil testing would be required due to access issues when the buildings were present during the initial assessment.

The site was remediated by completing data gap sampling, excavating and removing all contaminated material off site to an appropriately licenced landfill. Material around HA10 and HA24, sampling locations were contaminated with Lead and Benzo(a)pyrene. This material was classified as restricted waste and removed to the Elizabeth Road Landfill Facility in Kemps Creek. All material contaminated with friable asbestos was assumed to be special waste and removed from site to Windellmar Landfill, using appropriate waste tracking. Once this material was removed from site, additional excavated material was classified under the Excavated Natural Material Order 2014 and used at a site in Yarrangady. All other material remains on site.

In order to validate the site, gridded and judgemental soil sampling was undertaken over the footprint of the site for asbestos (+ 7mm and – 7mm fractions) and chemicals of concern including Lead and Benzo[a]pyrene. All samples were sent to National Australian Testing Authority (NATA) accredited laboratories. If laboratory analysis indicated elevated levels, further soil was excavated and the area re-sampled until levels were below the Health Investigation Levels (HILs) B, which is suitable for use as a health care facility. All air monitoring results provided were less than the limit of detection for this method of airborne asbestos testing and analysis.

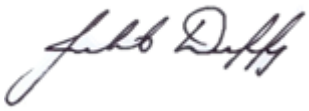
The data gap analysis was undertaken after the construction earthworks began, but no samples showed levels of the selected chemicals of concern.

As with all remediation sites it is highly probable that underground services (namely asbestos containing pipes and pits) may exist. There is always a risk that contaminated material may be encountered during future construction activities regardless of the level of sampling and due diligence applied. It is recommended that the Construction Environmental Management Plan (CEMP) addresses the process in case of unexpected finds of asbestos containing materials, general contamination, biological waste or underground tanks etc on site.

It is in the opinion of Regional EnviroScience that the site has been remediated, and that the site is now suitable for use as a health care facility.

In closing Regional EnviroScience would like to thank all participants in for their professional contribution and support during this valuable community project.

Reported By



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Director

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LIST OF APPENDICES

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1 INTRODUCTION

Regional EnviroScience Pty Ltd was engaged by Richard Crookes Constructions to undertake validation sampling for asbestos following building demolitions and removal of asbestos containing materials and soil from the site. The soil removal occurred at the Wagga Wagga Base Hospital NSW 2650. The remediation work was being undertaken, as part of the larger redevelopment, undertaken by Demex for Richard Crookes Constructions, at the Wagga Wagga Base Hospital location below (Figure 1), in accordance with the RAP. Upon completion of this work, Regional EnviroScience was asked to undertake a review of all remediation works undertaken on site and to provide a validation report for the works undertaken and complete this review accordance with the RAP.

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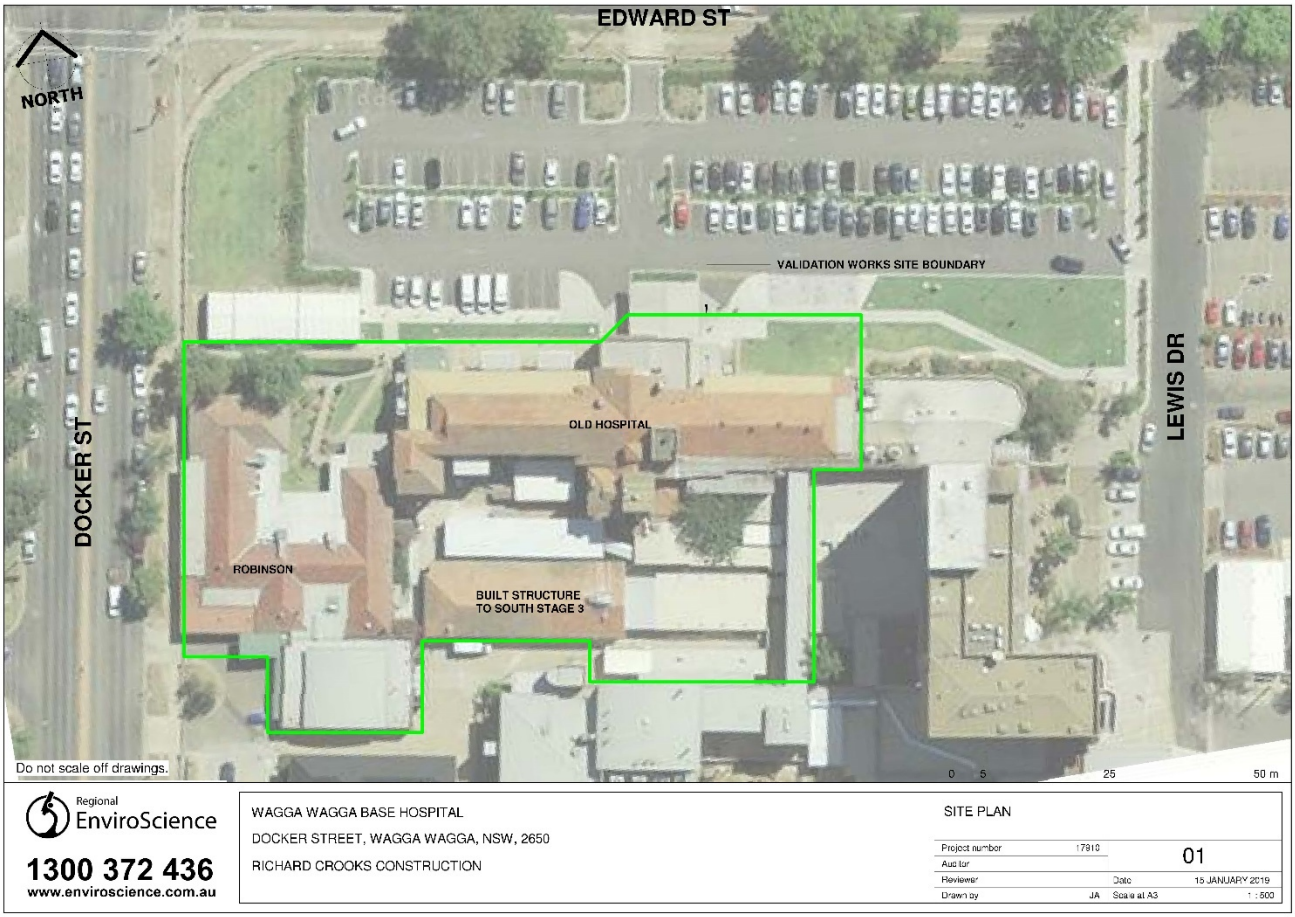

Figure 1: Location of Validation Site

1.1 BACKGROUND

The site has had multiple buildings demolished over time. New buildings were then constructed over the demolition sites, which had not been correctly remediated prior to construction. In addition, multiple renovations and maintenance activities occurred with asbestos containing materials. The remnants of the past activities relating to asbestos management have led to asbestos contamination in the soil. As part of the redevelopment, it is important that the site is correctly remediated prior to rebuilding on the site. It was identified in the provided HAZMAT registers that in one sub-floor section, the potentially asbestos contaminated soil had been capped and was contained under a concrete layer. During the site destructive testing another area was confirmed to also have asbestos contaminated soils in the subfloor area. This area was not capped as per the previous mentioned area.

1.2 OBJECTIVES AND SCOPE

The objectives for this work included:

- ✓ To obtain soil samples using appropriate sampling techniques for asbestos,
- ✓ To analyse the soil samples using appropriate analysis techniques for asbestos,
- ✓ To ensure the sampling undertaken meets the identified data quality objectives,
- ✓ To undertake works to complete the Data Gaps identified in the RAP for the site,
- ✓ Based on the soil sampling undertaken, validate that the remediation activities on site have removed asbestos contaminated soils,
- ✓ To ensure the area assessed met the requirements in the National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) for asbestos in a residential setting,
- ✓ that there were no residual human health risks from asbestos to site personnel undertaking the works,
- ✓ to ensure that the asbestos remediation undertaken is suitable for the proposed construction of new hospital infrastructure,
- ✓ to ensure that the remediation undertaken meet the remediation objectives, and
- ✓ to validate that the site is suitable for use as a Health Facility.

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1.3 SCOPE OF WORK

To achieve the aforementioned objectives this report documents the results of the validation sampling. The scope of work comprises:

- ✓ Description of the Site details,
- ✓ Description of validation sampling methodology for asbestos,
- ✓ Soil sampling to complete the Data Gaps identified in the RAP for the site,
- ✓ Undertake soil sampling and analysis for asbestos,
- ✓ Description of validation assessment criteria for asbestos,
- ✓ Assessment of soil results,
- ✓ Data Quality Assessment for the work undertaken,
- ✓ Review and collation of the validation testing undertaken
- ✓ Assessment of the validation testing against the remediation options outlined in the RAP, and
- ✓ Recommendations for further work or management of any contamination on site.

2 SITE INFORMATION

The following sections provide available site information relating to the proposed hospital development including the locations where the clean-up activities were undertaken.

2.1 SITE DETAILS

The hospital development details comprise the following:

Site Owner: NSW Department of Health;

Address: 260-280 Edward Street, Wagga Wagga NSW 2650

Real Property Description: Lot 334, SP1190643;

Planned land use: Hospital Development

LGA: City of Wagga Wagga;

Managing Authority: Health Infrastructure.

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2.2 SITE HISTORY

The nature of the site's history includes multiple buildings, some of which had been previously demolished, then had new buildings constructed over the top of the past demolition sites, which were not correctly remediated at the time.

The JBS&G RWP and RAP for Stage 3 of the Wagga Wagga Rural Referral Hospital outlines the site history. The site was first used as a hospital in 1910. In 1922, the first children's ward was established. In 1944, the site consisted of a complex of buildings, predominately in the northern portion of the hospital block, with landscaped lawns and tennis courts. Some of the buildings present at this time are consistent with the buildings existing prior to the stage 3 works. There is some disturbance outside of the stage 3 area which suggests buildings had been demolished or that building was to commence. In 1948 building commenced on a two storey domestic brick block for nurses, named Lewis house. Building was completed in 1952.

Site assessments began on the site in 2014 by Douglas Partners, with further investigations undertaken by JBS&G in 2017.

The *Health Infrastructure NSW, Wagga Wagga Rural Referral Hospital, Redevelopment Project Remedial Action Plan, Report 54397/114204-Revision 3*, (JSB&G RAP) undertaken by JSB&G in May 2018 outlines the key findings of the above reports. The identified the following potential contamination:

- Friable asbestos and asbestos fines (FA/AF) impacted soils in the sub floor area of the eastern portion of the Old Hospital Footprint,
- elevated lead and carcinogenic PAHs as Benzo(a)pyrene toxicity equivalent quotient (BaP TEQ) that exceed HIL-B thresholds in the area near sample HA 10 and to the southern face of the Old Hospital Building,
- FA/AF impacted soils in the western portion of the Old Hospital subfloor, suspected non friable asbestos containing materials (ACM) debris to ground surface in sub floor areas of the Old Hospital
- encapsulated FA/AF impacted soils in the south eastern corner of Robinson House,
- potential asbestos containing shotcrete beneath Robinson House,
- elevated levels of carcinogenic PAH as BaP TEQ at sampling point 24, and
- elevated levels of dieldrin and chlordane in samples HA 30 and HA 31.

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The JSB&G RAP identified the footprints of the Robinson building and the old hospital buildings as being potentially impacted by friable asbestos. The JBS&G RAP also identified data gaps, data quality objectives and remediation options for the site.

Regional EnviroScience was engaged to complete this sampling for validating whether asbestos materials had been successfully and safely remediated at the completion of works. Sample material was taken at each node location of this gridded area. Regional EnviroScience was then engaged to undertake a review of the remediation and validation works undertaken on the site and completion of the data gap assessment.

2.3 NEIGHBOURING LANDUSES

Land uses in the vicinity of the Site can be described as follows:

The land directly surrounding the worksite is hospital grounds with residential properties around the border of hospital grounds.

2.4 PROPOSED LANDUSE

New Hospital infrastructure is proposed for the site once the site has been remediated.

2.5 SOIL ASSESSMENT CRITERIA

For the purpose of validating the excavation of asbestos-contaminated soil and to consider whether asbestos impacts remain within the residual soil in the cleaned-up area, assessment criteria from the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (DoH, 2009) have been adopted.

The RAP for the site has identified HIL-B as an appropriate remediation level and setting for the site to continue use as a health care facility. As such, where soil identified as contaminated with Lead was removed from site, the acceptable validation level for these samples was HIL-B, below 1,200mg/kg.

For soils contaminated with B(a)P, the RAP identifies a concentration of 4.0mg/kg, also adopted from HIL-B settings.

Validation of the soils for Lead and B(a)P were below the selected remediation criteria.

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For soil samples collected as part of the Data Gap Analysis and analysed for Heavy Metals, Total Recoverable Hydrocarbons, Benzene, Toluene, Ethylbenzene and Xylenes, Polycyclic Aromatic Hydrocarbons, Organochlorine and Organophosphorus Pesticides, Polychlorinated Biphenyls and Asbestos, the HIL-B setting was also selected where appropriate. Where HIL-B does not apply, the Health Screening Level A & B (HSL A and HSL B) for Low-High Density Residential setting was selected, with soil type set to clay based on previous investigations undertaken on the site. Where neither the HIL-B or HSL apply, the Ecological Screening Levels (ESL) in an Urban Residential and public space setting for clay were adopted. If a sample was found above the selected limits further investigation would be required.

The selected limits for each analyte are published in the table below.

Potential Chemical of Concern	Source	Published Limit
As	HIL-B	500
Cd	HIL-B	150
Cr (VI)	HIL-B	500
Cu	HIL-B	30 000
Pb	HIL-B	1200
Hg (inorganic)	HIL-B	120
Ni	HIL-B	1200
Zn	HIL-B	60 000
Carcinogenic PAHs (as BaP TEQ)	HIL-B	4
Total PAH	HIL-B	400
DDT +DDE +DDD	HIL-B	600
Aldrin + Dieldrin	HIL-B	10
Chlordane	HIL-B	90
Endosulfan	HIL-B	400
Endrin	HIL-B	20
Heptachlor	HIL-B	10
HCB	HIL-B	15
Methoxychlor	HIL-B	500
Mirex	HIL-B	20
Chlorpyrifos	HIL-B	340
PCBs	HIL-B	1

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Potential Chemical of Concern	Source	Published Limit
Benzene	HSL-A & HSL-B Low – High Density residential - clay	0.7
Toluene	HSL-A & HSL-B Low – High Density residential - clay	480
Ethylbenzene	ESL- Urban residential/ Public Open Spaces- Fine	65
Xylenes	HSL-A & HSL-B Low – High Density residential - clay	110
F1 C_6-C_{10}	HSL-A & HSL-B Low – High Density residential - clay	50
F2 >C_{10}-C_{16}	HSL-A & HSL-B Low – High Density residential - clay	280
F3 >C_{16}-C_{34}	ESL- Urban residential/ Public Open Spaces- Fine	1300
F4 >C_{34}-C_{40}	ESL- Urban residential/ Public Open Spaces- Fine	5600
Bonded Asbestos	Health Screening Level (w/w) – recreational	0.04%
FA and AF (friable) asbestos	Health Screening Level (w/w) – recreational	0.001%
All forms of asbestos	Health Screening Level (w/w) – recreational	No visible asbestos for surface soil

2.6 REMEDIATION INVESTIGATIONS

Several remediation investigations have been undertaken on the site. The remediation timeline, including remediation actions and validation sampling is outlined in the table below.

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Date	Action	Comments
19th October 2017	JBSG – Remedial Work Plan	Sample HA 1 to HA 14 collected in June 2017. HA 10 elevated lead and B(a)P. HA 14 friable asbestos detected. Assumed all subfloors under shotcrete contained friable asbestos. Samples HA15-HA40 collected in September 2017. HA 38 friable asbestos (FA)/asbestos fines (AF) impacted soils located in western portion of the Old Hosptial Sub floor area. Suspected non-friable asbestos containing materials as fibre cement debris was observed to ground surfaces in sub floor area of Old Hospital Building. HA31 FA/AF impacted soils in external south eastern corner of Robinson House. Potential Shotcrete surfaces observed beneath Robinson House. HA 24 showed elevated levels of carcinogenic PAHs (as BaP TEQ) equal to the HIL-B threshold of 4mg/kg. HA30 and HA31 showed elevated levels of dieldrin and chlordane, although below the HIL-B thresholds.
24th April to 8th May 2018	SERS Subfloor assessment Robinson House	Assessment in Appendix 1

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9th May 2018	Remedial Action Plan - JBSG stage 3 (rev 3)	Details data gaps for site, remediation approach and data quality objectives.
11th May 2018	SERs Clearance of Robinson House, Subfloor friable, soil to depth approx. 200mm	Included in Appendix 2
June 2018	Asbestos containing soil, excavated and received at licensed landfill	Waste tracking documents in Appendix 3
18th June 2018	SERs Correspondence to Demex process to remove soil from footprint of buildings and disposed of Asbestos Contaminated Waste	See Appendix 4
Date	**Action**	**Comments**
27th June 2018	SERs validation sampling in the Old Hospital Building for asbestos	See Appendix 5 12 soil test pits and surface soil testing undertaken with a visual inspection. No asbestos detected. Fill locations identified. Depth of fill not noted.
9th July 2018	SERs – Validation for lead and B(a)P. 11 primary soil samples, 3 waste samples	See Appendix 6

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17th July 2018	SERs – Additional excavation, 3 waste samples	See Appendix 6
18th July 2018	34.684t of special waste at disposed of at the Elizabeth Drive landfill, Kemps Creek	See Appendix 6
March - July 2018	Regional EnviroScience Asbestos soil testing.	See Section 7.1 for details on testing and remediation works. Laboratory certificates included in Appendix 7 5x5m grid samples across site. Site validated as clear of asbestos in July 2018.
1st August 2018	Post Validation Construction works begun	. Excavations across Old Hospital Footprint and Robinson House footprint undertaken. Soil stockpiles created on site.

Date	Action	Comments
15th August 2018	Stockpile sampling for Excavated Natural Materials Order 2014 and Waste Classification undertaken by Regional EnviroScience. 3 stockpile samples from Yarragundy,	Reported as Regional EnviroScience Report Wagga Wagga Base Hospital – Stockpile Investigation, September 2018 Report No 19482R01, included in Appendix 8 All samples analysed in accordance with the ENM Order 2014 Mercury, Cadmium, Lead, Arsenic, Chromium (total), Copper, Nickel, Zinc, Electrical Conductivity, pH, Total Polycyclic Aromatic

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	8 samples of natural earth from Old Hospital Building excavated footprint 7 samples from stockpiled material to the south of the site.	Hydrocarbons (PAHs), Benzo(a)pyrene Benzene, Toluene, Ethyl-benzene, Xylene, Total Petroleum Hydrocarbons C10-C36, Rubber, plastic, bitumen, paper, cloth, paint and wood
20th September 2018	Benzo A Pyrene, Soil remediation SERs – Validation and Waste Classification	See Appendix 6 Validation report.

Date	Action	Comments
29th October 2018	Soil sampling in footprint of Robinson house and built structure. Further analysis of soil samples from Old Hospital Building excavation footprint for Organochlorine &	Figure 2 shows the locations of sampling. Soil samples tested for Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH) Benzene, Toluene, Ethylbenzene and Xylenes (BTEX)

	Organophosphorus Pesticides (OCP & OPP), Polychlorinated Biphenyls (PCBs)	Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP) Polychlorinated Biphenyls (PCBs) See section 7.2 for details of sampling. Certificates of Analysis are included in Appendix 9
17th December, 2018	Soil sampling in South Eastern corner of the site.	Figure 2 shows the location of sampling. See section 8 for details of sampling. Certificates of Analysis included in Appendix 9. Analysis for Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP), Polychlorinated Biphenyls (PCBs), and Asbestos (500ml)

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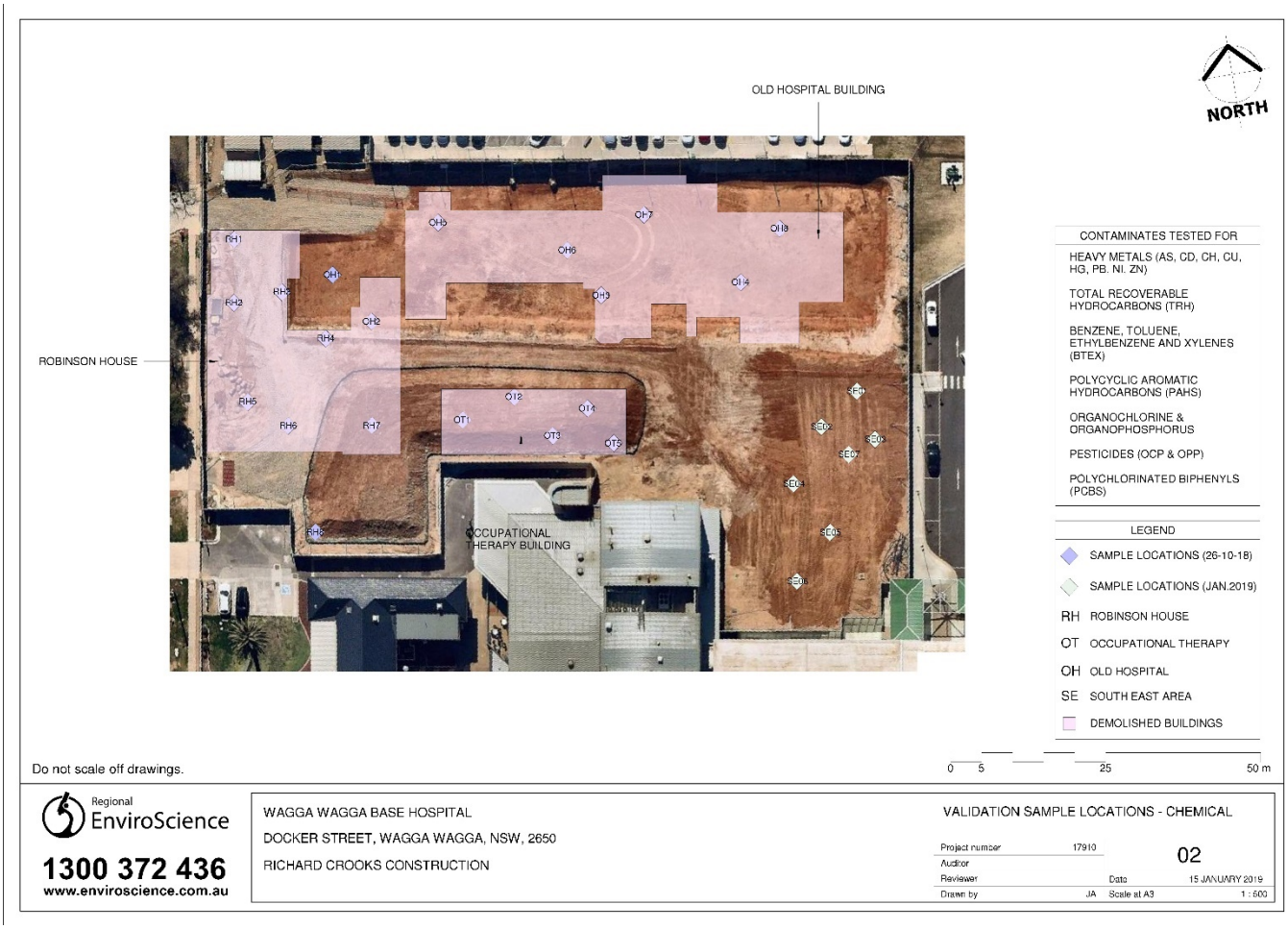

Figure 2: Building Footprint Validation sampling.

3 REMEDIATION AND VALIDTION WORKS

Validation testing had been undertaken across an area beyond the areas identified by the JBS&G RAP for asbestos. Regional EnviroScience was engaged to validate the remediated areas for asbestos upon completion of the remediation activities. Minor sections of the soil sampling was undertaken by SERs all methodologies and processes were discussed and agreed between SERs and Regional EnviroScience.

SERS report 154940_LR_CP_1942018, included in Appendix 1 for Robinson House identifies unknown asbestos containing material within the subfloor. The report makes the primary recommendation that the area is removed in its entirety as asbestos containing material and the removal of the top 200mm of soil should be considered for disposal as asbestos containing waste. SERS letter to DEMEX dated 18th June 2018, included in Appendix 4 proposes a site scrape and to dispose of the contents as Asbestos Contaminated Material due to the presence of bulk Asbestos cement packers, residue from a historical uncontrolled pipe lagging removal and miscellaneous vinyl in the soils within the former building footprint. It was further recommended that the all previously imported soils be assessed or directly exported as asbestos contaminated waste down to the base of the footing level and that the area be mechanically scraped back 200mm and the material either stockpiled for classification or loaded directly for disposal as Asbestos contaminated waste.

At the completion and removal of concrete layers where present and minimum 200mm of soil been excavated from under the building footprints, a visual inspection was undertaken by a licensed asbestos assessor. Following the visual inspection, either more material was removed as contaminated or validation soil sampling was undertaken to classify and validate the remaining soil material. At this stage site was divided into 5 x 5m grids, to conduct the validation sampling. Regional EnviroScience was engaged to complete this sampling for validating whether asbestos materials had been successfully and safely remediated at the completion of works. Sample material was taken at each node location of this gridded area. Regional EnviroScience was then engaged to undertake a review of

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the remediation and validation works undertaken on the site and completion of the data gap assessment.

Due to the identified asbestos in the footprint of the old hospital building, Robinson house and the southern built structure, the sampling area was increased. Samples were collected for asbestos across the whole of the site due to unexpected finds occurring.

Remediation was limited to the areas identified in Figure 6. The total remediated area was approximately 3700m^2.

The sampling method was calculated upon a validation area of 6300m^2 at surface level and a maximum depth of 1.2m bgl. There were 246 validation points across the site which were determined by breaking the site into a grid 5m X 5m pattern. A validation soil sample was taken from all 246 points at 0-200mm depth, if natural ground was not reached at 200mm depth then additional samples were taken every 300mm until natural ground was reached. If the samples obtained once analysed were determined to have contained asbestos at a concentration greater than 0.001% Friable or 0.01% non-friable then an additional minimum 200mm was scraped from the area and a secondary soil sample was obtained to determine that all contaminated soil had been removed.

Sampling method recommendations for evaluating asbestos contamination are provided in Table 7 of Schedule B2 of the ASC NEPM. It must be noted that the ASC NEPM recommends that all sampling methods are generally preceded by hand-picking (Emu Bob) to remove visible asbestos from the site surface and the collected material should be included in any contamination calculations.

Both the ASC NEPM and the Western Australian (WA) Department of Health (DOH) “Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)” (which has been adopted by the ASC NEPM) recommend ‘judgemental sampling’ to target particular areas of a site based on known or likely contamination.

4 DATA GAP ASSESSMENT

The RAP identified several data gaps for the site. These data gaps need to be addressed prior to the site being considered satisfactorily remediated. Further data gaps The data gaps and the measures taken to address them are considered below. During post remediation works, soils were moved

around the site. Soils in the South Eastern corner of the site were identified as having been relocated from other portions of the site and potentially from areas on site where the site had not been validated. This data gap testing is included below.

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4.1 OLD HOSPITAL BUILDING

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
Old Hospital Building – Footprint	1200m^3	7 sampling locations systematically placed over total area. Samples to be collected at surface (0-0.1m), near surface (0-0.3m) and then 0.5m intervals until natural materials encountered.	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH) Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP) Polychlorinated Biphenuls (PCBs) Asbestos (500ml)	Following remediation and validation of the old hospital building footprint for asbestos contaminated soils, excavation works began for construction. Excavations were approximately 1m deep. The OHB footprint area had been excavated into natural earth. Soil samples were collected in the excavation footprint following the construction works in the natural earth. Given the area had been validated as free from asbestos prior to the excavation works and the non-migratory nature of asbestos, asbestos testing was not undertaken on the natural earth in the excavation footprint. Eight surface soil samples were collected from the surface of the excavated area in the vicinity of the Old Hospital Building footprint with the locations shown in Figure 2 as OH1-OH8. Soil samples were	All results were below the limit of reporting for all analytes except for the heavy metals. All samples were within the background ranges for Australian soils as published in Hazelton and Murphy (2016). Soil samples for the selected analytes are below the selected criteria for all analytes. The soils require no further investigation for the potential chemical

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				analysed in accordance with the requirements outlined in the Excavated Natural Material Order 2014 for heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable Hydrocarbon, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), pH, EC and foreign materials (Rubber, plastic, bitumen, paper, cloth, paint and wood). Further analysis for OC/OP Pesticides and PCBs was then undertaken. The results of the analysis are included in Appendix 9. Material generated as a result of these excavations remained on site and was analysed as part of the stockpile analysis – see section 8.6 for details.	contaminants identified in the RAP.

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
Old Hospital Building	Depth of fill to be confirmed via test pitting and visual confirmation	7 locations	N/A	Post validation excavation depths were recorded by surveys of the site before and after excavations undertaken. Surveys are included in Appendix 10. The excavations in the old hospital building footprint excavated into natural earth. No records of the depth of fill across the footprint exist. Soil profile photographs, included in figure 8, show a distinct colour change within the soil profile between fill and natural earth.	Fill depth varies across site. Soil profile photographs from the old hospital building footprint show a distinct boundary between fill and natural earth. Depth of total excavation was ~1m according to the survey.
Old Hospital Building	Lateral extent of shotcrete surfaces to be confirmed by visual confirmation	Lateral extent	N/A	Lateral extent of the shotcrete surfaces to be confirmed via visual confirmation. Shotcrete subfloor was visually inspected by DEMEX and SERS. The shotcrete subfloor was found to be present and the material was validated by SERS. This is documented in a letter dated 18th	

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				June 2018 from SERS to Demex and included in Appendix 5	

4.2 ROBINSON HOUSE

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
Robinson House	1000m^3	7 sampling locations systematically placed over total area. Samples to be collected at surface (0-0.1m), near surface (0-0.3m) and then	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH)	This work was undertaken as part of the post validation works for the site. Remediation works and validation testing had been undertaken in the area for asbestos contamination. The remaining material in the Robinson house footprint was a mixture of fill	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) were found to be below the HIL-B criteria selected for the site. Total Recoverable hydrocarbons (TRH)

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
		0.5m intervals until natural materials encountered.	Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP) Polychlorinated Biphenyls (PCBs) Asbestos (500ml)	and natural earth. Given the area had been validated as free from asbestos prior to the excavation works and the non-migratory nature of asbestos, asbestos testing was not undertaken on the soil samples in the footprint. Seven locations were selected for sampling with the locations shown in Figure 2 as RH 1-7. Soil samples were collected at depths of 0-0.1m, 0.1-0.3m at each location with an additional sample at RH3, RH4, RH6 and RH7 at 0.3-0.6m. Fill was encountered in RH3, RH4, RH6 and RH7 to a depth of 0.3m. Soil samples were analysed in accordance with the requirements outlined in the Excavated Natural	Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) were below the LOR for all samples. Polycyclic Aromatic Hydrocarbons (PAHs) – Organochlorine & Organophosphorus Pesticides (OCP & OPP)- one sample, S01 (RH1, 0-0.1m) showed slightly elevated levels of Aldrin and Dieldrin, however the results were below the HIL-B limits. Polychlorinated Biphenyls (PCBs) were below the LOR for all samples.

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				Material Order 2014 for heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable Hydrocarbon, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), pH, EC and foreign materials (Rubber, plastic, bitumen, paper, cloth, paint and wood). Further analysis for OC/OP Pesticides and PCBs was then undertaken. The results of the analysis are included in Appendix 9.	Laboratory certificates of analysis are included in Appendix 9. See discussion in Section 8 Asbestos (500ml) discussed in section 8
Robinson House	Depth of fill to be confirmed via test pitting and visual confirmation	7 locations	N/A	Depth of fill to be confirmed via test pitting and visual confirmation- 7 locations. This work was undertaken as part of the post validation works for the site Remediation works and validation	As part of the soil samples collected for the chemical analysis for the Data Gap Assessment, the remaining material in the Robinson

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				testing had been undertaken in the area for asbestos contamination.	house footprint was a mixture of fill and natural earth. Seven locations were selected for sampling with the locations shown in Figure 2 as RH 1-7. Soil samples were collected at depths of 0-0.1m, 0.1-0.3m with an additional sample at RH3, RH4, RH6 and RH7 at depth of 0.3-0.6m. Fill was encountered in RH3, RH4, RH6 and RH7 to a depth of 0.3m. All other samples were taken in natural earth.

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
Robinson House	Lateral extent of shotcrete surfaces to be confirmed by visual confirmation	Lateral extent	N/A	Lateral extent of the shotcrete subfloor to be confirmed via visual confirmation. Soil samples were collected by Regional EnviroScience and tested for Asbestos.	Additional to visual inspection soil samples were undertaken in this area with asbestos were under the HILs B level. Asbestos results are included in Appendix 7.

4.3 BUILT STRUCTURE SOUTHERN PORTION STAGE 3

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
Built Structure to southern portion of Stage 3	370m^2	5 sampling locations systematically placed over total area. Samples to be collected at surface (0-0.1m), near surface (0-0.3m) and then 0.5m intervals until natural materials encountered.	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH)	This work was undertaken as part of the post validation works for the site. Remediation works and validation testing had been undertaken in the area for asbestos contamination. The remaining material in the Built structure footprint was a mixture	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) were found to be below the HIL-B criteria selected for the site. Total Recoverable hydrocarbons (TRH)

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
			Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP) Polychlorinated Biphenyls (PCBs) Asbestos (500ml)	of fill and natural earth. Given the area had been validated as free from asbestos prior to the excavation works and the non-migratory nature of asbestos, asbestos testing was not undertaken on the soil samples in the footprint. Five locations were selected for sampling with the locations shown in Figure 2 as OT 1-5. Soil samples were collected at depths of 0-0.1m, 0.1-0.3m at each location with an additional sample at OT5 at 0.3-0.6m. Fill was encountered at OT5 to a depth of 0.3m. Soil samples were	Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) were below the LOR for all samples. Polycyclic Aromatic Hydrocarbons (PAHs): elevated levels of PAHs were found in samples S21, S22, S23, S25, S29 and S30. All results were below the HIL-B limits. Organochlorine & Organophosphorus Pesticides (OCP & OPP)- two samples, 29 and S30 (OT5, 0-0.1m and 0.1-0.3m) showed slightly elevated levels of Dieldrin, however the results were below the HIL-B limits.

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				analysed in accordance with the requirements outlined in the Excavated Natural Material Order 2014 for heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable Hydrocarbon, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), pH, EC and foreign materials (Rubber, plastic, bitumen, paper, cloth, paint and wood). Further analysis for OC/OP Pesticides and PCBs was then undertaken. The results of the analysis are included in Appendix 9.	Laboratory certificates of analysis are included in Appendix 9. Polychlorinated Biphenyls (PCBs)) were below the LOR for all samples. Further discussion in section 8 Asbestos (500ml) discussed in section 8

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4.4 GRID HA 10 & HA 24

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
HA 10 (southern face of Old Hospital Building)	Further assessment of identified lead and and B(a)P contamination, to re-assess waste classification	3 sampling within HA 10 remedial area (25m2) at 0.5m depth intervals within fill materials.	TCLP lead TCLP B(a)P	The material was excavated in these areas and three samples were analysed by SERS for concentrations and TCLP of lead and B(a)P. The results for this work can be found in the SERS Report "*Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification*" Reference 155431_LEAD&BENZOAPYRENE_200918V3, included in Appendix 6	

4.5 DECEMBER 2018 DATA GAP- SOUTH EAST CORNER

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
South East Corner	700m^2	6 sampling locations systematically placed over total area. Samples to be collected at surface (0-0.1m), near surface (0-0.3m) and then 0.5m intervals until natural materials encountered.	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH) Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP)	This work was undertaken as part of the post validation works for the site. Remediation works and validation testing had been undertaken in the area for asbestos contamination. The remaining material in the Robinson house footprint was a mixture of fill and natural earth. Seven locations were selected for sampling with the locations shown in Figure 2 as RH 1-7. Soil samples were collected at depths of 0-0.1m, 0.1-0.3m at each location with an additional sample at RH3, RH4, RH6 and RH7 at 0.3-0.6m. Fill was encountered	Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn) were found to be below the HIL-B criteria selected for the site. Slightly elevated levels of PAHs were found in multiple samples, but all were below the selected criteria for the site. One sample, 20360S21, location 6 depth 0.3m, showed slightly elevated levels of dieldrin, but were below the HIL-B limits. One sample, 20360S11, location 3, depth 0.3m, showed slightly elevated levels of TRH in the F3 and F4 fractions. The levels were below the selected site criteria. All other analytes were below the laboratory limit of reporting for these samples.

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
			Polychlorinated Biphenyls (PCBs) Asbestos (500ml)	in RH3, RH4, RH6 and RH7 to a depth of 0.3m. Soil samples were analysed in accordance with the requirements outlined in the Excavated Natural Material Order 2014 for heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable Hydrocarbon, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), pH, EC and foreign materials (Rubber, plastic, bitumen, paper, cloth, paint and wood). Further analysis for OC/OP Pesticides and PCBs was then undertaken. The	Laboratory certificates of analysis are included in Appendix 9. See discussion in Section 8 No asbestos fibres were found in the samples submitted to the laboratory.See discussion in section 8.

Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
				results of the analysis are included in Appendix 9. Asbestos sampling was undertaken in the area with nine soil samples collected. Results of the analysis are included in Appendix 7.	
South East Corner	Depth of fill to be confirmed via test pitting and visual confirmation	6 locations	N/A	Depth of fill to be confirmed via test pitting and visual confirmation- 6 locations. This work was undertaken as part of the post validation works for the site Remediation works and validation testing had been undertaken in the area for asbestos contamination.	As part of the soil samples collected for the chemical analysis for the Data Gap Assessment, the remaining material was a mixture of fill and natural earth. Six locations were selected for sampling with the locations shown in Figure 2 as SE 1-7. Overburden was identified as a red brown clay loam with some stone and building debris evident. Natural earth was a slightly

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Location	Data gap assessment	Assessment Plan	Analyses	Methodology	Results
					redder clay loam and the absence of any stone. Natural earth was identified in SE01 at 900mm. Natural earth was identified in SE02 at 900mm. SE03 encountered refusal at 500mm. Natural earth was identified in SE04 at 500mm. Natural earth was identified in SE05 at 500mm. Natural earth was identified in SE06 at 1200mm. An additional sample, SE07 due to the refusal in SE03. Natural earth was identified at 500mm.

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5 REMEDIATION, VALIDATION AND WASTE CLASSIFICATION REPORTS

5.1 REMEDIATION

The site has been subject to multiple remediation activities on site. Remediation was undertaken on the site after the demolition of the buildings on site and removal of visible building materials from site. Remediation was undertaken in the form of excavation of the contaminated materials from site, classification and disposal of the waste material at appropriately licenced land fill facilities.

Wastes were tracked where required and tracking documentation provided.

5.2 VALIDATION

The site was subject to validation testing for identified contaminants, asbestos, lead and B(a)P.

Lead and B(a)P validation testing was undertaken by SERS in the areas of HA 10 and HA 24. The details of the validation testing and results are outlined in SERS report *Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification, Reference number 155431_LEAD&BENZOAPYRENE_2000918V3*.

Asbestos validation testing was undertaken by RES and is outlined in this report. Further site validation for asbestos under Robinson House building foot print is covered by the SERS clearance certificate was undertaken by SERS – *Asbestos Removal Clearance Certificate: 154910_CC_JFL-CP_23052018*. SERS report *Validation Soil Sampling Wagga Wagga Hospital, Wagga Wagga, NSW* (Reference 154910_Asbestossoilvalidtiation_TD_081018V3) validates the area below the old hospital building.

5.3 WASTE CLASSIFICATION

In accordance with the advice provided by SERS in the letters included in Appendices 1, 2, 4 and 5, Asbestos containing soils were loaded directly for disposal as Asbestos contaminated waste.

Soil around HA 10 and HA 24 was removed from site and subject to waste classification testing prior to removal from site. Waste classification report Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification, Reference number 155431_LEAD&BENZOAPYRENE_2000918V3.

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SERS, included in Appendix 6, took three waste classification samples of this material. Analysis for lead and B(a)P and the TCLP for both substances were undertaken. The results showed the samples were below the classification for general waste using Table 2: TCLP and SCC values for classifying waste by chemical assessment from the NSW EPA Waste Classification Guidelines Part 2: Classifying waste. However, given the high levels of lead previously found in these samples in the earlier investigations, the recommendation was made that the material be treated as Restricted waste. The waste was disposed of at the Elizabeth Drive Landfill Facility in Kemps Creek on the 18th of July 2018. The SERS report also includes a copy of disposal dockets and Transport Certificate No 2T00909342 for the waste.

Post validation, material excavated from across the site was stockpiled to the south of the site. This material was sampled for was undertaken for waste classification purposes. The stockpile on the site had elevated levels of lead and B(a)P in the southern section of the stockpile. The stockpile was not able to be removed from site as under the ENM exemption and ENM order. The results were all below the selected validation criteria for the site. It was recommended that the stockpile be reassessed and classified as waste using TCLP analysis if taken off site.

The Yarragundy material, was identified as natural earth and not containing asbestos prior to leaving the site by a Regional EnvioScience Soil Scientist and Licenced Asbestos Assessor. As the material left site and was undocumented, assessment of this material was undertaken under the Excavated Natural Material Order 2014. The material met the requirement for EMN classification. Testing undertaken on both stockpiles is detailed in the report WAGGA WAGGA BASE HOSPITAL – STOCKPILE INVESTIGATION 19482R01 included in Appendix 8

6 DATA QUALITY ASSESSMENT

The following data quality objectives were developed as part of the RAP for the site. The existing DQOs have been reviewed and the works assessed against the DQOs for the site to ensure compliance.

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State the problem		
Measure	**Requirement**	**Outcome**
The site is proposed to continue use as a health care facility.	That the site, following remediation, be able to meet the remediation objectives and validation requirements to be considered suitable for use as a health care facility.	Based on the information outlined in this report and the soil sampling undertaken the site is suitable for use as a health care facility

Identify the decisions		
Measure	**Requirement**	**Outcome**
Have lead and B(a)P impacted soils been successfully removed from site?	Validation samples below HIL- B for all samples for both analytes	Validation sampling for lead and B(a)P has been undertaken by SERS around the HA10 and HA24 areas previously identified. This work indicates the soils in this area have been successfully remediated
Have identified friable asbestos contaminated soils been successfully removed from identified locations?	Below HIL-B for asbestos for all samples.	Given the validation samples have returned results below the laboratory limit of detection and below the HIL-B adopted criteria, the asbestos contaminated soils can be considered to be successfully removed from the identified locations.
Have friable asbestos contaminated soils	No friable asbestos containing soils detected in validation sampling.	Friable asbestos containing soils have not been contained within a holding cell on site.

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Identify the decisions		
been successfully contained within the containment cell, in accordance with the RAP requirements?	No asbestos fibres detected during air monitoring.	A decision was made to remove friable asbestos contaminated soils from the site to an appropriately licenced landfill facility. Validation sampling undertaken shows that these soils have been successfully removed from site.
Have waste materials been suitably classified and lawfully disposed?	Collection of soil samples and analysis and reporting in accordance with the waste classification guidelines. Waste tracking certificates and deliver dockets for each waste stream and load removed from site.	Material excavated from the HA10 and HA25 areas were classified in the SERS Report *Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification, Reference number 155431_LEAD&BENZOAPYRENE_2000918V3*. SERS took three waste classification samples of this material. Analysis for lead and B(a)P and the TCLP for both substances were undertaken. The results showed the samples were below the classification for general waste using Table 2: TCLP and SCC values for classifying waste by chemical assessment from the NSW EPA *Waste Classification Guidelines Part 2: Classifying waste*. However, given the high levels of lead previously found in these samples in the earlier investigations, the recommendation was made that the material be treated as Restricted waste. The waste was disposed of at the Elizabeth Drive Landfill Facility in Kemps Creek on the 18th of July 2018. The SERS report also includes a copy of disposal dockets and Transport Certificate No 2T00909342 for the waste.

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Identify the decisions		
		All asbestos waste was removed from site to an appropriately licenced landfill, with waste tracking undertaken using a combination of delivery dockets and the EPA's Online Waste tracking system. The delivery dockets and consignment notices are included in Appendix 3. It is noted that several of the EPA certificates have incorrect weights on them. It appears a transcription error was made when entering the weights and the weights entered as tonnes rather than kilograms as required. The delivery dockets record the correct weights as tonnes for each certificate. A clearance report for the area under Robinson House building foot print was undertaken by SERS – *Asbestos Removal Clearance Certificate: 154910_CC_JFL-CP_23052018*, included in Appendix 2. Following remediation and validation of the old hospital building footprint, Robinson House footprint and the footprint of the built structure to the south, excavations were undertaken and material was stockpiled to the south of the site. Regional EnviroScience was engaged to undertake waste classification and assessment of material from the site on the 16th August 2018. The samples were initially tested in accordance with the *Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014, The Excavated Natural Material*

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Identify the decisions		
		Exemption 2014 and *The Excavated Natural Material Order 2014* to determine if the soils could be reused off site. The material was grouped into two stockpile areas for assessment, one on the hospital site, the other at Yarragundy. Material at Yarragundy was assessed prior to leaving the site to be natural earth only and not containing asbestos by Regional EnviroScience Soil Scientist and Licenced Asbestos Assessor and met the requirements for the ENM exemption and the ENM order. No tracking of the material was required. The stockpile on the site had elevated levels of lead and B(a)P in the southern section of the stockpile. The stockpile was not able to be removed from site as under the ENM exemption and ENM order. It was recommended that the stockpile be reassessed and classified as waste using TCLP analysis or managed under the ASC NEPM and remain on site. The Report is included in Appendix 8.
Is analytical data generated by the validation works reliable?	The data meets the requirements outlined in the DQO.	Exclusions in the DQO for the analytical data were noted. No trip spike was collected for the validation samples undertaken by SERS, however volatile loss was minimised through chilling of the samples during collection and transport. No trip blank was analysed for the validation samples undertaken by SERS. Trip blanks are designed to measure potential cross contamination between samples and from outside sources during transport. It is noted that B(a)P returned results below the

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Identify the decisions		
		laboratory limit of reporting and the samples may be treated as a proxy trip blank due to this. Duplicate samples for the asbestos soil samples were not collected due to the heterogeneous nature of asbestos contamination. The site soils were heterogeneous and an appropriate splitting technique was not available. The nature of asbestos contamination is such that the splitting of the sample using normal splitting techniques will not be a true indication of reproducibility. Despite these exclusions, the analytical data generated by the validation works is still considered reliable.
Is a Long Term Environmental Management Plan required?	If contamination is to remain on site, the site must have a long term environmental management plan developed to manage the contamination.	The RAP for the site proposed encapsulation in a containment cell on site for friable asbestos contaminated soils. During remediation works, the decision to move the material to waste was taken. Removal to landfill as waste was assessed as a suitable option for asbestos contaminated soils and the preferred option for the lead and B(a)P impacted soils. An outline of this decision process is included in Appendix 11. Given the decision was made not to construct a containment cell on site, a Long Term Environmental Management Plan is not required. Management of the asbestos containing pipework on site shall be managed through an updated site specific asbestos management plan or a site specific hazardous materials plan. The location and presence of the pipe shall be included on the updated asbestos register for the site.

Identify the decisions		
Is the site suitable for the proposed land use as a health care facility?	The data collected is reliable and the results of the validation samples is below the specified limits.	Based on the information outlined in this report and the soil sampling undertaken the site is suitable for use as a health care facility.

Identify Inputs to the decision		
Measure	**Requirement**	**Outcome**
Field observations, sampling and analytical data of unexpected finds;		Field conditions were documented in SERS reports and RES reports with photographs and field notes retained. Unexpected finds were dealt with on a case by case basis.
Field observations, sampling and analytical data of the soil remaining onsite where asbestos contaminated soil has been removed;		246 soil samples for asbestos collected five validation samples collected around HA 10 eight validation samples collected around HA 24
Data quality indicators as assessed by quality assurance/quality control.		Undertaken and assessed in this section

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Define the study boundary		
Measure	**Requirement**	**Outcome**
The area determined in the Remedial Action Plan;	The area remediated	The area identified in the RAP around HA 10 and HA 24 were excavated to natural earth and removed from site. Validation samples were collected across the defined footprints of Stage 3 in 5x5m grids.
	Any areas where unexpected finds occurred	SERS report 154940_LR_CP_1942018, included in Appendix 2 for Robinson House identifies unknown asbestos containing material within the subfloor. The report makes the primary recommendation that the area is removed in its entirety as asbestos containing material and the removal of the top 200mm of soil should be considered for disposal as asbestos containing waste. SERS letter dated 18th June 2018, included in Appendix 1 for Robinson House identifies unknown asbestos containing material within the subfloor. The report makes the primary recommendation that the area is removed in its entirety as asbestos containing material and the removal of the top 200mm of soil should be considered for disposal as asbestos containing waste. Due to the identified asbestos in the footprint of the old hospital building, Robinson house and the southern built structure, the remediation area was increased. Samples were collected for asbestos across the whole of the identified remediation area due to unexpected finds occurring during the remediation process

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Define the study boundary		
	To a depth of 1.2m or natural earth	Samples were taken to natural earth or beyond based on the laboratory results.

Develop a decision rule		
Measure	**Requirement**	**Outcome**
Have lead and B(a)P impacted soils been successfully removed from site?	Soils will be considered to have been successfully removed from when the validation results meet the selected criteria of 1,200mg/kg for lead and 0.7mg/kg for B(a)P.	Validation sampling for lead and B(a)P has been undertaken by SERS around the HA10 and HA24 areas previously identified. This work indicates the soils in this area have been successfully remediated.
Have identified friable asbestos contaminated soils been successfully removed from identified locations?	The identified areas with potentially asbestos contaminated soils were identified from the previous reports. The identified friable asbestos impacted soils associated with the Old Hospital Building and Robinson House were excavated and removed from site. Results of the laboratory analysis of soil samples collected from the base and walls of resultant excavations shall be assessed against adopted health based criteria (HIL-B) as presented below. If an excavation validation sample exceeds the criteria, further remediation by excavation of the soils and	Given the validation samples have returned results below the laboratory limit of detection and below the HIL-B adopted criteria, the asbestos contaminated soils can be considered to be successfully removed from the identified locations.

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Develop a decision rule		
	subsequent validation of the affected area will be undertaken.	
Is analytical data generated by the validation works reliable?	If the analytical data meets the Data Quality Indicators established in Section 5, then the analytical data are considered to be reliable.	Based on the assessment of the analytical data against the QA/QC requirements, the analytical data generated in this report can be considered to be reliable.
Have waste materials been suitably classified and lawfully disposed?	Waste materials from site should be appropriately classified and disposed of an appropriately licenced land fill. Tracking of waste should be undertaken as the material is removed from site	Material excavated from the HA10 and HA24 areas were classified in the SERS Report Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification, Reference number 155431_LEAD&BENZOAPYRENE_2000918V3 included in Appendix 6 SERS took three waste classification samples of this material. Analysis for lead and B(a)P and the TCLP for both substances were undertaken. The results showed the samples were below the classification for general waste using Table 2: TCLP and SCC values for classifying waste by chemical assessment from the NSW EPA Waste Classification Guidelines Part 2: Classifying waste. However, given the high levels of lead previously found in these samples in the earlier investigations, the recommendation was made that the material be treated as Restricted waste. The waste was disposed of at the Elizabeth Drive Landfill Facility in Kemps Creek on the 18th of July 2018. The SERS report also includes a copy of disposal dockets and Transport Certificate No 2T00909342 for the waste.

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Develop a decision rule		
		All asbestos waste was removed from site to an appropriately licenced landfill, with waste tracking undertaken using a combination of delivery dockets and the EPA's Online Waste tracking system. The delivery dockets and consignment notices are included in Appendix 3. It is noted that several of the EPA certificates have incorrect weights on them. It appears a transcription error was made when entering the weights and the weights entered as tonnes rather than kilograms as required. The delivery dockets record the correct weights as tonnes for each certificate. Following remediation and validation of the old hospital building footprint for asbestos, Robinson House footprint and the footprint of the built structure to the south, excavations were undertaken and material was stockpiled to the south of the site. Regional EnviroScience was engaged to undertake waste classification and assessment of material from the site on the 16th August 2018. The samples were initially tested in accordance with the *Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014, The Excavated Natural Material Exemption 2014* and *The Excavated Natural Material Order 2014* to determine if the soils could be reused off site. The material was grouped into two stockpile areas for assessment, one on the hospital site, the other at Yarragundy. Material at Yarragundy was verified on site as being natural earth only and not to contain asbestos by a Regional EnviroScience Soil scientist and licenced asbestos assessor. The material met

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Develop a decision rule		
		the requirements for the ENM exemption and the ENM order. No tracking of the material was required. The stockpile on the site had elevated levels of lead and B(a)P in the southern section of the stockpile. The stockpile was not able to be removed from site as under the ENM exemption and ENM order. It was recommended that the stockpile be reassessed and classified as waste using TCLP analysis prior to leaving site or be managed under the ASC NEPM and remain on site. The Report is included in Appendix 8.
Is a Long Term Environmental Management Plan required?	A Long Term Environmental Management Plan is required if friable asbestos contaminated soils remain on site. Given the Remediation Plan requires the construction of a containment cell on site, the site will require a LTEMP. The LTEMP will detail the management strategies required to ensure the long term integrity of the containment cell and required controls for scheduled work within the containment cell.	The RAP for the site proposed encapsulation in a containment cell on site for friable asbestos contaminated soils. During remediation works, the decision to move the material to waste was taken. Removal to landfill as waste was assessed as a suitable option for asbestos contaminated soils and the preferred option for the lead and B(a)P impacted soils. An outline of this decision process is included in Appendix 11. Given the decision was made not to construct a containment cell on site, a Long Term Environmental Management Plan is not required. Management of the asbestos containing pipework on site shall be managed through an updated site specific asbestos management plan or a site specific hazardous materials plan. The location and presence of the pipe shall be included on the updated asbestos register for the site.

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Develop a decision rule		
Is the site suitable for the proposed land use as a health care facility?	Remediation works have been completed for lead and B(a)P in accordance with the JBS&G RAP	Based on the information outlined in this report and the soil sampling undertaken the site is suitable for use as a health care facility.
	Remediation works for asbestos have been completed in accordance with the JBS&G RAP	
	Validation sampling for asbestos has been completed and met the requirements outlined in the JBS&G RAP and this validation report	
	Validation sampling for lead and B(a)P has been completed and met the requirements outlined in the JBS&G RAP	

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Develop a decision rule		
	When waste has been appropriately classified, documented and lawfully disposed	
	Analytical data generated is considered reliable	
	A suitable Long Term Environmental Management Plan will be implemented at the site.	

Specify Limits of Decision Error		
Measure	**Requirement**	**Outcome**

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Specify Limits of Decision Error		
A qualitative assessment shall be undertaken of potential decision errors associated with the data in accordance with the provisions in NEPM 2013.	A decision can be made based on a certain assumption of 95% confidence in any given data set. A limit on the decision error will be 5% that a conclusive statement may be a false positive or false negative.	Given the site has been sampled in accordance with the RAP and standard procedures and appropriately trained staff were used for collection and analysis of the samples, the validation sampling is considered to meet this requirement.
	Sampling errors when the sampling program does not adequately detect the variability of a contaminant across the area.	The site was sampled in accordance with the minimum number of samples required by the RAP.

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Specify Limits of Decision Error		
	Measurement errors during sample collection, handling, preparation, analysis and data reduction	Field staff following standard operating procedures when sampling, undertaking decontamination of tools and use of appropriate sample containers and preservation methods Laboratories following a standard procedure when preparing samples for analysis and undertaking analysis, and Laboratories to report quality assurance/quality control data for comparison with the DQIs established for the project

Optimise the design for obtaining data		
Measure	**Requirement**	**Outcome**
Sampling design was specified in the RAP.	The identified areas with potentially asbestos contaminated soils were identified from the previous reports. The JBS&G RAP	Sampling was undertaken in accordance with the RAP requirements. Additional sampling for asbestos was undertaken in a 5x5m grids across the identified footprint of stage 3 due to building materials being found during the excavations and remediation process

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Optimise the design for obtaining data		
	required a validation sampling frequency of 1 sample per 10m linear excavation face and 1 sample per 100m2 from the base of the excavation.	

Quality Assurance/Quality Control		
Measure	**Requirement**	**Outcome**
Precision	One duplicate for every 20 samples RPD<50% and agreement between asbestos presence/absence	Not undertaken for asbestos analysis. The site soils were heterogeneous and an appropriate splitting technique was not available. The nature of asbestos contamination is such that the splitting of the sample using normal splitting techniques will not be a true indication of reproducibility. The SERS report states one field duplicate and one field triplicate was undertaken for every batch of 20 samples taken. Table 2-2 of the SERS report shows a maximum RPD of 17.1% for lead in HA10. No RPD was calculated for B(a)P as results were below the laboratory limit of reporting for all samples in HA10 and HA24. The December 2018 sampling collected 2 interlaboratory duplicate samples and 2 intralaboratory duplicate samples. The RPD for the samples were calculated for all analytes with results above the PQL. Where the reported value was <5x the PQL, there was no limit for the RPD. Where the reported value was >5x the PQL, the RPD limit was 50%. All samples for all

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Quality Assurance/Quality Control		
		analytes met the requirements, with the exception of the interlaboratory sample 'pit 3" and sample 20360S09 and S10 for Copper. Given the heterogeneous nature of the fill material and the fact that all other results are within the required RPD limits, this is not considered to be a significant outlier. The results are considered to be meet the requirements for precision.
Accuracy:	Surrogate spikes for all organic samples 70-130% and Matrix samples 1 per lab batch, 70-130%.	Results can be found in the SERS report in Appendix 6. Surrogate spikes were 91%, with matrix spikes 88-120% for EnviroLab CoA 196122, Surrogate spikes were 96-99%, with matrix spikes 103-117% for EnviroLab CoA 213645, Surrogate spikes were 67.0-85.2%, with matrix spikes 88-120% for ALS CoA ES1820408. It is noted that while one result from ALS was below the RAP requirements, ALS sets surrogate control limits for PAH surrogates of 65-129%. The results are considered acceptable. Results for the December 22018 sampling can be found in Appendix 9. For Envirolab CoA 208327, surrogate spikes ranged from 86-110%. Matrix spikes ranged form 94-115%. For ASL CoA ES1838254, surrogate spikes ranged from 51.0-109%. Only one analyte, 2,4,6-tribromophenol returned results under the 70% RAP limit. ALS imposes a lower limit of 40% for this analyte and as such the result meets the laboratory requirements and is not considered to be an exclusion. Matrix spikes ranged from 45.6-110%. Only one sample was below the RAP limit of 70%- Pentachlorophenol. The laboratory recovery limits for this analyte are 20-130%. As such this is not considered an exclusion.

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Quality Assurance/Quality Control		
Representativeness:	Sampling appropriate for media and analytes	Sampling techniques were in accordance with WA DoH Guidelines. Additionally, 10L soil samples were obtained from each grid location and sieved through a 7mm sieve and forwarded to a NATA laboratory for analysis (EnviroScience and EnviroLab Services Pty Ltd). Both +7mm and -7mm soil fraction were analysed, with all clearance sampling indicating that no asbestos materials were identified. Sampling techniques for all samples is in accordance with the Schedule B2 of the ASC NEPM.
	Samples extracted and analysed within holding times	All samples were extracted and analysed within holding times for all analytes.

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Quality Assurance/Quality Control		
	Trip Spike – one per sampling event targeting volatiles, 70-130% recover	SERS did not use a trip spike for any sampling. This was minimised by the samples being chilled during transport and during collection.
	Trip blank <LOR	SERS did not use a trip blank. Potential for loss of volatile and semi volatile analytes. Given B(a)P was below the LOR, the soil samples can be considered to meet this requirement.
Comparability	standard operating procedures for sample collection & handling	Sampling techniques for asbestos in soils were in accordance with WA DoH Guidelines. 10L soil samples were obtained from each grid location in 200mm-300mm increments or natural ground was encountered. Standard operating procedures were used for soil sampling on site. Procedures are reviewed on an annual basis. SERS sampling techniques were compliant with ASC NEPM.
	Standard analytical methods used for all analysis	Analytical methods for analysis by both Envirolab. The selected analytical laboratory, EnviroLab, sieved the full sample volume supplied by regional EnviroScience through a 2mm sieve. Material greater than 2mm is retained and analysed. The sub-2mm portion of material is sub-sampled in accordance with EnviroLab NATA reviewed sub-sampling processes and the sub-sample analysed, with the greater than 2mm portion, for asbestos. Should asbestos not be detected from this analysis, trace analysis is conducted in accordance with AS4964-2004. Standard methods were used by both ALS and Envirolab for the lead and B(a)P for the analysis.
	Consistent field conditions, sampling staff and laboratory analysis	Soil sampling was supervised by a licenced asbestos assessor. SERS staff were described as environmental scientists.

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Quality Assurance/Quality Control		
		Soil samples were submitted to a NATA accredited laboratory for analysis
	Limits of reporting appropriate and consistent	Should asbestos not be detected in a sample, EnviroLab and Enviroscience reports a statement similar to, "No Asbestos Detected at the detection limit of 0.1g/kg". The HIL-B guidelines have a requirement of 0.04%w/w. The detection limit is equivalent to 0.001%w/w. This is adequate to assess against the HIL-B guidelines. ASC NEMP guidelines require that if asbestos is detected, laboratories should indicate the type of asbestos and provide a factual description. The type of asbestos and a factual description is included in both EnviroLab and Regional EnviroScience's analytical reports for heterogeneous samples, including soil. LOR for lead was 5mg/kg for ALS and <1mg/kg for EnviroScience. LOR for B(a)P was 0.5mg/kg for ALS and 0.05mg/kg for EnviroLab. Given the selected limits are 1200mg/kg for lead and 0.7mg/kg for B(a)P, these limits are considered acceptable.
Completeness	Soil description and COCs completed and appropriate documentation	COCs were completed for each sample collected. These have been included in Appendix 12 for asbestos soils and December 2018 sampling and in the SERS report in Appendix 6 for the Lead and B(a)P.

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Quality Assurance/Quality Control		
	Satisfactory frequency and result for QC samples	QC samples for asbestos soil were not collected due to problems with sample splitting. QC samples were collected for lead and B(a)P were collected at a rate of 1/20 samples. RPDs met the quality objectives.
	Data from critical samples is considered valid	Given the above assessment, critical samples can be considered valid
Sensitivity	Field and analytical methods and limits of recovery appropriate for media and adopted site assessment criteria.	The ASC NEPM, Schedule B1, May 2013 guidelines recommend a minimum sample size of 500mL from each relevant soil stratum at each location for laboratory analysis. The larger quantity can improve sensitivity of asbestos detection mainly during the standard laboratory pre-analysis screening of the sample through a 2mm sieve. As per AS4964-2004, the >2mm fragments are examined for presence of asbestos. Detection of any >2 mm asbestos fragments will be more likely within this volume of sample. A single 2x2x2 mm fragment would represent less than 0.001% w/w of the sample when factoring in an assumed 15% asbestos content of an asbestos cement fragment. The sub-2 mm fraction can then be used to prepare a representative subsample for further analysis, including trace analysis, in accordance with AS4964-2004 and the laboratory's protocols. All sub-sampling uses an appropriate validated procedure and is reported with the analytical results. The samples had a volume that exceeded the requirement, recommended sample size (500mL). It is considered that because the majority of samples and the average sample size complied with the recommended minimum weight it is the soil sampling generally complied with the guidelines.

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Quality Assurance/Quality Control		
		SERS sampling techniques were compliant with ASC NEPM. LOR for lead was 5mg/kg for ALS and <1mg/kg for EnviroScience. LOR for B(a)P was 0.5mg/kg for ALS and 0.05mg/kg for EnviroLab. Given the selected limits are 1200mg/kg for lead and 0.7mg/kg for B(a)P, these limits are considered acceptable.

Validation and Sampling Plan		
Measure	**Requirement**	**Outcome**
Old hospital building footprint area	1 sample per 10m linear excavation face per 0.5m depth excavation. 1 sample per 100m2 from the base of excavations	Given the extent of the asbestos contaminated soils and the nature of the fill across the site, the site was divided into 5mx5m grids. Samples were taken in each grid. Additional judgemental samples were collected where excavations revealed building wastes or other suspicious materials. This resulted in 246 soil samples being collected over the site. The exceeded the requirements outlined in the RAP. For Lead and B(a)P validation sampling, the five samples were taken for each 25m2 location excavated. Sampling was taken at the base of the excavations. This exceeds the requirements outlined in the RAP.
Robinson House footprint	1 sample per 10m linear excavation face per 0.5m depth excavation. 1 sample per 100m2 from the base of excavations	

Adopted soil validation criteria		
Measure	**Requirement**	**Outcome**
Asbestos Containing Material (ACM)	Limit Of Reporting (LOR) 0.01%w/w HIL-B 0.04%w/w	All samples were below the limit

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Adopted soil validation criteria		
Friable Asbestos/Asbestos Fines (FA/AF)	LOR 0.001% w/w HIL-B 0.001%w/w	All samples were below the limit
Lead.	HIL_B for lead of 1200mg/kg and Ecological Investigation/Screening Levels (ESL) of 0.7mg/kg	All samples were below the limit
Polycyclic Aromatic Hydrocarbons (PAHs)	had an adopted limit of 400mg/kg for the total PAH concentration and 4mg/kg for the Carcinogenic PAHs as B(a)P TEQ.	All samples were below the limit

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7 REMEDIATION DECISION

7.1 ASBESTOS

Remediation will be considered to be successfully completed when the specified health investigation limits for asbestos have been met for both soil and in air.

The RAP for the site had proposed encapsulation in a containment cell on site for friable asbestos contaminated soils as a suitable remediation option. This option was investigated and was agreed by all parties not to be considered due to the cost and health concerns because of the proximity to public access.

The decision to move the material to waste was adopted and agreed by all parties. Removal to landfill as waste was assessed as a suitable option for asbestos contaminated soils.

The sequence of events which lead to the decision to not proceed with encapsulation is as follows:

- The proposal for the on-site encapsulation option was considered and costed by the Contractor in accordance with layout plan provided by the Principal for the location of the encapsulation.
- The proposal for encapsulation option was provided to the Principal on 30th May 2018
- Given the size of the areas where encapsulation could occur, it was estimated that only 300m^3, or less than 50% of the contaminated material could be encapsulated on site, the balance of material would still need to be removed from site.
- Given the restricted encapsulation area and the manner in which the material would need to be handled and transported by small machinery, the programme would be extended by 2 weeks for encapsulation.
- There was a substantial additional cost for encapsulation compared to removal from site.
- There was consideration applied to the increased health risks associated with moving and tipping contaminated soil on site, in such close proximity to the public, compared to removing from site, ie only handling the material once at site. The risk of material becoming airborne is halved in a public area.

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- Following the Principals (Health Infrastructure) consideration of the above points, the Contractor was instructed not to proceed with the encapsulation option, and to remove all of the contaminated material from site.

This decision is documented in an email from Richard Crookes Construction to Regional EnviroScience dated the 20th of September 2018. This correspondence has been included in Appendix 11.
It was estimated that thesampled validation area was approximately 6300m^2. Based on these estimates the following sampling regime was undertaken; The site was broken up into a 5m X 5m grid formation of 246 validation points. All of these validation points were sampled between 0-300mm, or until natural ground was reached.

Where asbestos material was identified in the +7mm fraction or the –7mm (500gm) sample for %w/w laboratory analysis another minimum of 200mm of soil was scraped from the surface and removed as contaminated. Sampling was repeated again until the 500gm soil collected from the area was below the acceptable validation level of 0.001% w/w friable (-7mm) and 0.01% w/w for the non friable (+7mm) and additionally that no asbestos was visible at the surface.

No Respirable Asbestos Fibres above the reporting limit of 0.1g/kg detected by trace analysis, and asbestos where detected is below the detection limit of 0.1gm/Kg with any of the samples.

The validations and judgemental sampling when required found that the asbestos contamination on the site had be satisfactorily remediated from the area outlined in Figure 5.

Analysis of the validation samples were conducted in accordance with AS4964-2004 and comprised qualitative identification of fibre type in bulk samples. Samples were taken every 200mm-300mm or until natural ground was reached to ensure that all potentially contaminated soils were successfully validated. Soil was removed in each grid until the acceptable validation level of 0.001% w/w friable and 0.01% w/w non friable was met. Where the samples returned positive for asbestos, further excavation was undertaken with the material removed to landfill and sampling undertaken again.

7.2 LEAD AND B(A)P

Two areas for remediation of Lead and B(a)P were identified on site as HA10 and HA 24. These areas were remediated by excavation and removal to waste of the excavated material. The excavation areas initially were 5x5m to a depth of 0.2m around HA 10 and 5x5m 0.55m for HA24. Further

excavation and removal to waste was undertaken around HA24 in the north eastern corner of the grid, with an area of 1.5x1.5m excavated to a depth of 0.95m. The soils were classified and removed to an appropriately licenced landfill facility and tracking documents are provided. The remaining soil was sampled in accordance with the JBS&R RAP. The soil samples returned results below the selected criteria for soils on this site. Based on the testing and results of the soil samples collected, the site is considered to meet the aims for remediation outlined in the JBS&R RAP.

7.3 OTHER -CRITERIA AND CLASSIFICATION

Previous investigations have revealed elevated levels of Chlordane and Dieldrin. Where the material is to remain on site, the concentration for Chlordane and Dieldrin sampling was undertaken was below the adopted HIL-B levels.

Where material with Chlordane and Dieldrin are to be removed to waste, the waste must be classified in accordance with the NSW EPA waste classification guidelines and be accepted by an appropriately licenced landfill and managed in accordance with the Chemical control order for scheduled chemicals, however as the waste is classified as “Special Waste – Asbestos", the requirements for isolation and minimal contact are met.

8 REMEDIATION WORKS

8.1 ASBESTOS

Sampling method recommendations for evaluating asbestos contamination are provided in Table 7 of Schedule B2 of the NEPM. It must be noted the NEPM recommends that all sampling methods are generally preceded by hand-picking (Emu Bob) to remove visible asbestos from the site.

Both the NEPM and the Western Australian (WA) Department of Health (DOH) “Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)” (which has been adopted by the NEPM) recommend a combination of ‘grid’ and ‘judgmental sampling’ to target particular areas of a site based on known or likely contamination.

Soil validation sampling was conducted by Regional EnviroScience. The validation was conducted on a progressive basis throughout the works program. See Figure 3 below for sample collection staging. The validation methodology was undertaken in accordance with NEPM and the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (DoH, 2009). Sample quality procedures were used to ensure that the sample and data collected from the site was of suitable quality and were in accordance with the Australian Standards for collection of

contaminates soil samples (AS4882.1-2005). These procedures included logging the location and description of all soil samples, double bagging soil samples in appropriately labelled ziplock bags and the use of chain of custody documentation for transporting the samples to a laboratory for suitable analysis.

Once the excavation and removal of the contaminated surface soils was completed a 10L sample of soil was removed from each grid location and passed through a 7mm sieve. The +7mm fraction of sieved material was spread out and visually inspected for any potential asbestos containing material. Where potential asbestos containing material was identified this material was sent for laboratory analysis at Regional EnviroScience's NATA accredited laboratory.

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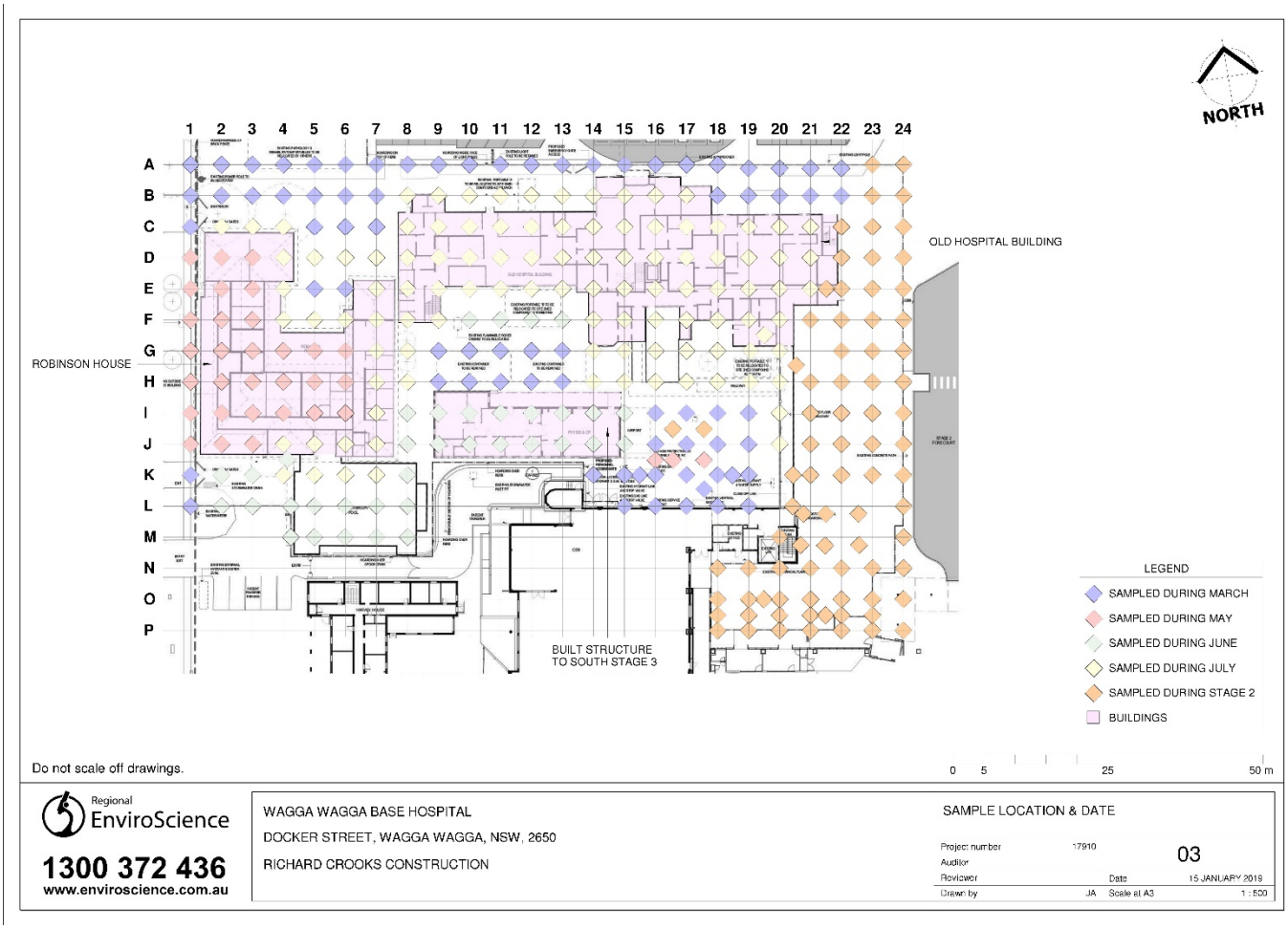

Figure 3 Sample collection staging by month

A 500mL sample of the -7mm fraction of soil was then obtained from the material that had been passed through the sieve and sent to either EnviroLab and/or Regional EnviroScience's NATA accredited laboratories.

If the analysed materials collected from the +7mm fraction or where the 500mL -7mm fraction samples were positive for asbestos containing materials a further 200mm soil was removed and disposed of as contaminated waste followed by further validation sampling until the 500mL -7mm fraction sample analysed was below the acceptable validation level 0.001% w/w friable and 0.01% w/w non friable fines and no visual asbestos was present at the surface. Three (3) areas, one area to the north of the Old Hospital building, one area to the east of the old hospital building and one area in the west of the Southern built structure, needed additional remediation due to asbestos containing material observed on the surface these areas are identified below in Figure 4. Following the additional remediation through excavation and disposal off site, the areas were re-sampled. The indicative location of the validation soil samples and extent of remediation upon completion can be seen in Figure 5. Soil samples which are below the 0.001% w/w friable and 0.01% w/w non friable acceptable validation level are identified as black symbols on the map.

All asbestos waste was removed from site to an appropriately licenced landfill, with waste tracking undertaken using a combination of delivery dockets and the EPA's Online Waste tracking system. The delivery dockets and consignment notices are included in Appendix 3. It is noted that several of the EPA certificates have incorrect weights on them. It appears a transcription error was made when entering the weights and the weights entered as tonnes rather than kilograms as required. The delivery dockets record the correct weights as tonnes for each certificate.

The December 2018 supplementary sampling for asbestos were sampled as above. Seven locations were selected from the post remediation south east corner area. The samples were submitted for analysis by the Regional EnviroScience NATA accredited laboratory. Certificates of Analysis are included in Appendix 7. No asbestos fibres or asbestos materials were found in the samples submitted for analysis.

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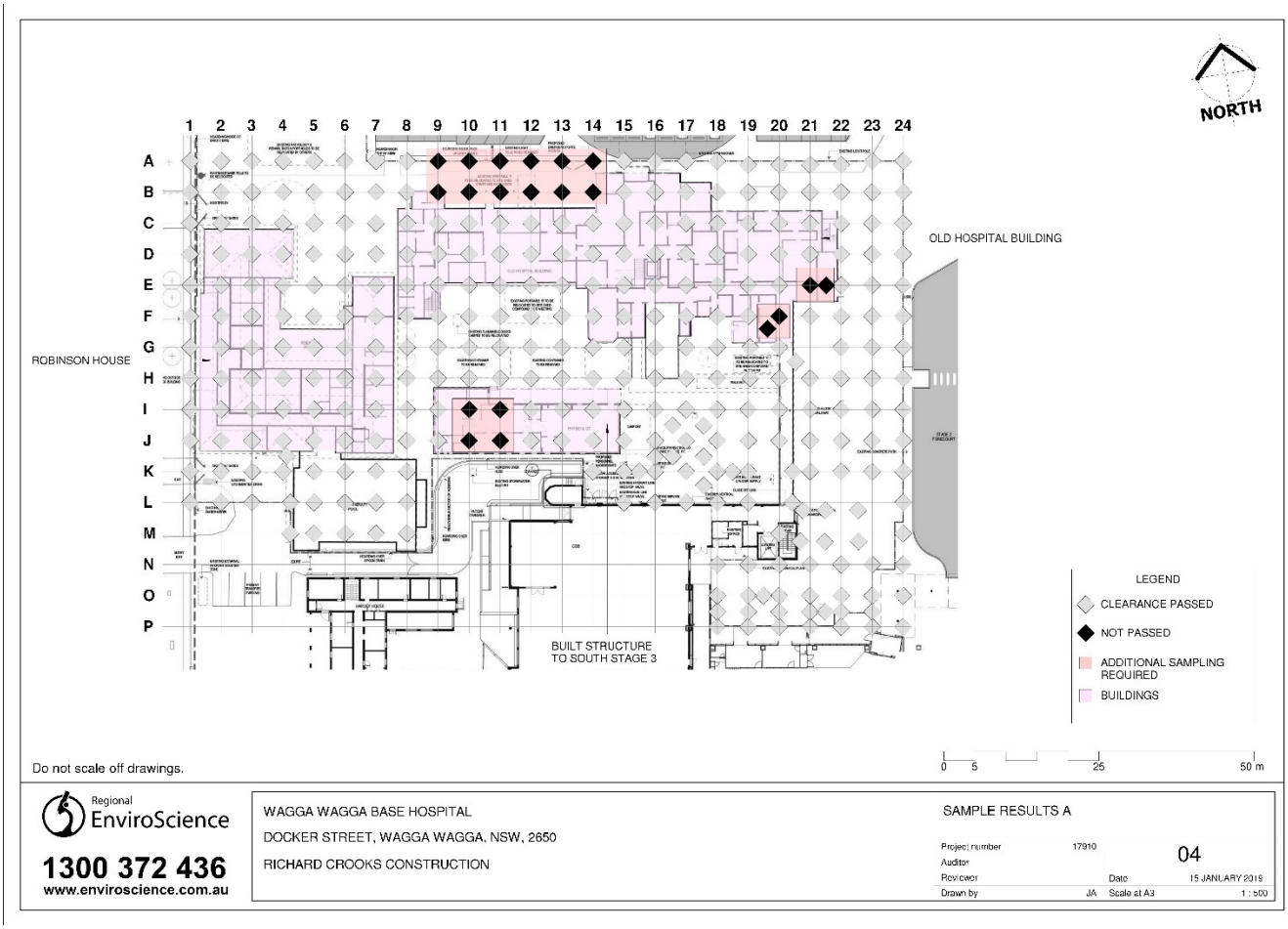

Figure 4. Areas of additional remediation

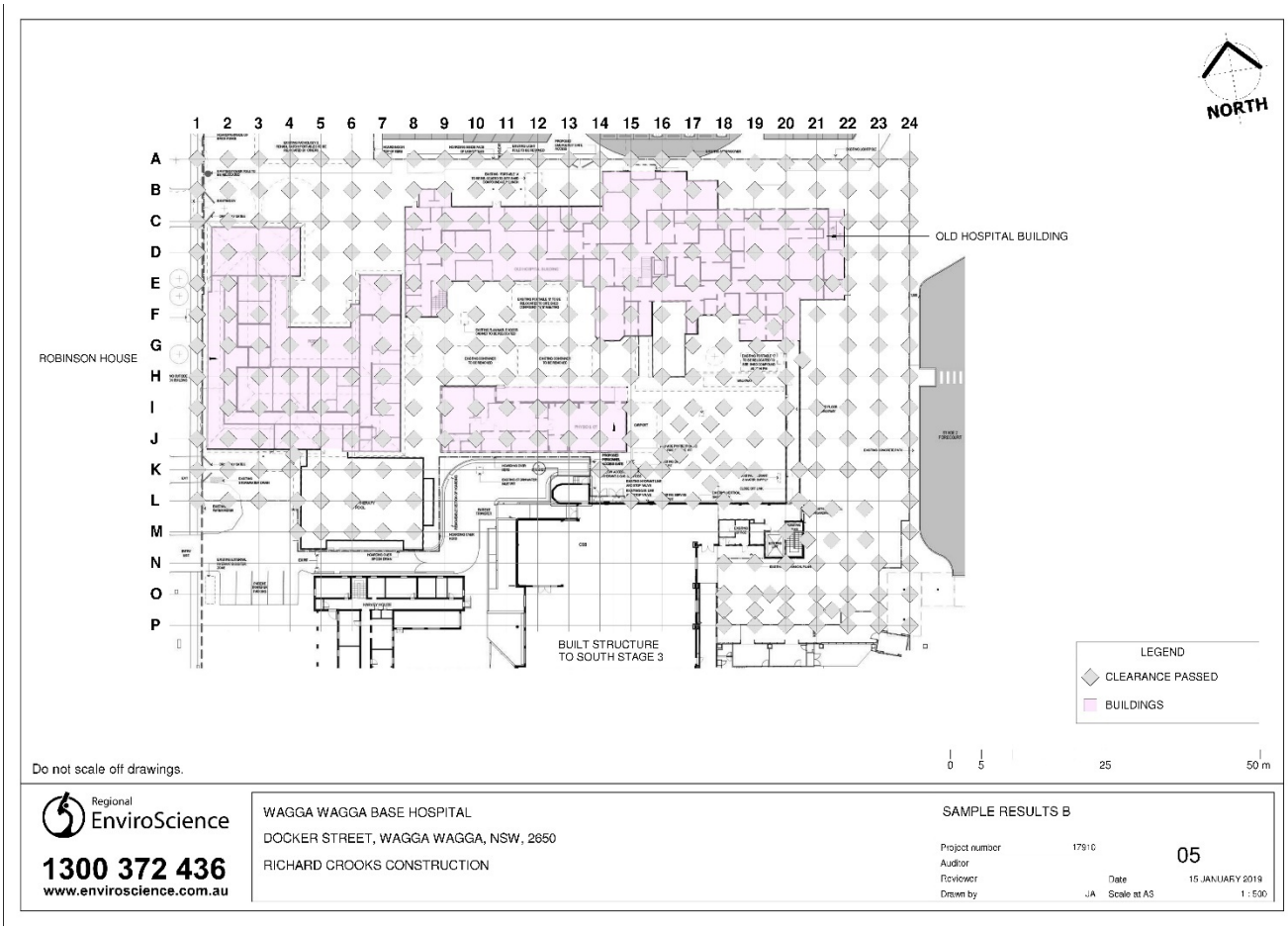

Figure 5. Areas of acceptable remediation

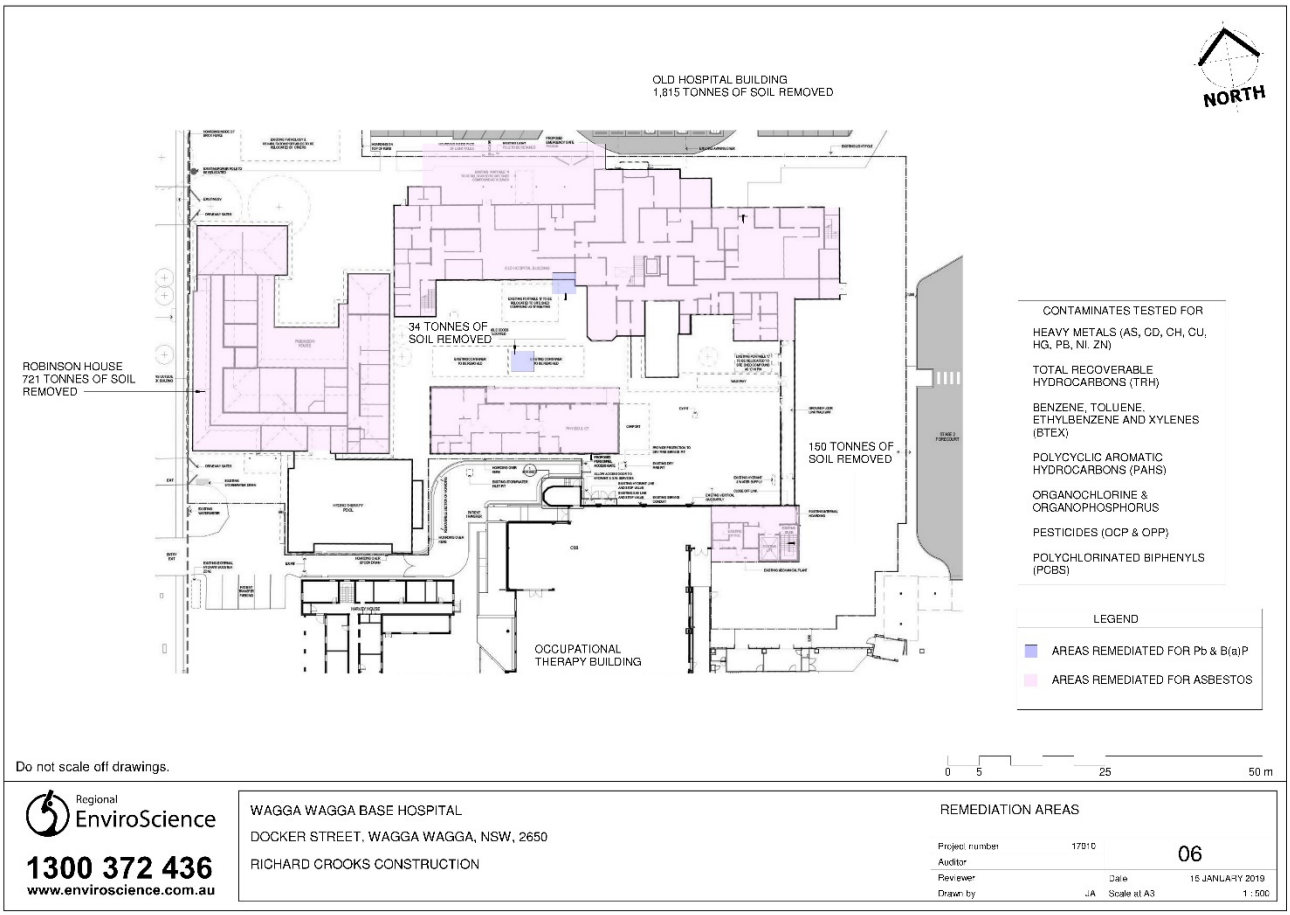

Figure 6: Total remediation area

8.2 LEAD AND B(A)P SOILS

Validation sampling for lead and B(a)P was undertaken by SERS on the 9th and 17th of July 2018. The details of the sampling are outlined in the SERS report "*Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification*" Reference 155431_Lead&benxoapyrene_200918V3, included in Appendix 6 of this report.

8.2.1 SERS Sampling

SERS undertook soil sampling in the region of HA10 and HA24. Previous investigations had found elevated levels of lead and B(a)P in the soils at HA10 and B(a)P in the soils at HA24. Soils were excavated to a maximum depth of 0.55m in the area of HA24 and 0.2m in the area of HA10. These soils were disposed offsite. Following the excavation of the material, SERS undertook validation sampling in these areas. During remediation works, stained soil was found in the North Eastern corner of the 5x5m grid around HA24. An additional soil sample was taken in this area, HA24V06. HA24V06 was taken at a depth of 0.95m.

Soils were collected using a stainless-steel hand trowel by a SERS environmental Scientist. Soil samples were placed in laboratory supplied soil jars. Samples were then chilled and shipped to an appropriately NATA accredited laboratories, with ALS as the primary laboratory and Envirolab as the secondary laboratory. The samples were transported by courier in eskies containing freezer bricks to prevent loss of volatile components. Documentation including QA samples, COC's and Laboratory certificate can be found in the SERS Reports. Samples around HA10 were analysed for lead and B(a)P and samples HA24 were analysed for B(a)P.

The remediation area has been successfully managed by removing lead and B(a)P contaminated soil to a depth of 0.2m. Inspection and testing of the soils remaining on site show the identified areas around HA 10 and HA 24 have been successfully remediated. The excavated soil was classified and removed to an appropriately licenced waste facility.

As part of the Data Gap Analysis, soil samples were collected in the Robinson house footprint and the built structure to the south. The table below identifies the Sample location and depth with the analytical sample name.

Analytical Sample Name	Sample Location	Depth (m)
20038-S01	RH1	0-0.1
20038-S02	RH1	0.1-0.3
20038-S03	RH2	0-0.1
20038-S04	RH2	0.1-0.3
20038-S05	RH3	0-0.1
20038-S06	RH3	0.1-0.3
20038-S07	RH3	0.3-0.6
20038-S08	RH4	0-0.1
20038-S09	RH4	0.1-0.3
20038-S10	RH4	0.3-0.6
20038-S11	RH5	0-0.1
20038-S12	RH5	0.1-0.3
20038-S13	RH6	0-0.1
20038-S14	RH6	0.1-0.3
20038-S15	RH6	0.3-0.6
20038-S16	RH8	0-0.1
20038-S17	RH8	0.1-0.3
20038-S18	RH7	0-0.1
20038-S19	RH7	0.1-0.3
20038-S20	RH7	0.3-0.6
20038-S21	OT1	0-0.1
20038-S22	OT1	0.1-0.3
20038-S23	OT2	0-0.1
20038-S24	OT2	0.1-0.3
20038-S25	OT3	0-0.1
20038-S26	OT3	0.1-0.3
20038-S27	OT4	0-0.1
20038-S28	OT4	0.1-0.3
20038-S29	OT5	0-0.1
20038-S30	OT5	0.1-0.3
20038-S31	OT5	0.3-0.6
198629-EXS01	OB1	0-0.1
198629-EXS02	OB2	0-0.1
198629-EXS03	OB3	0-0.1
198629-EXS04	OB4	0-0.1
198629-EXS05	OB5	0-0.1
198629-EXS06	OB6	0-0.1
198629-EXS07	OB7	0-0.1
198629-EXS08	OB7	0-0.1

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Testing for the soil in the Robinson House footprint and southern built structure met the requirements of the Data Gap analysis with seven soil locations tested and samples collected at surface and near surface for all locations. Where the near surface sample was not in natural earth, one further soil sample was collected. collected from the Robinson House footprint and five soil samples collected from the southern built structures. All results were below the selected limits for all analytes. Based on these results, the Robinson house footprint and the footprint of the southern built structure does not require further assessment.

8.2.2 Data Gap Sampling – September 2018

Sampling in the old hospital footprint was undertaken in September 2018.

Eight soil samples were taken in for analysis at this point, however, the area under investigation extended past the known footprint of the old hospital building towards Robinson house. Six soil samples were taken in the Old Hospital Footprint. While the RAP required 7 soil locations to be analysed, all six soil samples were collected in the Old Hospital Building footprint, one in the pathway to Robinson House and one under Robinson House. Results are reported in EnviroLab Certificate of Analysis 198629 and 198629-A and have the suffix EX for excavated area in the sample name. Soil samples were only taken at the surface of the area as the material was considered natural earth. While not meeting the requirements of the RAP, it is still considered that the soil results are adequate. All soil samples were found to be below the selected limits and no further investigations for the area were required.

8.3 AIR MONITORING AND DATA RESULTS

NATA accredited asbestos air monitoring was undertaken during the remediation works by SERs, for both collection of samples and laboratory analysis. A review of the thirty–seven (37) reports indicated that appropriate volume of air was collected to satisfy the testing methodology that is adopted in Australia; National Occupational Health and Safety Commission's Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC: 3003 (2005)] (Safe Work Australia, 2005).

The laboratory analysis provided indicated that all results were below the limit of detection for this method of testing, i.e. below less than 0.01 fibres/ml. This is effectively a zero or the limit of detection for this method of testing. There were instances, mainly associated with the decontamination unit where levels were slightly elevated, i.e. 3 to 4 fibres in 100 microscopic fields of view, however these fibres could be artefact fibres, i.e. cotton or synthetic for example. However, these elevated results are still below the limit of detection. In reviewing the reports, it was also found that quality assurance criteria had been met with at least in every 20 field samples a "laboratory blank" was collected and analysed in the laboratory and treated effectively as a field blank. These results should be reported as "acceptable" as opposed to a calculated concentration, i.e. less than 0.01 fibres/ml as no volume of air was passed through the filter, this information should be passed back the Laboratory Manager of SERs and the reporting certificate amended to reflect this going forward.

The table below depicts the control levels that were adopted during asbestos works;

Control Level (Airborne asbestos fibres/ml)	Control / Action
<0.01	Continue with current control measures
≥0.01	Stop removal work, review, investigate and implement control measures
≥0.02	Stop removal work, find cause and notify Safe Work NSW. Works not to re-commence until levels are below 0.01fibres/ml

All results provided indicate the all results were less than the detection limit i.e. below less than 0.01fibres/ml and is effectively a "clearance or acceptable validation" for these works, and that normal activities may resume in the areas that have been validated.

The air monitoring results maybe be seen in Appendix 13.

8.4 OTHER

Testing of the remaining soils in the foot print of the old hospital building, Robinson House and the built structure to the south showed Chlordane was below the limit of reporting for all samples. Dieldrin was found to be present but was below the selected criteria- HIL- B for the remaining soils.

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All waste soils were classified in accordance with the NSW Waste classification guidelines. Surface waste materials, including in the area of HA30 and HA31 were transported to appropriately licenced landfills.

8.5 WASTE

Material excavated from the HA10 and HA24 areas were classified in the SERS Report Lead and Benzo A Pyrene in Soil Remediation, Validation and Waste Classification, Reference number 155431_LEAD&BENZOAPYRENE_2000918V3 included in Appendix 6 were classified in accordance with the NSW Waste classification guidelines. SERS took three waste classification samples of this material. Analysis for lead and B(a)P and the TCLP for both substances were undertaken. The results showed the samples were below the classification for general waste using Table 2: TCLP and SCC values for classifying waste by chemical assessment from the NSW EPA Waste Classification Guidelines Part 2: Classifying waste. However, given the high levels of lead previously found in these samples in the earlier investigations, the recommendation was made that the material be treated as Restricted waste. The 34 tonne of soil waste was disposed of at the Elizabeth Drive Landfill Facility in Kemps Creek on the 18th of July 2018. The SERS report also includes a copy of disposal dockets and Transport Certificate No 2T00909342 for the waste.

SERS report 154940_LR_CP_1942018, the SERS letter to DEMEX and the SERS Old Hospital Building Validation Report, included in Appendices 1, 4 and 5. Robinson House and the old hospital building make the primary recommendation that the area is removed in its entirety as asbestos containing material and the removal of the top 200mm of soil should be considered for disposal as asbestos containing waste and the material be loaded directly for disposal as asbestos contaminated waste.

Due to the identified asbestos in the footprint of the old hospital building, Robinson house and the southern built structure, the remediation area was increased. Excavations of asbestos waste was removed from site to an appropriately licenced landfill through June 2018. Waste tracking undertaken using a combination of delivery dockets and the EPA's Online Waste tracking system. The delivery dockets and consignment notices are included in Appendix 3. It is noted that several of the EPA certificates have incorrect weights on them. It appears a transcription error was made when entering the weights and the weights entered as tonnes rather than kilograms as required. The delivery dockets record the correct weights as tonnes for each certificate. Material excavated from the Robinson House footprint and disposed to waste totalled 721 tonne. Excavated asbestos contaminated soil waste from

the Old Hospital Building footprint totalled 1815 tonne of contaminated soils. An additional 150tonne of asbestos contaminated soils were excavated from various hotspots on the site identified from Regional EnviroScience testing and a small area to the south east of the site. Volumes and locations of remediation are provided in Figure 6.

8.6 POST VALIDATION WORKS

8.6.1 Post validation works

Following remediation and validation for asbestos, lead and B(a)P, material was excavated for construction purposes across the site. Excavations began on the 1st of August 2018 and can be seen in the aerial photograph obtained from Google Earth dated the 2nd August 2018. A change in soil profile is evident with the stockpiles to the south west appearing darker and the excavation into red earth occurring. The completed excavation and soil profile is also provided in figures 7 and 8.

The material was a mixture of fill and natural earth from the old hospital footprint, Robinson House footprint and other locations on site.

Regional EnviroScience was engaged to undertake waste classification and assessment of material from the site on the 16th August 2018. The samples were initially tested in accordance with the Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014, The Excavated Natural Material Exemption 2014 and The Excavated Natural Material Order 2014 to determine if the soils could be reused off site. The material was grouped into two stockpile areas for assessment, one on the hospital site, the other at Yarragundy. Material at Yarragundy was natural earth only and met the requirements for the ENM exemption and the ENM order. The stockpile on the site had elevated levels of lead and B(a)P in the southern section of the stockpile, however these levels are below the selected validation criteria for the site (HILs B). The stockpile was not able to be removed from site as under the ENM exemption and ENM order. It was recommended that the stockpile be reassessed and classified as waste using TCLP analysis or managed under the ASC NEPM and remain on site. The variation between the areas of the stockpile is supported by the August 2018 aerial showing distinct soil stockpile locations. The Stockpile Report is included in Appendix 8.

8.6.2 December 2018

During post remediation works, soils were moved around the site. Soils in the South Eastern corner of the site were identified as having been relocated from other portions of the site and potentially from

areas on site where the site had not been validated. Seven locations were sampled at surface, near surface (0.3m) and then every 0.5m until natural earth was found. The volume of fill varied across the area. A total of 29 samples were collected over the area and submitted to a NATA accredited laboratory for analysis for Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn), Total Recoverable hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs) Organochlorine & Organophosphorus Pesticides (OCP & OPP), Polychlorinated Biphenyls (PCBs), and Asbestos (500ml). Two intralaboratory duplicates were collected and two interlaboratory duplicates were collected. The Relative Percentage difference was calculated for the samples.

Soil sampling in the South Eastern Corner of the site was undertaken on the 17th December, 2019. Results are reported in EnviroLab Certificate of Analysis 208327 (primary laboratory), ALS Certificate of Analysis ES1338254 and Regional EnviroScience B20360-R1. Sample locations are designated by the suffix SE on Figure 2 and the interal RegionalEnviroScience job number 20360 in the laboratory certificates. The table below shows the laboratory certificate sample names and their locations and depths. All soil samples were found to be below the selected limits and no further investigations for the area were required.

Analytical Sample Name	Sample Location	Depth (m)
20360S01	SE1	0-0.2
20360S02	SE1	0.3
20360S03	SE1	0.5
20360S04	SE1	0.9
20360S05	SE2	0-0.2
20360S06	SE2	0.3
20360S07	SE2	0.5
20360S08	SE2	0.9
20360S09	SE3	0-0.2
20360S10	SE3*	0-0.2
PIT 3	SE3+	0-0.2
20360S11	SE3	0.3
20360S12	SE3	0.5
20360S13	SE4	0-0.2
20360S14	SE4	0.3
20360S15	SE4	0.5
20360S16	SE5	0-0.2
20360S17	SE5	0.3

Analytical Sample Name	Sample Location	Depth (m)
20360S18	SE5*	0.3
PIT 5	SE5+	0.3
20360S19	SE5	0.5
20360S20	SE6	0-0.2
20360S21	SE6	0.3
20360S22	SE6	0.5
20360S23	SE6	0.9
20360S24	SE6	1.2
20360S25	SE7	0-0.2
20360S26	SE7	0.3
20360S27	SE7	0.5

*Intralaboratory samples. + Interlaboratory Samples - ALS

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Figure 7: Completed site excavation

Figure 7: Completed site excavation – Showing profiles

8.7 VALIDATION RESULTS AND DISCUSSION

The Data Gaps identified by the RAP have been successfully assessed and addressed.

The results for lead and B(a)P in the SERS report indicate the soils in the areas around HA 10 and HA 24 have been successfully remediated through excavation and removal of the soils off site.

Asbestos testing outlined in this report in section 8 show that the asbestos containing soils have been successfully remediated across the site, with contaminated materials disposed of at appropriately licenced waste facilities and tracked accordingly.

9 CONCLUSION AND RECCOMENDATIONS

9.1 SUMMARY OF WORKS

The RAP for the site identified potential contamination across the site from friable asbestos. Two locations, HA 10 and HA 24, were identified as being contaminated from lead and B(a)P. The RAP identified several locations where sampling was unable to be undertaken and potential contamination may occur.

Soil sampling around HA 10 and HA 24 showed elevated levels of lead and B(a)P. a 5x5m grid was excavated around each sampling point to a depth of 0.2m and the material removed from site and disposed of at an appropriately licenced landfill facility.

Soil sampling for asbestos was undertaken across the site with the site split into 5x5m grids. Where samples returned a positive result, further excavation was undertaken, and the areas retested. Upon completion of the validation sampling across the site, the site was considered to have been successfully remediated. The material excavated from site was disposed of at an appropriately licenced landfill and waste was tracked through the EPA waste tracking system.

Further testing of the site was undertaken to complete the data gaps for the site. Sampling in the footprint of the Old Hospital Building, Robinson house and the built structure in the south, after

remediation showed the material remaining on site was natural earth and met the remediation objectives. Soil sampling undertaken in the south eastern corner of the site in the fill and natural earth met the remedation objectives.

Lead and B(a)P contaminated soil material removed from site was classified against the waste classification guidelines and disposed of at appropriately licenced landfills with waste tracking. Asbestos contaminated soils was removed directly from site under the supervision of a Licenced Asbestos Assessor, and disposed of at an appropriately licenced landfill with waste tracking. Following remediation and validation works, natural earth was excavated and assessed in accordance with the ENM Order and exemption. This material was stockpiled at a site in Yarragundy. The material at the Yarragundy site met the requirements of the ENM order.
Fill material remains stockpiled on site and will be reused on site. This material has been found to meet the requirements of the ASC NEPM and the remediation limits set in the RAP for all identified contaminants.

Remediation requirements were defined in the RAP. The Health Investigation Levels for residential setting B was selected as the remediation limit. Validation sampling undertaken across the site show that the levels of all identified contaminants were below the remediation objectives set in the RAP.

9.2 LIMITATIONS OF THE INVESTIGATION

The comprehensive site investigation, remediation strategy and sampling regime conducted over the entire site, has indicated a successful remediation of the estimated and unforeseen asbestos materials. Therefore, the likelihood of exhuming asbestos materials is minimal.

ACM remains on site below the existing structure in the form of pipework. A plan showing the location of the remaining ACM is included in Appendix 14.

The presence of potential ACM contamination leads to the following suggested management approach:

Address the obligations of the Work Health and Safety Regulation (2011), including

- Maintaining an asbestos register for the site
- Developing and implementing an Asbestos Management Plan
- Inform relevant stakeholders about the risk of associated with the potential ACM, for example Local Government and service or utility providers that may conduct works in the area.
- Any surface disturbances in these areas (areas in the immediate vicinity of the clean-up area) should be managed as potentially ACM disturbing.

Activities that may require management due to the possibility of ACM disturbance such as:

- Any sort of digging, trenching or any form of earth disturbance including horizontal boring;
- Large scale natural soil disturbances such as tree fall which may disturb soil from around the root ball, or erosional mechanisms such as storm surges.

Other activities with potential to generate dust, expose fragments of ACM, break fragments of ACM and or lead to movement of presently undisturbed ACM present location.

There is always a risk that contaminated material may be encountered during construction activities regardless of the level of sampling and due diligence applied. It is recommended that the Construction Environmental Management Plan (CEMP) addresses the process in case of unexpected finds of asbestos containing materials, general contamination, biological waste or underground tanks etc on site. All personnel should be made aware of the protocol for unexpected finds. Please refer to a suitable example of an unexpected find protocol in Appendix 15.

9.3 STATEMENT – PROPPOSED SUITABILITY

The validation operations at the Wagga Wagga Base Hospital, were conducted to meet the desired outcomes for the remediation outlined in the JBS&G RAP.

Based on the evidence and testing undertaken by Regional EnviroScience and SERS, all validation samples for the identified contaminants were found to be below the Health Investigation Levels for residential setting B. The soil sample results are acceptable and indicate that successful remediation for lead, B(a)P and asbestos has been completed in the identified areas.

The completion of this report concludes that the validation objectives have been achieved and that all soils on the site are therefore suitable for the proposed land use, consistent with ASC NEPM 2013 Health Screening Levels Residential setting B.

It is in the opinion of Regional EnviroScience that the site has been remediated in accordance with the RWP and RAP, and that the site is now suitable for use as a health care facility.

10 REFERENCES

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