Broaden Management Pty Ltd
Former Black Hill Steggles Poultry Farm
Remedial Action Plan – Stage 2 Civil Works

John Renshaw Drive, Black Hill, NSW

14 August 2018

54892 - 116888 / Rev 0

JBS&G Australia Pty Ltd

www.jbsg.com.au

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material
ASTs	Above ground Storage Tanks
ASS	Acid Sulfate Soils
APEC	Areas of Potential Environmental Concern
AF	Asbestos Fines
ASC	Assessment of Site Contamination
ASRIS	Australian Soil Resource Information System
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CSM	Conceptual Site Model
COC	Contaminants of Concern
COPC	Contaminants of Potential Concern
DQI	Data Quality Indicator
DQO	Data Quality Objective
DPI	Department of Primary Industry
DPI	Department of Primary Industry
DP	Deposited Plan
DSI	Detailed Site investigation
DA	Development application
EIL	Ecological Investigation Levels
ESL	Ecological Screening Levels
ENM	Excavated Natural Material
FA	Friable Asbestos
GSW	General Soil Waste
HIL	Health Investigation Levels
HSL	Health Screening Levels
Ha	Hectare
JBS&G	JBS&G Australia Pty Ltd
IN2	Light Industrial Zone
LOR	Limit of Reporting
LOR	Limit of Reporting
LEP	Local Environmental Plan
MCMS	Materials Compliance Management System
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NOHSC	National Occupational Health and Safety Commission
NAA	Noel Arnold & Associates
EPA	NSW Environmental Protection Authority
OCP	Organochlorine Pesticides
PPE	Personal Protective Equipment
PID	Photo-ionisation Detector
PCB	Polychlorinated Biphenyls
PAH	Polycyclic Aromatic Hydrocarbons
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity
PSI	Preliminary Site investigation
QA/QC	Quality Assurance / Quality Control
RPD	Relative Percent Difference
RAP	Remedial Action Plan
REMP	Remediation Environmental Management Plan
SAQP	Sampling, Analysis and Quality Plan
SWA	Special Waste (Asbestos)
TWA	Time Weighted Average
TRH	Total Recoverable Hydrocarbons
USTs	Underground Storage Tanks

Term	Definition
UCL	Upper Confidence Limit
VENM	Virgin Excavated Natural Material
VOC	Volatile Organic Compounds
WHSP	Work Health and Safety Plan

EXECUTIVE SUMMARY

JBS&G Australia Pty Ltd (JBS&G) was engaged by Barr Property and Planning, care of Broaden Management Pty Ltd (Broaden, the client), to prepare a Remedial Action Plan (RAP) in relation to a portion of the former Steggles poultry farm located on John Renshaw Drive, Black Hill, NSW. Additional site identification information is provided in **Section 3.1**.

It is understood that the client is proposing to develop the site as an industrial park, inclusive of vegetation clearing (Stage 1) and earthworks comprising significant cut/fill activities (Stage 2). A RAP has already been prepared for the Stage 1 works, which will be replaced by an Environmental Management Plan (EMP) based on additional investigations not highlighting contamination within the proposed land clearing areas. This RAP has been prepared specifically for the Stage 2 works. The proposed development is discussed in more detail in **Section 2**.

Contamination investigations have historically been undertaken in relation to the site and adjacent land to the south which also forms part of the historical poultry farm (see **Section 4**). JBS&G was engaged to complete an environmental site assessment (ESA) in 2018, inclusive of a review of historical contamination reports as well as targeted soil sampling/analysis (see JBS&G 2018[1]). JBS&G (2018) identified a range of potential contamination issues which will require remediation in order to render the site suitable for the proposed development, with Asbestos Containing Material (ACM) in bonded form, as well as nutrient / microbiological contamination associated with historical animal waste management activities, representing the primary concerns. The assessment activities have resulted in the fill material being considered as 'asbestos contaminated soil' as per the requirements for management of asbestos in *How to Manage and Control Asbestos in the Workplace Code of Practice* (SWA 2016[2]). JBS&G (2018) also identified a number of data gaps and this has been reflected in this RAP.

The objective of this RAP is to provide a framework for remediation of relevant portions of the site, including:

- Identify the management and/or remedial strategy(ies) to be adopted by an assessment of remedial options and development objectives; and
- Document the procedures and standards to be followed in order to appropriately manage risks posed by the identified contamination.

Overall, it is considered that the proposed actions outlined in this RAP conform to the requirements of the NSW Site Auditor Guidelines (EPA 2017) because they are: technically feasible; environmentally justifiable; and consistent with relevant laws policies and guidelines endorsed by NSW EPA.

Subject to the successful implementation of the measures described in this RAP and the recommendations below, it is concluded that the risks posed by contamination in the Stage 2 areas can be managed in such a way as to be adequately protective of human health and the environment, and that the site can be remediated to a level which is suitable for the proposed commercial / industrial use.

It is noted that pre-remediation investigation works are to be undertaken prior to the implementation of this RAP. This RAP is subject to findings of this investigation being consistent with the findings to date, and if not, the RAP needs to be re-evaluated and amended.

[1] JBS&G Australia (14 August 2018) Environmental Site Assessment, Part Lot 1131 DP1057179, John Renshaw Drive, Black Hill, NSW.

It is recommended that the processes outlined in this RAP be implemented and that the following documentation be developed and implemented to ensure the risks and impacts during remediation works are controlled in an appropriate manner:

- Development stage specific Sampling, Analysis and Quality Plan (SAQPs) which consider the SAQP framework provided in this RAP;
- Detailed Scope of Works documents for each stage of remediation to detail the development stage specific remediation and validation plan;
- A Remediation Environmental Management Plan (REMP) for each stage of the remediation, to document the monitoring and management measures required to control the environmental impacts of the works and ensure the validation protocols are being addressed; and
- A Work Health and Safety Management Plan (WHSMP) for each stage of the remediation to document the procedures to be followed to manage the risks posed to the health of the remediation workforce.

The REMP and WHSMP will require to be cognisant of the potential occurrence and storage/handling of asbestos contaminated soils on the site.

Upon completion of remediation works for each development stage, validation reports are required to be submitted by JBS&G to certify which portions of the site are suitable for the proposed use. A long term management plan (LTMP) should also be implemented at the conclusion of remediation works to manage the encapsulated impacted soils onsite into the future. The LTMP should be documented in accordance with **Appendix E.**

1. Introduction

1.1 Introduction and Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Barr Property and Planning, care of Broaden Management Pty Ltd (Broaden, the client), to prepare a Remedial Action Plan (RAP) in relation to a portion of the former Steggles poultry farm located on John Renshaw Drive, Black Hill, NSW. Additional site identification information is provided in **Section 3.1**.

It is understood that the client is proposing to develop the site as an industrial park, inclusive of vegetation clearing (Stage 1) and earthworks comprising significant cut/fill activities (Stage 2). The proposed development is discussed in more detail in **Section 2**.

Contamination investigations have historically been undertaken in relation to the site and adjacent land to the south which also forms part of the historical poultry farm (see **Section 4**). In brief, these investigations have identified that the primary contamination concerns relate to Asbestos Containing Materials (ACM) associated with the demolition of historical sheds and microbiological contamination associated with the burial of organic wastes. The available data indicates that site contamination exists which warrants remediation and/or management in order to render the site suitable for the proposed development. As such, a RAP is required to provide an appropriate framework for the necessary remediation and management work.

This RAP has been prepared in accordance with guidance made or approved by the NSW EPA, inclusive of:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013* (the ASC NEPM);
- Office of Environment and Heritage, 1997/2011, *Guidelines for Consultants Reporting on Contaminated Sites*;
- Department of Environment and Conservation NSW, March 2007, *Guidelines for the Assessment and Management of Groundwater Contamination*;
- NSW Government, 2014, *Managing Asbestos in or on Soil*;
- NSW EPA, November 2014, *Waste Classification Guidelines Part 1: Classifying Waste*;
- NSW EPA, September 2015, *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*;
- NSW EPA, October 2016, *Addendum to the Waste Classification Guideline (2014) – Part 1: classifying waste*; and
- NSW EPA, October 2017, *Contaminated Land Management (Guidelines for the NSW Site Auditor Scheme)*.

1.2 Objectives

The objective of this RAP is to provide a framework for remediation of relevant portions of the site, including:

- Identify the management and/or remedial strategy(ies) to be adopted by an assessment of remedial options and development objectives;
- Document the procedures and standards to be followed in order to appropriately manage risks posed by the identified contamination; and
- Outline the remediation strategy appropriate to render the site suitable for the proposed commercial/industrial land use.

2. Development Details and Staging

2.1 Development Details

The client is proposing a multi-stage development consisting of 30 individual lots (proposed allotments 101-105, 201-205, 301-305, 401-406, 501-505, 601-604) and associated roadways and infrastructure. The proposed development is largely confined within the IN2 zoned area (see **Section 3.1**). The proposed development plans are included in **Appendix A**, including subdivision plans and cut/fill plans. The development of the site is proposed over individual stages that are defined below.

2.1.1 Stage 1 - Site Vegetation Clearing

The initial stage of development will involve the removal of the vegetation cover from the proposed development areas. The areas of proposed vegetation clearance are depicted in **Figure 7** located in the figures section.

The RAP for the development of this Stage 1 areas has been documented within *Former Black Hill Steggles Poultry Farm Remedial Action Plan – Stage 1 Vegetation Clearing* (JBS&G, 54633 – 113,795/Rev 0, 22 February 2018). However, on the basis of works completed by JBS&G during July/August 2018, the Stage 1 RAP is to be replaced by an EMP on the basis that no evidence of contamination has been identified within the proposed land clearing areas.

On the basis of the available information, Stage 1 works are only expected to result in relatively localised disturbance to near surface soils in areas which may contain elevated contaminant concentrations. They are not expected to contain significant contamination as the areas requiring clearing are outside the primary areas of concern with respect to contamination (e.g. waste burial areas, former poultry sheds).

2.1.2 Stage 2 – Site Modifications and Civil Works

Following the removal of vegetation from the site, it is understood that cut and fill operations are proposed for the development, with excavated material from elevated parts of the proposed industrial subdivision being used as bulk fill in lower lying areas of the site (see **Appendix A)**. These works are anticipated to result in the widespread disturbance of contaminated materials and require appropriate segregation, sampling/analysis and management of excavated materials.

As indicated above, it should be noted that only the industrial zoned area is to be developed as part of the proposed works. This equates to approximately 170 ha of land to be developed. The land zoned Environmental Conservation 2 in the northern portion of the Site (approximately 50 ha) is to be retained primarily in its current condition.

This RAP applies to the excavation, movement and disposal/remediation of soils during the above described Stage 2 development works.

2.1.3 Project Staging

At the time of this RAP, it is envisaged that the development will be staged, with Stage 1 works to be completed in discrete portions of the site, following by Stage 2 works (i.e. rather than Stage 1 works being completed across the site, followed by Stage 2 works across the site). Stage 2 works must not commence in any area of the site until Stage 1 works have been completed in accordance with the Stage 1 EMP (yet to be prepared).

3. Site Condition

3.1 Site Identification

The site is located within a portion of the former Steggles Poultry farm. The site details are summarised in **Table 3-1** and described in more detail in the following sections.

Table 3-1 Site Details

Lot/DP	Part Lot 1131 DP1057179
Address	John Renshaw Drive, Black Hill, NSW
Local Government Authority	Cessnock City Council
Site Area	Former Poultry Farm – approximately 300 ha Site – approximately 220 ha (excludes former poultry form area contained with proposed E4 Environmental Conservation Area, see **Appendix A**)
Current Land-use	Vacant / agricultural land use
Former Land-use	Steggles Poultry Farm (commercial/industrial)
Proposed Land-use	Industrial Development (retail, residential and an extension to Portman Lane)
Current Zoning	Light Industrial (IN2) – approximately 170 ha E2 Environmental Conservation Zone – approximately 50 ha
Site Coordinates	NW Corner - -32.822251, 151.604396 NE Corner - -32.816468, 151.622232 SE Corner - -32.837585, 151.618284 SW Corner - -32.835358, 151.602233
Site Location	Refer to **Figure 1**
Site Layout	Refer to **Figure 2**

3.2 Site Condition

The site is currently used for cattle grazing. Historical reports (see **Section 4**) indicate that the majority of the buildings once used for poultry farming were demolished a number of years ago. The remaining building footprints are predominantly covered in grass.

Large areas of native vegetation are located across the site. There are also several small dams and a number of running, stagnant and dry creeks intersecting the site. A number of rural properties lie to the south of the site. Bushland borders the Site to the east, west and north and the Donaldson Coal Mine Site lies beneath and to the north of the Black Hill site.

Additional information regarding the historical condition of the site is provided in **Section 4**.

3.3 Geology & Soil

The Newcastle Coalfield Regional Geology 1:100,000 Geological Series Sheet 9231 (NSW Department of Mineral Resources, 1995) describes the lithology of the Black Hill Site as being from the Tomago Coal Measure and may comprise either:

- Siltstone, sandstone, coal, tuff and minor carbonaceous claystone;
- Sandstone, minor siltstone, claystone, coal and tuff; or
- Laminated sandstone, claystone, siltstone, coal and tuff.

Bedrock was not encountered during the *Site Contamination Investigation Diocese of Mainland-Newcastle Former Steggles Poultry Farm Blackhill Road, Black Hill* (NAA (2013)) investigation, however the Douglas Partners 2005 report reportedly indicates that two of the groundwater bores installed at the Site encountered bedrock (sandstone and siltstone) at approximately 3 metres below ground level. These wells (GW02 and GW03) were installed to the north west of the northern dump area.

The Newcastle Soil Landscape Series Sheet 9232 (Department of Land and Water Conservation of NSW) indicates that the Black Hill Site is of the Beresfield soil landscape type.

Test pits excavated as part of the NAA (2013) investigation encountered soil which was consistent with the desktop review, however areas of the Site were found to have been extensively disturbed and fill material included soil, farming/building debris, poultry waste material and clay capping.

In accordance with Mine Subsidence reports completed for the site by Douglas Partners and Ditton Geotechnical Services in September 2017 and February 2018 respectively, underground coal mining has occurred across the majority of the Site with the exception of the north west and south west corners. The mine beneath the site ceased operation in 2016 and is currently operating under a "care and maintenance" phase. The mining lease for the site expires on 15 May 2029. As a result of mining activities, subsidence is known to occur in the regional area (Blackhill Mine Subsidence District) and on the site itself. Conclusions of the reports completed indicate that subsidence at the Site has practically completed, unless mining activities commence once more.

3.4 Acid Sulfate Soil

The National Acid Sulfate Soil (ASS) Map accessed through the Australian Soil Resource Information System (ASRIS) indicates that the Site is located in an area where the probability of acid sulfate soil being present is extremely low (with very low confidence). Cessnock City Council Local Environmental Plan (LEP) 2011 mapping does not show the site to be in an area classified as containing acid sulfate soil.

3.5 Topography & Hydrology

The site varies from level fields to undulating terrain and contains a main creek systems running through the northern portion of the site. Another creek system is located just offsite to the south. The two creeks run in a general south-west to north-east direction. Both creeks were predominantly dry at the time of the JBS&G field investigations in 2017 and 2018. Much of the runoff from the site feeds into these creeks. Historical dams referenced within the reports provided by the client (see **Section 4**) were investigated by JBS&G during 2018 and are known to have been previously backfilled. Both the creek systems and dams have been plotted on **Figure 3**.

3.6 Salinity Potential

Based on a review of historical reports provided to JBS&G, it does not appear that an assessment of site salinity has been completed to date. Following a review of the Hunter Catchment Salinity Assessment final report, the site is considered to be located in an area of very high salinity risk[3]. This risk will be considered and addressed within the proposed remedial strategy documented within this RAP, noting that the principle concerns for salinity are crop sensitivity and raising of the water table. No crops are proposed as part of the proposed development. Raising of the water table as a result of the proposed development appear to represent a low risk based upon the local hydrogeology (i.e. water table aquifer is at significant depth, likely to be depressed by mining activities).

3.7 Hydrogeology

JBS&G (2018) summarises groundwater bores located within a 1 km radius of the site. Ten bores were noted, with an average depth greater than 30 m below ground level. Standing water levels were not recorded, however, all wells were installed for the purpose of monitoring.

Based on documents reviewed as part of the ESA, it is understood that up to ten groundwater monitoring bores may have been installed at the site. It is believed that four were installed by Environmental Earth Sciences (EES) during 2003, another four were installed by the same company during 2004, and Douglas Partners installed two during May 2005. Based on the limited information currently known, groundwater monitoring wells have targeted the following features:

[3] NSW EPA (2013), *Hunter Catchment Salinity Assessment,* EPA 2013/0787, November 2013
Figure 4: Areas of dryland salinity and salinity risk within the Hunter River Catchment

- BH2 – adjacent the vaccine lab;
- BH8 – within Farm 9;
- BH15 – eastern site boundary;
- BH16 – creek area;
- Unknown Well ID, GW02 and GW03 – northern dumping ground;
- Unknown Well ID – south eastern dumping ground;
- GW01 – Farm 10 (offsite); and
- Unknown Well ID – Down slope of the truck wash.

BH2, BH8, BH15, BH16 were all relatively shallow wells (i.e. maximum depth of 6.0 m) and were screened within sediments and/or the top of the shale bedrock. BH2 and BH8 were dry during the first round of sampling in 2003, while the standing water levels within BH15 and BH16 were 2.90 m and 5.10 m below ground level respectively.

NAA (2013) references three groundwater monitoring bores (GW01 though GW03) that were previously installed at the site, one of which, GW01, was locate offsite adjacent Farm 10. Standing water levels within the monitoring wells ranged from 0.15 m to 9.14 m below ground level. Electrical conductivity was reported above 10,000 µS/cm in GW01 and GW03 (mislabelled as MW01 and MW03), compared to 756 µS/cm in GW02 (mislabelled MW02). Based on the depth to groundwater and the EC reading, it is considered likely that GW02 is representative of surface water ingress rather than regional groundwater.

Based on groundwater conditions discussed in previous reports, it is understood that there is perched groundwater located atop of bedrock at the site. This water is likely highly influenced by season rainfall. True groundwater is likely located deeper within bedrock, which is influenced by mining activities below and surrounding the site. The water table aquifer is likely located deeper within bedrock at between 30 and 40mbgl (as per surrounding bores) and flows in a north east direction, however, this is likely influenced by mining activities below and surrounding the site (see **Section 3.3** for further details).

3.8 Flora and Fauna

An assessment of flora and fauna at the site has not been completed by JBS&G as part of this RAP It is understood that the client has completed appropriate flora/fauna assessments as part of the Environmental Impact Statement (EIS) process for the proposed development and any flora/fauna related approvals / management requirements relevant to the Stage 2 works will be managed by the client directly outside of this RAP.

3.9 Heritage

An assessment of heritage related issues at the site has not been completed by JBS&G as part of this RAP. It is understood that the client has completed appropriate heritage assessments as part of the EIS process for the proposed development and any heritage related approvals / management requirements relevant to the Stage 2 works will be managed by the client directly outside of this RAP.

4. Previous Environmental Assessments

Environmental investigations have been completed at the site since the late 1990s and have been documented in approximately 37 reports to date. JBS&G have reviewed 27 of these reports, with the balance being unavailable for review at the time of preparing this RAP. The available background information has been summarised in JBS&G (2018).

The following provides a summary of the summary of historical information presented within JBS&G (2018):

- From 1967 to 2003 the site was used for intense poultry farming, and may have also been used for intensive pig farming within the south western portion of the site;
- The majority of structures were demolished between 2003 and 2009. No documentation has been provided with regard to the fate of all wastes generated during demolition works;
- A total of 17 farm areas may have existed at the site, each with between one and five poultry sheds present at any one time, with the exception of Farm 19, which appeared to never have had buildings constructed. All sheds have subsequently been removed. No documentation of how and when the removal of sheds took place, whether any contamination or Asbestos Containing Material (ACM) clearance was completed, and where the demolished building material was placed. Multiple references were made to the presence of ACM within the sheds;
- Three nominated dump areas exist at the site; northern, southern and western, utilised for the disposal of various items including dead poultry carcasses, building materials and laboratory waste;
- Burial, composting and incineration of deceased poultry occurred at the site. Dead birds and rotten eggs were originally buried at the site, with only disease-ridden birds being incinerated. Owing to complaints from surrounding properties, all dead birds were reportedly incinerated from circa 2000. Former employees indicated that the incinerator ash was disposed of both on and off site, while dead bird burials occurred primarily in two areas (i.e. northern and southern dump areas). Anecdotal information from previous employees, suggests that a major disease outbreak was not known to have occurred at the site;
- Evidence suggests that there were up to three underground storage tanks (USTs) located at the site; two adjacent the former workshop area, and a third in an unknown area. The latter UST was removed during 2008, with collected validation samples from the tank pit indicating remediation was successful. The two USTs adjacent the workshops are understood to have been removed at a later date, however, no documentation has been provided for their removal;
- At least one above ground storage tank (AST) was known to have been located at the site, located within the south-eastern portion of the site;
- Anecdotal evidence suggests that that a combination of Longlife 250S disinfectant, diesel and formaldehyde was used around poultry sheds as a disinfectant, while hydrocarbons were also used as a wood preservative on poultry shed timber posts;
- ACM was identified at multiple locations across the site; within building materials, on the surface scattered at multiple locations, and co-mingled with soil at multiple locations;
- Portions of the site have been capped with imported or site sourced capping material, including a portion of the northern dump area, as well as a portion of the southern dump area; and

- The area to the south of the site designated as a proposed E4 Environmental Conservation Area, includes former Farm 10, which was linked to significant ACM contamination. This area was capped. This area is outside of the subject site;
- Impacts on soil, groundwater and surface water have been identified in previous investigations. This is summarised as follows:
    - ACM on the ground surface in some areas as well as within stockpiles of construction waste and fill material. FA/AF have not been identified in soil above the LOR of 0.001%;
    - Metals results within soil samples were considered to be predominantly consistent with potential natural background levels, with no detections above commercial/industrial use criteria based on the protection of human health. Some exceedance of Ecological Investigation Levels (EILs) was evident, however, the results did not appear to be indicative of EIL exceedances which warrant remediation;
    - TRH, Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene (BTEXN) and PAHs have predominantly been identified below the LOR within soils, with the exception of minor TRH concentrations during test pitting and during UST removal. The TRH concentrations from the test pits were considered to most likely be representative of acceptable contamination levels when considering the possible source of the TRH (i.e. possibly not petrogenic);
    - Total coliforms and E. Coli levels have commonly been detected across the site within soils, with ten samples exceeded the NSW EPA (1997) *Environmental Guidelines, Use and Disposal of Biosolids Products* criteria of 1,000MPN[4]/g;
    - Elevated total nitrogen levels have been identified in soil at the site, although there are no definitive protection of the environment or human health criteria for nitrogen in soil;
    - Elevated concentrations of ammonia, copper, zinc, E.Coli, faecal coliforms in surface water samples (some exceeding ANZECC 2000 maintenance of ecosystem criteria);
    - Elevated concentrations of ammonia, nitrate, nickel, zinc, E.Coli, total coliforms and faecal coliforms, with some results exceeding ANZECC 2000 maintenance of ecosystem criteria, in groundwater samples.

[4] Most Probable Number

5. Conceptual Site Model

The following section details the CSM for the site, based on the site history review conducted and the historical reports provided for review.

5.1 Areas of Environmental Concern

Areas of environmental concern (AECs) and associated contaminants of potential concern (COPCs), as identified through desktop review of site history, are provided in **Table 5.1**, below.

Table 5.1 Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern (AEC)	Contaminant of Potential Concern (COPC)
Fill materials used for historical levelling and backfilling of dams at the site	TRH, BTEX, PAHs, VOCs/SVOCs, Heavy Metals, Asbestos
Poor demolition of former buildings	Asbestos and Lead
Burial pits for waste including animal carcasses	TRH, BTEX, PAHs, VOCs/SVOCs, Heavy Metals, Asbestos, ground gases (i.e. methane, ammonia)
Petroleum storage and use (e.g. former UST, AST areas)	TRH, BTEX, PAH
Transpiration pits and runoff from farm areas	Nutrients and biologicals (including E. Coli)
Dam sediments (seven dams in the south western portion of the site)	Nutrients and biologicals (including E. Coli), Heavy Metals
Operation of incinerator on site and the spreading of ash	PAHs
Chicken shed poles treated with hydrocarbons as a timber preservative	TRH, BTEX, Creosotes
Farm areas that had Longlife 250S, formaldehyde and diesel fuel as a disinfectant applied	TRH, BTEX, formaldehyde
Treatment of farm associated residential buildings, including storage of chemicals	OCPs, PCBs

5.1.1 Potentially Contaminated Media

Potentially contaminated media at the site include:

- Fill;
- Natural Soils;
- Sediment in Dams;
- Surface Water; and
- Groundwater.

Fill is considered a potentially contaminated medium based on the unidentified sources of fill material potentially imported to the site historically to backfill/raise topographic features and the potential for fill material at the site to contain waste materials and aesthetically impacted waste/soil associated with historical activities. This would also include the investigation associated with burned waste (previously identified) and the possibility of burial areas for various animals (e.g. chickens).

Natural soils are considered a potentially contaminated medium based on the possible leaching of contaminants from fill materials.

Based on the leachability of identified COPCs and the limited available groundwater data, groundwater at the site is considered a potentially contaminated medium. As with the natural soils, the potential for contamination of groundwater will depend upon the actual nature, occurrence and characteristics of contamination within the overlying fill material and/or the natural soils. In addition, it is understood that underground infrastructure is located at the site which has potential to have migrated through the soil and impact the underlying groundwater. However, it is pertinent

to note that historical groundwater wells appear to have targeted perched water above bedrock and the likely beneficial uses of the aquifer are likely to be limited.

5.1.2 Potential for Migration, Exposure Pathways and Receptors

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

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

The potential contaminants of concern as identified as part of the site history review are generally in either a solid form (e.g. heavy metals, asbestos, etc) or liquid form (e.g. fuel, solvents, etc).

The potential for contaminant migration via windblown dust and for surface water intrusion is considered moderate as the site is currently unsealed. Following the completion of the proposed development, it is expected that migration via windblown dust is considered low as the majority of the site is proposed to be sealed.

There is the potential for migration of contamination via groundwater movement, should contamination extend to the depth of the groundwater. However, with consideration of the underlying geology and the expected depth to the regional groundwater, it is considered that migration of contaminants off-site via groundwater is unlikely.

There is potential for surface contamination to migrate offsite through runoff during heavy rainfall.

5.1.3 Potential Exposure Pathways

Based on the COPCs identified in various media as discussed above, the exposure pathways for the site include:

- Dermal;
- Ingestion; and
- Inhalation.

Due to the presence of potentially impacted soil/fill on ground surfaces dermal exposure must be considered a potential exposure pathway.

The potential for ingestion of soil is considered a potential pathway as the site is unsealed, and should dust be generated during redevelopment, ingestion must also be considered a potential exposure pathway during future construction works and for neighbouring properties.

Groundwater is not anticipated to be extracted under the proposed land-use. One creek is located at the site, with a second immediately to the south. It is considered that the ingestion of groundwater or surface water is unlikely. While it is considered unlikely that the surface water or groundwater would be used for primary recreation, there is a potential exposure pathway and therefore dermal contact and ingestion of the surface water should be considered.

5.1.4 Receptors

Potential receptors of environmental impacts present within the site which will require to be addressed with respect to the suitability of the site for the proposed industrial land use include:

- Future industrial site users and temporary occupants of the site;

- Excavation/construction/maintenance workers conducting future civil works as part of site establishment and ongoing future maintenance;
- Current and potential future mining workers below and surrounding the site;
- Neighbouring site users, noting that the areas surrounding the site are generally vacant bushland or mining related land (i.e. low potential for exposure by sensitive human receptors);
- Surrounding users of groundwater, noting that registered users of groundwater within 1km of the site are limited to monitoring bores only;
- Terrestrial flora and fauna, noting that impacts to these receptors are being assessed by others as part of an EIS; and
- Aquatic flora and fauna, noting that impacts to these receptors are being assessed by others as part of an EIS.

The E2 Environmental Conservation Area in the northern portion of the site represents a historical receptor, with surface water representing the primary pathway of concern.

5.1.5 Preferential Pathways

For the purpose of this assessment, preferential pathways are natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gases. Man-made preferential pathways may occur at the site associated with excavated and backfilled areas and within underground services infrastructure potentially installed below the site.

Fill materials are anticipated to have a higher permeability than the underlying natural soil and/or bedrock. Commonly, material used to backfill services trenches and features such as former drainage channels is less compacted than the surrounding soil profile and is therefore of higher permeability. This may promote vertical and/or lateral movement or waters.

The burial pits are also anticipated to have a higher permeability than surrounding native soils and bedrock and as such may be a preferential pathway for water infiltration or vapour accumulation. The buried waste, including poultry carcasses, was likely pushed into an excavation and covered with soil, with very little compaction occurring. Furthermore, overtime, it is likely the poultry carcasses would have compressed and/or decayed leaving void space, increasing the permeability of the pits. Recent capping of the burial pits may have reduced the potential for water to infiltrate, but also for vapour to escape.

Historical reports suggest the presence of a perched aquifer upon underlying bedrock. Perched water migration may have preferentially been on top of the rock layer, with the exception of any vertical migration pathways created as a result of mine subsidence.

The surface water bodies which intersect the site are likely to have been a historical preferential pathway for migration of contaminants which were entrained in surface water runoff. While the onsite creeks were noted to be dry during the JBS&G investigations in 2017 and 2018, erosion was identified within portions of the creek, which is evidence that significant water flows occur through the site during substantial rain events.

Underground coal mining is known to have occurred beneath and surrounding the site. These works are likely within the region of the true groundwater and as such may be a preferential pathway for groundwater flow.

5.1.6 Data Gaps

Based upon consideration of NAA (2013), *Contaminated Land Due Diligence Assessment* (JBS&G 2017) and JBS&G (2018), 248 sampling locations have been established across the site. Based upon an AS4482.1 recommended sampling density of 11 points / hectare and a total area of

approximately 220 hectares, the combined NAA/JBS&G sampling density represents approximately 10.3% of the density which would be required to meet default AS4482.1 recommendations based upon a square grid-based sampling program.

The following table provides a summary of the data collected prior to this report for each identified area of concern. Comment has been made with respect to whether data gaps are critical for the preparation of a RAP based upon the position that the RAP should identify each of the likely broad types of contamination requiring remediation.

To date, gross contamination across the site has not been identified, although contamination issues have been identified which require remediation based on the proposed land use. The table below indicates an increased sampling density within the majority of AECs (not critical to inform the RAP), which is designed to significantly reduce data gaps and hence the risk of identifying unknown contamination during the development stage.

Table 5.2 Areas of Environmental Concern Data Gaps

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
Farms					
Farm 1	10,000	2 central locations (2 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 2	16,500	7 locations on an approximate SW-NE transect (4.25 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 3	10,000	5 locations on two general SW-NE transects (5 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 4	16,500	7 locations on a SW-NE transect (4.24 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 5	16,500	6 locations on a SW-NE transect (3.64 per hectare) Asbestos data only for JBS&G locations.	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 6 including historical AOI L1	16,500	8 random locations (4.85 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 7	10,000	3 locations west and east (3 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Contamination associated with construction and general waste identified west of sheds.	Increased sampling density in accordance with relevant guidance
Farm 8	10,000	1 location within building footprint (1 per hectare) (excluding historical	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
		AOI J and transpiration area 2)			
Farm 9	16,100	7 locations on a general N-S transect (4.35 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection and shed post preservation. NA assuming contamination limited to asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance
Farm 11	17,500	8 random locations (4.57 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria	Extent of contamination unclear. Coliform and E.Coli contamination identified at single location. Possible burial area located to the west. Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 12	14,500	8 random locations (5.52 per hectare)	Three total coliforms exceedances of NSW EPA Biosolids criteria	Extent of contamination associated with former pig farm unclear. ACM, coliform and E.Coli contamination identified. Possible nutrient contaminations associated with truck wash. Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 14	20,500	4 central locations (1.95 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. NA assuming contamination limited to asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance
Farm 15	12,100	8 locations on two SW-NE transects (6.61 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. NA assuming contamination limited to asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
Farm 16	22,800	6 locations on an approximate S-N transect (2.6 per hectare)	Criteria exceedances not identified.	Extent of contamination associated with organic waste identified within historical AOI G unclear. Possible use of hydrocarbons during shed disinfection.	Increased sampling density in accordance with relevant guidance
Farm 17	16,500	4 locations in north west/west of farm (2.42 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. NA assuming contamination limited to asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance
Farm 18	23,500	3 random locations (1.27 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. NA assuming contamination limited to asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance
Farm 19	21,800	15 gridded locations (6.88 per hectare)	Criteria exceedances not identified.	Data Gaps not identified that are critical to RAP	Increased sampling density in accordance with relevant guidance
Waste dumps					
Western Dump Area	3,500	6 random locations (17.14 per hectare)	Criteria exceedances not identified.	NA	Increased sampling density in accordance with relevant guidance
Northern dump area (including DP (2007) Historical AOI K and Z)	112,000	19 random locations (1.70 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria. ACM identified	NA	Extent of individual contaminants
Southern Dump Area A (DP,2007)	12,000	5 random locations (4.17 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria. Construction and general waste identified	NA assuming contamination limited to construction waste asbestos and biological impacts	Extent of biological contamination
Transpiration areas					
Transpiration Area 1 (DP,2007)	5,000	1 location (2 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria.	NA assuming contamination limited to nutrient impacts	Increased sampling density in accordance with relevant guidance
Transpiration Area 2 (DP,2007)	1,500	4 locations (26.67 per hectare)	Three total coliforms exceedances of	NA assuming contamination limited to	Increased sampling density in

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
			NSW EPA Biosolids criteria. Visual signs of biological waste	construction and general wastes and nutrient impacts.	accordance with relevant guidance
Ponds					
Infilled Pond 1	1,100	1 location (9.10 per hectare)	Criteria exceedances not identified, noting the ESA identified elevated E.Coli / Coliforms and the potential for unidentified demolition wastes and animal carcasses.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 2	1,150	2 locations (17.40 per hectare)	As above.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 3	3,000	3 locations (10.0 per hectare)	As above.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 4	2,000	2 locations (10.0 per hectare)	As above.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 5	800	2 locations (25.0 per hectare)	As above.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 6	3,700	3 locations (8.11 per hectare)	As above.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 7	3,700	3 locations (8.11 per hectare)	As above, noting that bonded ACM was identified in a berm adjacent to the pond.	NA assuming contamination limited to nutrient and biological impacts.	Increased sampling density in accordance with relevant guidance.
Other areas (DP,2007)					
Q (Workshop) (DP,2007)	5,100	1 location (1.96 per hectare)	Criteria exceedances not identified. Identified ACM and possible incineration material	NA assuming contamination limited to asbestos and isolated OCPs. Potential nutrient impact maybe associated with the presence of an incinerator.	Increased sampling density in accordance with relevant guidance

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
D1 (DP,2007)	1,700	1 location (5.88 per hectare)	Criteria exceedances not identified. E Coli/ Coliforms identified by NAA	NA assuming contamination limited to nutrients and biologicals	Increased sampling density in accordance with relevant guidance
D2 (DP,2007)	500	2 locations (40 per hectare)	Criteria exceedances not identified.	NA assuming contamination limited to nutrients and biologicals	Increased sampling density in accordance with relevant guidance
E4 (DP,2007)	3,000	2 locations (6.66 per hectare)	Criteria exceedances not identified	NA assuming contamination limited to asbestos and isolated OCPs.	Increased sampling density in accordance with relevant guidance
E5 (DP,2007)	1,500	4 locations (26.67 per hectare)	Criteria exceedances not identified. Visual signs of biological waste	NA assuming contamination limited biological and general waste.	Increased sampling density in accordance with relevant guidance
F1 (DP,2007)	700	5 locations (71.43 per hectare)	Criteria exceedances not identified. Construction and general waste identified	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
G (DP, 2007)	900	1 location (11.1 per hectare)	Criteria exceedances not identified. Organic waste identified	NA assuming contamination limited organic and general waste.	Increased sampling density in accordance with relevant guidance
H1 (DP,2007)	2,400	6 locations (25 per hectare)	Criteria exceedances not identified. Construction and general waste identified	NA assuming contaminations limited to asbestos and construction and general waste	Increased sampling density in accordance with relevant guidance
H2 (DP,2007)	400	3 locations (75 per hectare)	Criteria exceedances not identified. Surficial ACM identified	NA assuming contaminations limited to asbestos.	Increased sampling density in accordance with relevant guidance
I (DP,2007)	2,200	2 locations (9.10 per hectare)	Criteria exceedances not identified. Surficial ACM identified	NA assuming contaminations limited to asbestos.	Increased sampling density in accordance with relevant guidance
J (DP,2007)	300	2 locations (66.67 per hectare)	Criteria exceedances not identified. Visual signs of biological waste	NA assuming contaminations limited to nutrients and biological impacts associated with burial area	Increased sampling density in accordance with relevant guidance
Chemical Store (DP,2007)	600	2 locations (33.33 per hectare)	Criteria exceedances not identified. ACM identified by NAA, but not by JBS&G	NA assuming contaminations limited asbestos and isolated OCPs	Increased sampling density in accordance with relevant guidance
M1 (DP,2007)	3,500	4 locations in an approximate SW-NE	Criteria exceedances not identified.	NA	Extent of individual contaminants

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
		transect (11.4 per hectare)	Construction waste identified by JBS&G and organic waste identified by NAA. E Coli/ Coliforms identified by NAA		
M2 (DP,2007)	5,300	3 locations (5.6 per hectare)	Criteria exceedances not identified. Construction waste identified by JBS&G and organic waste identified by NAA	NA	Extent of individual contaminants (construction waste and asbestos, organic waste, coliform and E.coli)
L2 (DP,2007)	716	No available data	No chemical data	NA	-
L3 (DP,2007)	1210	4 locations in an approximate N-S transect (33 per hectare)	Criteria exceedances not identified.	NA	-
Y (DP, 2007)	-	No available data	No chemical data	NA assuming road based used across whole site	-
Other areas (JBS&G,2017)					
JBS&G AOI – 1	485	1 location (20.6 per hectare)	Criteria exceedances not identified. ACM identified by JBS&G	NA assuming contaminations limited to asbestos	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 2	1,317	4 locations (30.4 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 3	948	2 locations (21.1 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 4	886	1 location (11.3 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 5.1	703	1 location (14.2 per hectare)	Criteria exceedances not identified. Minor construction waste	NA assuming contaminations limited to construction waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 5.2	643	1 location (15.6 per hectare)	Criteria exceedances not identified. Minor construction waste	NA assuming contaminations limited to construction waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 7	197	2 locations (101.5 per hectare)	Criteria exceedances not identified. ACM identified by JBS&G	NA assuming contaminations limited to asbestos	Increased sampling density in accordance with relevant guidance
JBS&G AOI - 8	2,284	4 locations (17.5 per hectare)	Criteria exceedances not	NA assuming contaminations limited to asbestos	Increased sampling density in

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
			identified. ACM identified by JBS&G		accordance with relevant guidance
JBS&G AOI – 9	105	2 locations (190.5 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 10	40	2 locations (500 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 11	63	No available data	No chemical data. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 12	1,659	2 locations (6.0 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 13	202	2 locations (99.0 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 14.1	791	1 location (12.6 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction, organic and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 14.2	643	1 location (15.6 per hectare)	Criteria exceedances not identified. Assumed construction waste	NA assuming contaminations limited to construction, organic and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 14.3	580	No available data	No chemical data. Assumed construction waste	NA assuming contaminations limited to construction, organic and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 14.4	675	No available data	No chemical data. Assumed construction waste	NA assuming contaminations limited to construction, organic and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 14.5	3,070	3 locations (9.8 per hectare)	Criteria exceedances not identified. Minor construction and general waste	NA assuming contaminations limited to construction, organic and general waste	Increased sampling density in accordance with relevant guidance

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps – Critical to Inform RAP	Data Gaps – Not Critical to Inform RAP
JBS&G AOI – 14.6	858	6 samples (69.9 per hectare)	Criteria exceedances not identified. Surficial ACM identified by NAA and construction waste by JBS&G	NA assuming contaminations limited to construction and asbestos waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 15	177	1 location (56.5 per hectare)	Criteria exceedances not identified. Construction and organic waste identified	NA assuming contaminations limited to construction and organic waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 16	131	1 location (76.3 per hectare)	Criteria exceedances not identified. Visual signs of biological waste	Extent of biological waste poorly delineated to the west, south and north.	Increased sampling density in accordance with relevant guidance.
JBS&G AOI – 17	259	2 locations (77.2 per hectare)	Criteria exceedances not identified. Minor construction and general waste.	NA assuming contaminations limited to construction and general waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 18	1,440	2 locations (101.5 per hectare)	Criteria exceedances not identified. Surficial ACM identified by NAA	NA assuming contaminations limited to asbestos waste	Increased sampling density in accordance with relevant guidance
JBS&G AOI – 19	101	2 locations (101.5 per hectare)	Criteria exceedances not identified. Minor general waste.	NA assuming contaminations limited to general waste	Increased sampling density in accordance with relevant guidance

As groundwater contamination has been identified, the nature and extent of groundwater contamination must be adequately defined. At the time of reporting, JBS&G was only aware of relatively limited historical groundwater investigations in the vicinity of the northern dump area. Additional groundwater investigations will be required across the site, particularly in the vicinity of dump areas and transpiration areas. Based on the available information, it is considered that these investigations should initially focused upon perched water above the bedrock. The need to investigate the water table aquifer would be reassessed based upon the findings of the perched water investigations, noting that considering the regional hydrogeological information this aquifer is likely to occur at significant depths (i.e. limits potential for vertical migration of contamination) and have a relatively low range of beneficial uses. The water table aquifer is also likely to be depressed as a result of nearby mining activities.

Surface water data had not been collected within the last 5 years. Additional surface water data is required in order to provide an assessment of current conditions.

5.2 Sampling, Analysis and Quality Plan for Pre-Remediation Investigations

Based on the data gaps identified as part of the working and refined CSM above, a SAQP was developed for pre-remediation investigations. The SAQP for these works has been attached in **Appendix C**.

It is noted that the development and the remediation of the site is likely to be staged. As such, the completion of additional investigations in accordance with the SAQP are also likely to be staged. It is

envisaged that a high level SAQPs may be prepared (on the basis of the attached SAQP) in relation to each development stage and that the overall sampling/analysis approach is likely to change as detailed investigation data is obtained and the necessary scope of future investigations is better informed. Any revisions to the SAQP, or preparation of development stage specific SAQPs, must be endorsed by a NSW EPA accredited Site Auditor.

6. Remediation Options Assessment

6.1 Remediation Objectives

For the purposes of this RAP, the remediation objective is to render the site suitable for the proposed development. This will include the appropriate handling and management of contaminated media in the context of the proposed future development of the site.

6.2 Extent of Remediation

For the purposes of this RAP, the extent of remediation will include consideration of all contaminated environmental media across the E2 and Industrial Zoned areas (as per **Figure 2**). The southern portion of the property (zoned E4) is not part of the current development proposal and as such no remediation works are planned for this area.

The potential extent of remediation has been estimated as part of preparing this RAP on the basis of the available information. Whilst it is considered that sufficient sampling/analysis has been conducted to identify the most likely contamination issues requiring remediation, additional investigation work is required to further define the nature and extent of contamination in order to refine remediation extent estimates. The remediation extents provided should be considered preliminary only and will require revision following completion of pre-remediation investigations (see **Section 5.2**).

Preliminary waste classification assessments indicate that soil requiring remediation will most likely be classified as either General Soil Waste (GSW) or Special Waste (Asbestos) (SWA) in accordance with NSW EPA *Waste Classification Guidelines Part 1: Classifying Waste* (2014) (see **Appendix D**). Final waste classification will be completed following completion of additional investigations (see **Section 5.2**). **No soils should be removed from the site without a final waste classification.**

Based on the current data, it has been determined that numerous AECs require remediation to make the site suitable for the proposed land use. A summary of the potential extent of remediation is as follows:

- 70 separate AECs across the site are to be remediated as part of this RAP;
- The total volume of soil which is required to be excavated as part of this RAP is approximately 67,000 m^3 (in situ).

A spreadsheet showing full details regarding the AEC to be remediated, estimated excavation volume, expected waste type, and the remediation driver, has been provided in **Appendix D**. The AECs requiring remediation have been highlighted in **Figures 3, 4, 5a, 5b, 5c and 5d**. The extent of remediation has been estimated based upon the available information and should be viewed as preliminary only, with the necessary extent of remediation to be better defined through additional investigations (see **Appendix C**).

It is noted that ground gases (i.e. methane, ammonia) have been highlighted as a potential COPC for buried waste, in particular buried carcasses. While a remedial option has not been discussed specifically for this COPC, it is expected to be addressed as part of remediation of the 'Biologicals & Associated Malodourous Soils'.

At this stage, it is not anticipated that surface water, groundwater or sediments will require remediation in order to permit the proposed land use. However, this position will be reassessed following completion of pre-remediation investigations (see **Section 5.2**).

6.3 Possible Remedial Options

The approach adopted in this RAP is consistent with the preferred hierarchy of options for site clean-up and/or management provided in the ASC NEPM, which are listed as follows:

- on-site treatment so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
- off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site; or

if the above are not practicable,

- consolidation and isolation of the soil on-site by containment within a properly designed barrier; and
- removal of contaminated soil to an approved site or facility, followed where necessary, by replacement with appropriate material;

or

- where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

In addition, it is also a requirement that remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the Site undisturbed. Also, where there are large quantities of soil with low levels of contamination, alternative strategies are required to be considered or developed (NSW EPA 2017).

Consideration of each of the clean-up and/or management options is presented in **Table 6-1**.

Table 6-1 Remedial Options Screening Matrix

Option	Discussion	Conclusion
Option 1 On-site treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level.	ACM in stockpiles/surface soils/fill Handpicking of ACM within a soil matrix (such as stockpiles/surface soils/fill) is labour intensive and can be costly and time consuming. It involves laying the material out in remedial "pads" and repeated raking and hand picking until all ACM is removed. The success of the remediation method is highly dependent upon the soil type and the amount of other building rubble present within the fill. The more clayey the soil, or the more building rubble present, the harder it is to achieve validation. Given the relatively minor amount of ACM material identified requiring remediation and the potential difficulties in achieving validation of handpicked soils, this is not the preferred option.	Not the preferred option.
	Biologicals & Associated Malodourous Soils Biological impacted soils associated with disposal of poultry carcasses and general poultry raising operations may not have had sufficient oxygen and time to degrade. Treatment of these aspects may be achievable through excavation, drying and aeration to promote destruction of biological residues. Amendment may be required to assist, and subject to validation the material could then be reused within topsoil. Onsite treatment of intact carcasses however is not considered appropriate owing to the prolonged time required to break down and possible OH&S and odour issues. Based on this, on-site treatment of biological impacted soils is a possible option, excluding intact poultry carcasses.	Possible option, but not for intact poultry carcasses.
	Waste material in fill and on ground (aesthetic) The waste materials, including building rubble and poultry carcasses, in and on soils poses an aesthetic issue that cannot be treated onsite. Screening may assist to segregate waste materials for preferred management (Option 3).	Not a preferred option.
Option 2. Off-site treatment of the soil so that the contaminants are either destroyed or the associated hazards are reduced to an acceptable level, after which the soil is returned to the site.	ACM in stockpile/surface soils/fill JBS&G is unware of any suitably licensed off-site treatment facilities to treat asbestos impacted soils. This option is not appropriate.	Not a suitable option.
	Biologicals & Associated Malodourous Soils The option is technically feasible however involves duplication of transport and material handling costs, involved in removing the material to an appropriately licensed off-site treatment facility, assuming a facility licensed to treat this type of material can be identified. This option is considered not to be cost effective or sustainable, and off-site treatment facilities may not be licensed to treat these specific impacts.	Not a preferred option.
	Waste material in fill and on ground (aesthetic) The waste material poses an aesthetic issue that cannot be treated and returned to the site.	Not a suitable option.

Option	Discussion	Conclusion
Option 3. Excavation and offsite removal of the impacted material.	ACM in stockpile/surface soils/fill As the material is bonded and intact (based upon the information obtained to date), removal of ACM sheet is relatively inexpensive, easy to conduct, and the ACM can then be removed from the site. However, considering that considerable excavation and filling of the site is required for development, and encapsulation of the ACM impacted soils is possible and a more financially viable option than disposing it off-site, this is not the preferred option. This would only be considered further if ACM impacted soil was at volumes in excess of that which could be capped onsite, which is considered unlikely at this point.	Not the preferred option, but potentially required as a contingency.
	Biologicals & Associated Malodourous Soils Given the ability to treat the soil aspect of this material on site and subsequent possible reuse of treated material, to minimise off-site disposal volumes and associated costs, this option is not preferred. However, owing to the unsuitability of intact carcasses to be treated or reburied onsite, the disposal of this aspect of this material is the preferred option. Furthermore, should the preferred option (on-site treatment) for the soil be unsuccessful, or the material be considered unsuitable for reuse for reasons other than the identified impacts (e.g. geotechnically unsuitable), off-site disposal may be a suitable alternative.	Not the preferred option for the soil component, but potentially required as a contingency. Is the preferred option of intact poultry carcasses.
	Waste material in fill and on ground (aesthetic) The waste materials, including building rubble and poultry carcasses, poses an aesthetic issue that cannot be treated and returned to the site, although some screening of materials may assist in reducing the volume of material required for disposal. Some materials may also be able to be recycled, which is considered within this 'disposal' option. As such, this option is preferred.	The preferred option.
Option 4 Consolidation and isolation of the soil by on-site containment within a properly designed barrier and ongoing management.	ACM in stockpile/surface soils/fill Containment of ACM impacted material is the preferred option given the potential for considerable ACM impacted soil volumes being generated, and the development requiring considerable cut and fill to achieve the design level. The client is already aware that remediation via containment will place restrictions on the proposed redevelopment of the site (i.e. a Site Management Plan including capping requirements), as well as a legal requirement for ongoing management placed on the ultimate custodian of the land where material is contained.	The preferred option
	Biologicals & Associated Malodourous Soils Given the ability to treat the soil aspect of this material on site and subsequent possible reuse of treated material, to contain this material on-site (without any treatment) is not preferred. Furthermore, if intact poultry carcasses were reburied at the site, ground gases may be generated which would require management (through active gas controlling features) which would not be cost effective.	Not the preferred option (noting treated materials may be retained onsite)

Option	Discussion	Conclusion
	Waste material in fill and on ground (aesthetic) As some of these materials may be able to be removed for recycling, and containment may not be feasible for materials that are not able to be compacted, containment without any segregation / treatment is not the preferred option.	Not the preferred option (noting segregated materials may be reused onsite subject to geotechnical requirements and recycling considerations)

6.4 Proposed Remediation Strategy

A number of potential remediation options have been outlined in **Table 6-1** for the various impacts identified. The preferred remedial approach for the impacts comprises:

- Excavation and on-site encapsulation of identified ACM impacted AEC as per the spreadsheet provided in **Appendix D**;
- Excavation and on-site encapsulation of identified ACM, nutrient and bacteria impacted AEC (i.e. areas where all three of these contaminant groups are present) as per the spreadsheet provided in **Appendix D;**
- Onsite treatment (i.e. excavation, drying and aeration) and reuse of nutrient and bacteria only impacted AEC as per the spreadsheet provided in **Appendix D**; and
- Excavation and offsite disposal of any waste material (inclusive of intact poultry carcasses) in fill and on ground (aesthetic). Preference is for waste to be recycled at a suitable facility where practicable. Onsite reuse of this material may be considered if deemed satisfactory from a geotechnical perspective. Intact poultry carcasses are to be removed from site to negate issues with possible ground gas generation.

Unexpected finds that may arise following demolition and during remediation or bulk earthworks will also require to be addressed along similar lines, using the process presented in **Section 10**. This should also include potentially contaminated material which is generated during the Stage 1 tree clearing works and may wish to be dealt with during the Stage 2 works.

7. Remediation Action Plan

7.1 Regulatory and Planning Requirements

7.1.1 Planning Context

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

Environment Planning and Assessment Act 1979 / SEPP 55

It is understood that the client has engaged planning consultants to consider SEPP 55 Category 1 triggers related to ecological factors, planning policy and zoning. It is also understood that as the consent authority, Council will make a determination with respect to the category of remediation works in accordance with SEPP 55 as part of reviewing the DA for Stage 2 works.

Based upon the available information, JBS&G consider that the Stage 2 remediation works are likely to be classified Category 1 in accordance with SEPP 55 on the basis of the volume and area-based triggers for contaminated soil treatment (i.e. designated development trigger of treating/storing greater than 30,000m^3 of contaminated soil or disturbing more than 3 hectares of contaminated soil).

Environment Planning and Assessment Regulation 2000 – Schedule 3 Designated Development

It is understood that the client's appoint planning consultant has assumed that the remediation work is designated development and the planning application for the development has taken this into account.

Protection of the Environment Operations Act 1997

It is assumed that the designated development application process will highlight the need to obtain licensing under the *Protection of the Environment Operation Act 1997* (POEO Act 1979) and that an Environmental Protection Licence (EPL) will be required for the works.

Water Management Act 2000

Based on the CSM, it is considered unlikely that groundwater will be encountered as part of the work, and as such, a dewatering approval is unlikely to be required as part of this stage of works. It is noted that it is possible that perched water may be encountered during excavations in some areas, however, on the basis of the available information this perched water is unlikely to be sufficient to require dewatering (noting that it is unclear if the intent of the Water Management Act 2000 to control perched water dewatering).

Any future stages of work that involve groundwater dewatering will require dewatering approval from the NSW Department of Primary Industry (DPI) – Water NSW.

Protection of the Environment Operations (Waste) Regulation 2014

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the Site are not required to be licensed. Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

Provision is provided in the Regulation and EPA (2014) guidelines for the NSW EPA to approve the immobilisation of contaminants in waste (if required with unexpected finds).

Waste Classification Guidelines (EPA 2014)

All wastes generated and proposed to be disposed off-site shall be assessed, classified and managed in accordance with this guideline. Where wastes require immobilisation prior to off-site disposal (to reduce waste classifications) an immobilisation approval shall be sought in accordance with Part 2 of

this guideline. Immobilisations are only anticipated to be required if unexpected finds are encountered.

Cessnock Council, Development Control Plan, Contaminated Lands

The Council Development Control Plan (DCP) for contaminated lands[5] provides reference to SEPP 55 requirements and guidance issued by NSW EPA. SEPP 55 and NSW EPA guidance have been considered when preparing this document. With respect to the relevant guidelines noted in the DCP (points numbered to address relevant DCP guideline numbers):

1. There is indication that land is contaminated and accordingly investigations have been completed;
2. This RAP has been prepared in accordance with NSW EPA guidance. A number of reports have previously been prepared in relation to the site;
3. A Site Auditor has been engaged to review historical reports and endorse the RAP;
4. A PSI process has identified that the land is potentially contaminated and investigations have been completed;
5. A DSI process has identified that the site is not suitable for the current use in its current condition (i.e. remediation is required);
6. This RAP has been prepared with reference to SEPP 55;
7. This RAP has made reference to the guidelines noted in the DCP;
8. This RAP addresses this guideline with respect to Stage 2 works;
9. It is understood that this RAP does not relate to a proposed LEP amendment; and
10. It is understood that the land has not been identified in a DCP as being suitable for a particular use.

Development Application Requirements

In addition to the aforementioned regulatory and planning requirements reference should be made to site specific DA requirements upon issue.

Asbestos Removal Regulations and Code of Practice

The removal and disposal of asbestos will be managed in accordance with the National Occupational Health & Safety Commission (NOHSC) “Asbestos: Code of Practice and Guidance Notes”, SafeWork NSW Code of Practice – How to Manage and Control Asbestos in the Workplace, Workplace Health and Safety Regulation 2011, Safe Work Australia and NSW WorkCover Guidelines and the NSW EPA (2014) Waste Classification Guidelines (if offsite disposal is necessary).

Excavation and handling of asbestos impacted soils are required to be conducted by a Class B licensed contractor, unless subsequent investigations identify friable material at the site. The appointed contractor is required to notify NSW WorkCover at least 7 days prior to the commencement of works.

7.1.2 Requirements in Relation to Development Control Plan

The requirements of the Council DCP have been discussed in the preceding section.

[5] https://www.cessnock.nsw.gov.au/resources/file/BuildingDevel/SLUP/DCP/Part%20C/C3%20Contaminated%20Lands.pdf

8. Remediation Scope of Works

It is considered that the appointed principal contractor undertaking the Stage 2 work must provide a detailed scope of works prior to commencement in accordance with the requirements of this RAP. Based on the available information, it is likely that the remediation work will be staged and accordingly multiple stage specific scope of work documents will be required. The scope outlined below will provide the basis for the detailed scope of works.

As identified in **Section 2.1.1**, the Stage 1 vegetation clearing works are to be managed under the Stage 1 RAP, which is to be replaced by an EMP on the basis that no evidence of contamination has been identified within the proposed land clearing areas.

8.1.1 Preliminary Works

The remediation and validation works will be overseen by an appropriately qualified and experienced environmental consultant and undertaken by an appropriately licensed contractor. An appropriately qualified and experienced environmental consultant, for the purposes of this RAP, is defined as a person who has been certified under schemes which are approved by NSW EPA (e.g. Environment Institute of Australia and New Zealand accredited Certified Environmental Practitioner, Site Contamination Specialist). An appropriately licensed contractor, for the purposes of this RAP, is a contractor who holds relevant and current licenses to complete the required tasks at the site (e.g. appropriate waste transport licenses, appropriate asbestos handling removal licences).

Prior to commencing the works, a project kick-off meeting will be held on site with the Site owner, environmental consultant and all site operating sub-contractors to confirm the proposed scope of works.

All site operators will complete necessary site inductions and any required training prior to commencing work on the site.

8.1.2 Site Establishment

All safety and environmental controls are to be implemented at the commencement of Stage 2 remediation works. These controls will include, but not be limited to:

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

Environmental controls are outlined in **Section 11**.

8.1.3 Pre-Remediation Investigations

Prior to the completion of remediation works, the CSM noted in **Section 5** and the SAQP provided in **Appendix C** must be referred to. Where additional investigations are required for a specific area (i.e. a development stage), additional sampling and analysis must be completed in accordance with the SAQP and the CSM must be refined based upon the information obtained. On the basis of the refined CSM, the stage specific scope of works document may require a deviation to the preferred approaches presented in this RAP.

8.1.4 Land Clearing

Stage 1 works consists of clearing existing vegetation from the site in accordance with a Stage 1 EMP *(to be prepared)*). Stage 2 works should not commence until the Stage 1 works have been completed within a specific work area.

It should be noted that the Stage 1 works may identify unexpected contamination, which may be left in-situ or ex-situ so be managed during the Stage 2 works. If this is the case, then this material needs to be incorporated into the remedial works section documented below. If the material cannot be incorporated into the future development, owing to the volume or contamination present, then another management option (i.e. off-site disposal) should be considered.

8.1.5 Dam Dewatering

Prior to excavation of areas where onsite dams contain water, the dam water should be sampled and analysed in order to determine appropriate disposal options (e.g. onsite irrigation for dust suppression, or discharge to the local surface water body). Dam water sampling must be Council requirements for discharge into the local surface water body. The contaminants of concern should be based upon the working CSM as well as any additional data requirements stipulated by Council. Appropriate dam water discharge decisions should be made based upon Council requirements. At this stage, it is anticipated that dam water must meet ANZECC (2000) criteria for fresh water ecosystems to permit discharge into onsite waterways and that dam water must be ANZECC (2000) irrigation criteria in order to permit discharge onto soils for dust suppression purposes. Water may require treatment to meet these criteria (e.g. sand filters).

The base of the dams should be inspected following dewatering. If any evidence of contamination is observed at the base of the dams in the former of chemical drums or other unexpected potential contamination sources, the unexpected finds protocol detailed in **Section 10.1** must be implemented.

8.1.6 Remedial Works

Remedial works for each type of contaminated material are discussed below.

Excavation and On-site Encapsulation – ACM Impacted Soil

The following remedial works will be undertaken:

- Establishment of appropriate site management controls consistent with relevant requirements in **Section 11**;
- Establishment of appropriate asbestos controls for bonded ACM removal works consistent with relevant guidelines/codes as noted in **Section 11.2.3**;
- Excavation of ACM impacted soils to a level where hardstand or a suitable 0.5 m capping layer (overlain by a marker layer) can be installed as part of the final design surface;
- Removal of the residual excavated ACM impacted material for placement within a pre-prepared low-lying portion of the site which requires elevating as part of the cut and fill process of developing the site. See **Appendix A** for draft earth works plan;
- Placed ACM impacted soils should be prepared and compacted under appropriate asbestos controls for bonded ACM works consistent with relevant guidelines/codes as noted in **Section 11.2.3**;
- All final surfaces of placed and retained ACM impacted soils should be surveyed; and
- A suitable capping layer consisting of hardstand or at least 0.5 m of suitable capping (overlain by a marker layer) will be installed over all areas which retain ACM impacted soils. The final capping surface will also be surveyed.

As part of the development plans provided in **Appendix A**, figures showing the existing site grades, regrading plan, and an earth works plan (i.e. showing cut and fill) have been provided. ADW Johnson have also provided cut and fill calculations, indicating that for all six proposed development stages, a balance (filling required less materials being cut) of 355,862 m^3 of material is estimated. Based on this design balance volume and the estimated remediation volumes (as presented in **Appendix D**), there is sufficient cut and fill activity occurring as part of the redevelopment to adequately encapsulate the contaminated material onsite. It should be noted that contaminated material cannot be encapsulated beneath roadways which are to be dedicated to Council on the proposed development unless express written consent is provided by Council, and that this volume should be excluded from the balance figure quoted above at the time of this RAP (i.e. no current proposal to retain contaminated soils beneath roads which are to be dedicated to Council).

Excavation and On-site Encapsulation – ACM, Nutrient and Bacteria Impacted Soil

Owing to the presence of asbestos within this material, the soil will need to be treated in the same manner as the material listed above.

Excavation and Treatment of Biological Impacted and Malodourous Material

The following remedial works will be undertaken:

- Establishment of appropriate site management controls consistent with relevant requirements in **Section 11**;
- Excavate a portion of representative material to assess whether the material may be able to be treated and reused following the procedure below and in consideration of geotechnical suitability as required;
- If the material is suitable for reuse, excavation of biological impacted and malodourous materials is to be undertaken to a depth where the full extent of impacted/malodourous material is removed. The vertical and lateral extent of remedial excavations will be guided by JBS&G based on field observations;
- Removal of any animal remains (e.g. poultry carcasses) identified within the malodourous materials. These will be classified as putrescible waste and disposed at an appropriately licenced landfill. This will negate the need to address potential ground gas generation issues;
- Preparation of compacted soil pads for treatment of impacted soils, covered by builder's plastic to ensure preservation of underlying soils. The pads should incorporate appropriate runoff controls to manage stormwater;
- Spreading of material into windrows on the prepared compacted soil and treatment with lime by thorough mixing with soils to increase pH. A summary of soil liming and liming rates for agricultural purposes are provided on the Tasmanian Government website[6]. A recommended maximum liming rate of 7.5 kg/m^3 appears to be inferred by the information provided on this website. From previous involvement at a site requiring remediation of similarly impacted soils a liming rate of 15 kg/m^3 of hydrated lime was used for soil treatment. The remediation contractor may need to consider the liming rate used depending on soil types and conditions. To enable aeration and drying soils are to be turned between 3 and 5 times. Exposure to UV light and high pH is anticipated to reduce pathogen levels and aeration will assist in reducing odours;
- Continue the process or if appropriate amend the process should subsequent testing indicate pathogen levels and odours have not sufficiently reduced, under the guidance of JBS&G, until sampling and analysis by JBS&G confirms that pathogen levels and odours have

[6] http://dpipwe.tas.gov.au/agriculture/land-management-soils/soil-management/soil-ph-liming

reduced sufficiently. While odour validation criteria (i.e. a set value in Odour Units) will not be adopted for the treatment of soils, this material, if to be used at the surface of the site, must not be considered offensive to site users in accordance with ASC NEPM. There are no restrictions on odorous materials if placed beneath capping layers at the site. pH should also be evaluated at the end of the remediation process, and if soil is to be retained for use on the surface, consideration should be given to the site vegetation requirements. If the soil is to be placed below capping, then there is no restriction on pH levels; and

- Reinstatement, if required, using either validated imported material or filling/levelling using validated material from the site.

Excavation and Off-site Removal – Various B&D Waste Materials and Poultry Carcasses

The following remedial works will be undertaken:

- Establishment of appropriate site management controls consistent with relevant requirements in **Section 11**; and
- Sorting/screening of materials as required and loading for removal off site to appropriately licensed recycling and/or disposal facilities with appropriate material tracking documentation. As noted above, animal remains (e.g. poultry carcasses) must be removed from the site; they will be classified as putrescible waste and disposed at an appropriately licenced landfill.

8.1.7 Segregation of Impacted Soils

It is likely that the soil encountered during the Stage 2 works will vary with respect to contamination status. The detailed scope of works must include allowance for segregating soil on the basis of available analytical data as well as any visual/olfactory evidence of contamination (i.e. odour, staining, ACM) and implementing a well documented procedure for tracking the source and fate of all excavated soil. It is critical to note that mixing relatively minor volumes of different types of contaminated material (i.e. asbestos waste, putrescible waste, etc.) could result in larger volumes of soil which require higher levels of management.

8.1.8 Stockpile Management

The following procedures will be implemented with regards to stockpiled material:

- Where vegetation, soils or other materials are to be placed on the ground surface (e.g. felled trees, excavated tree stumps, soil stockpiles, gravel for roadways) the contamination status of near surface soils within the relevant area should be well understood in order to avoid the accidental generation of contaminated wastes due to an inability to segregate placed materials from underlying soils;
- No stockpiles or other materials shall be placed in close proximity to waterways (including dams or creek systems) or open excavations, on steep slopes (or other features which may cause the stockpile to become unstable), footpaths or roadways (if established during progressive development of the site) and will be away from all stormwater infrastructure (including drainage lines, stormwater pits, gutters, etc.) where possible. Where this is not possible, sediment controls will be placed over stormwater grates, or drainage systems altered, to prevent ingress of sediment into stormwater features;
- Stockpiles shall be formed with sediment control structures placed immediately down slope to protect other lands and waters from sediment pollution;
- All asbestos impacted soil will be covered with plastic; and
- Appropriate signage and barricading will be placed around stockpiles.

8.1.9 Waste classification

At this stage, it is expected that the majority of impacted soils can be reused at the site as part of the cut and fill process of development.

If, during the process, soil is not considered appropriate to remain on-site (i.e. high leachability, etc.) the soil is to be disposed off-site to an appropriately licenced landfill. To do this, the material must be waste classified on the basis of previously collected data (if applicable) or representative samples (see **Section 9.3**) which are collected from the stockpiles and submitted for laboratory analysis. Materials must be classified in accordance with NSW EPA (2014) or an appropriate exemption as created under the *Protection of the Environment Operations (Waste) Regulation 2014*.

8.1.10 Off-Site Removal of Site/Impacted Materials

Material requiring offsite disposal will be required to be removed to a facility lawfully able to receive the material. Based on the current understanding of the site, it is assumed that soil requiring remediation would most likely be classified as either GSW or SWA in accordance with NSW EPA (2014). This position is preliminary only and will be reassessed following implementation of the SAQP.

8.1.11 Imported Fill

Any materials imported on site by the remedial contractor to re-establish ground levels in remediated areas must be validated as environmentally suitable material (i.e. VENM or ENM). No recycled materials, including recycled materials supplied as 'quarried products', should be imported to site for reinstatement of remedial excavations.

8.1.12 Asbestos Management

Given that the impacted material at the site has been identified as containing asbestos, environmental, health and safety management requirements for the handling of all materials disturbed during remediation and subsequent construction activities will be based on the requirements provided for asbestos-related works in the National Occupational Health & Safety Commission (NOHSC) "Asbestos: Code of Practice and Guidance Notes", SWA 2016, Workplace Health and Safety Regulation 2011, Safe Work Australia and NSW WorkCover Guidelines and the DECCW Waste Classification Guidelines (if offsite disposal is necessary). This will include preparation of an asbestos register and associated asbestos removal control/management plan by the appointed remediation contractor/asbestos removalist.

Works are to be supervised by a Class B Asbestos licensed contractor, unless JBS&G advises that asbestos related provisions of this RAP do not apply specific portions of site. **If friable asbestos is identified, then asbestos provisions will need to be reassessed and this RAP updated.**

8.1.13 Long Term Management Plan

Following completion of remediation activities which involve onsite retention of contaminated soils, a long term management plan must be prepared in order to provide a framework for the long term management of this material. The management plan should be prepared based current NSW EPA guidance (i.e. Section 3.4.6 of NSW EPA 2017 at the time of this report). Appropriate public notification mechanisms must be established in order to ensure that potential purchasers or other interested parties are aware of the contained materials (e.g. Planning Certificate issued under the *Environmental Planning and Assessment Act 1979*, or a covenant registered under the *Conveyancing Act 1919*). A potential structure for a long term management plan is provided in **Appendix E**.

9. Validation Plan

9.1 Overview

The following sections establish the data quality objectives (DQOs) to be adopted during validation of the site remediation works. A stage specific validation plan will need to be developed as part of the stage specific detailed scope of works. The validation approach outlined below will provide the basis for the detailed scope of works.

9.2 State the Problem

Following the proposed development works, sufficient validation documentation is required to demonstrate that the identified environmental and health based risks to future use(s) have been appropriately managed.

9.2.1 Identify the Decision

The following decisions are required to be addressed during validation:

- Have impacted soils been satisfactorily capped or removed from site to make the land suitable for the proposed land use;
- Is analytical data generated by the validation works reliable?

9.2.2 Identify Inputs to the Decision?

Inputs to the decisions are:

- Field observations in relation to inspection of all excavation bases, walls and stockpiles for odours, sheen, discolouration, and other indicators of potential contamination;
- Waste classification and/or material characterisation data obtained during assessment of fill materials/soil;
- Soil validation analysis data collected from stockpiles and the base and walls of remedial excavations (where/if required);
- Materials tracking records;
- Disposal dockets and relevant documents in relation to appropriate disposal of material to be removed from the Site (if applicable) as part of the remediation works (landfill dockets, beneficial reuse/recycling dockets);
- Suitable data to ensure that containment cells over impacted soils have been appropriately constructed as per specifications (i.e. capping material, survey data proving cap thickness, etc.);
- Data quality indicators as assessed by quality assurance/quality control (QA/QC).

9.2.3 Define the Study Boundaries

The study boundaries of the site are as follows:

- The lateral extent of the works relevant to this RAP include the whole development site, the boundaries of which have indicated on **Figure 1 and 3**, and the plans of which have been provided in **Appendix A**;
- The vertical extent of the study varies between the AEC (i.e. depth to which contamination has been identified) and based on the contamination location in context of the development (i.e. cut and fill areas). Delineation works may be required to ensure that sufficient excavation has occurred to remove all impacted soils. Alternatively, if sufficient capping

material can be installed over in situ contamination, this may negate the need for excavation.

9.2.4 Develop a Decision Rule

To successfully validate the absence of unacceptable contamination within soils outside of containment areas or materials used in the proposed containment areas, the following can be completed:

- Provision of analytical validation data that meets the validation assessment criteria as presented in **Section 9.6** inclusive of levels nominated for commercial/industrial use (HIL-D) derived from the ASC NEPM. The only exception to the above is the Farm 9 area, which represents the only identified AEC within the proposed E2 area. Results for this area will be compared to criteria based upon open space / recreational use (i.e. HIL C) and areas of ecological significance (i.e. EILs/ESLs) (this has also been presented in **Section 9.6**). In addition, material shall not be classified as asbestos contaminated soil as per the meaning provided to SWA 2016/NSW WorkCover 2016 and requiring asbestos exposure management. Visual assessment will also be required to validate the removal of impacted soil, predominantly comprising ACM fragments; and
- Provision of survey levels indicating that impacted material is covered by an appropriate thickness of capping material (i.e. hardstand or 0.5m of chemically suitable soil). The capping material must the criteria as presented in **Section 9.6**. Photographic records should also be kept to verify that a marker layer is present and covers the full extent of the capping.

Where a valid data set can be generated as based on assessment of the soil within portions of the site and the potential exposure scenarios, the following statistical criteria will apply:

- The 95% upper confidence limit (UCL) average concentrations shall be below the soil criteria;
- The standard deviation of the generated data set shall be below 50% of the soil criteria; and
- The maximum concentration shall be below 250% of the soil criteria.

Existing data for chemical constituents (not asbestos) from materials remaining at the site shall also be included in analytical data sets created for the soil. The presence of remaining asbestos will be evaluated by visible surface ACM and the presence of AF/FA.

Any additional information pertaining to data gaps (arising from pre-remediation works) will need to be adequately addressed during validation.

9.2.5 Specify Limits of Decision Error

This step is to define, in statistical terms, the decision-makers acceptable error rates based on the consequences of making an incorrect decision. Two types of decision error are defined in AS4482.1-2005 'Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds':

a) Deciding that the site is acceptable when it actually is not; and

b) Deciding that the site is unacceptable when it is.

AS4482.1-2005 nominates setting limits of 5% probability of (a) type errors, and 20% probability of (b) type errors. These limits are in general accordance with suggested limits as outlined in US EPA (July 1994) 'Using the Data Quality Objectives Process in Risk Assessment'.

Each of the data sets as formed by the application of the decision rules will require to be assessed using the following relationship as provided in AS4482.1-1995 as based on the adopted limits of decision error to assess the number of sample locations required to make a decision:

$n = 6.2\ \sigma^2 / (Cs - \mu)^2$

where: n – number of samples needed

6.2 – factor derived from probability errors (a) and (b)

σ – estimated standard deviation of contaminants concentration in sampling area

Cs – acceptable limit (mg/kg)

μ – estimated average concentration in sample area (mg/kg)

This relationship will be required to be applied for each constituent in each data set to assess that a sufficient number of samples are available to meet the limits on decision error. Separate data sets shall be required to be prepared based on the data sets generated for the assessment of the soils data to the adopted assessment criteria. Consideration shall also be required to be given to rates of soil leaching and environmental protection criteria. Where the 'n' calculated is in excess of the samples available in the data set, additional samples shall require to be analysed.

This method is generally not appropriate for the assessment of data that will be generated by the validation works. Where impact is present in the materials on the site it is anticipated to related to heterogeneous sources including potential localised sources of petroleum hydrocarbons or heterogeneously distributed source materials in filling. A qualitative assessment shall be undertaken of potential decision errors associated with the data.

9.2.6 Optimising the Design for Obtaining Data

Validation is required for all remediated or altered surface soils to verify that the final site surface is suitable for the proposed land use. This may be in the form of two separate processes including:

- The provision of survey data showing where impacted material has been encapsulated including verification of the thickness of the capping layer; and
- The provision of validation sampling showing that all contaminants are below the adopted validation criteria provided in **Section 9.6**.

A visual assessment of the sampling areas will initially be completed to assess for any residual ACM fragments of deleterious material. Details of the soil sample collection densities and proposed analytical schedule are provided in **Table 9-1** below.

Table 9-1 Sample Quantification and Analytical Schedule

Item	Sampling Frequency			Analytes
	Excavation floors	Excavation walls	Materials	
Excavations formed by the removal of impacted soil	1 / 25 m^2	1 / 5 m (from each distinct horizon / material type / 1 m vertical soil profile)	N/A	To be guided based upon COPC for each AEC, as detailed in **Section 5**.
Waste classification of material requiring off-site disposal (if required).	1 / 25m^3 with a minimum 3 samples per stockpile where <75m^3. Above 75m^3, ASC NEPM guidance applies.			To be guided based upon COPC for each AEC, as detailed in **Section 5**.
Material generated by treating soils onsite	1 / 25m^3 with a minimum 3 samples per stockpile where <75m^3. Above 75m^3, ASC NEPM guidance applies.			To be guided based upon COPC for each AEC, as detailed in **Section 5**.

9.3 Soil Sampling Methodology

The soil sampling methodology shall be determined by the Field Scientist as consistent with the observations of the site sub-surface and appropriate to generate representative samples. The soil sampling method shall be consistent with the data quality indicators in **Section 9.5**.

Samples will be collected directly from the base and side of the excavation following the removal of the impacted soil, or from the excavator bucket depending on the final depth of the excavation. Re-usable equipment shall require to be decontaminated between sampling locations.

9.3.1 Soil Sample Containers

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

Collected soil samples shall be immediately transferred to sample containers of appropriate composition (glass jars) fitted with Teflon sealed lids. 500 mL samples shall be additionally collected and placed in new zip lock bags where asbestos analysis is required (i.e. sample collected following passing at least 10 L of soil through a 7 mm sieve as per ASC NEPM procedure). Sample labels shall record sample identification number and date and time of sampling. Sample containers shall be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form shall be completed and forwarded with the samples to the testing laboratory, containing the following information:

- Sample identification;
- Signature of sampler;
- Date of collection;
- Type of sample;
- Number and type of container;
- Inclusive dates of possession; and
- Signature of receiver.

9.3.2 PID Screening

Soil samples will be screened during field works using a photo-ionisation detector (PID) to assess the potential presence of VOCs including petroleum hydrocarbons. Samples obtained for PID screening will be placed in a sealed plastic bag for approximately 2 minutes to equilibrate, prior to a PID being attached to the bag. Readings will then monitored for a period of approximately 30 seconds or until values stabilise and the stabilise/highest reading will be recorded on the field sample forms. The PID will be calibrated prior to the commencement of field works and then check readings will be completed on a daily basis during the field program using suitable calibration gas. If required, the PID will be re-calibrated during the field program in accordance with manufacturer's instructions.

9.4 Laboratory Analyses

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

9.5 Quality Assurance/Quality Control

The pre-determined Data Quality Indicators (DQIs) established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters), and are shown in **Table 9-2**.

- Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD)[7] of duplicate samples.

[7] $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C0 is the analyte concentration of the original sample. Cd is the analyte concentration of the duplicate sample

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

Table 9-2 Summary of Quality Assurance / Quality Control Program

Data Quality Objective	Frequency	Data Quality Indicator
Precision		
Blind duplicates	1 / 20 samples	<50% RPD[1]
Split duplicates	1 / 20 samples	<50% RPD[1]
Trip blank	1 / media / day (if volatiles are a significant concern)	<LOR
Rinsate blank	1 / media / day (if equipment decontamination is undertaken)	<LOR
Trip spike	1 / media / day (if volatiles are a significant concern)	70-130%
Accuracy		
Surrogate spikes	All organic samples	70-130%[2]
Matrix spikes	1 per lab batch or 20 samples	70-130%[2]
Laboratory control samples	1 per lab batch or 20 samples	70-130%[2]
Representativeness		
Sampling appropriate for media and analytes		-
Laboratory blanks	1 per lab batch	<LOR
Samples extracted and analysed within holding times.	-	180 days for phosphorus and alkali metals 28 days for other metals and nitrogen derivatives 14 days for organics soil/water except where noted above/below 7 days TRH C_{10}-C_{40} and SVOCs in water 72 hours for E. Coli and Total Coliforms
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples
Standard analytical methods used for all analyses	All Samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples
Limits of reporting appropriate and consistent	All Samples	All samples
Completeness		
Soil description and COCs completed and appropriate	All Samples	All samples

Data Quality Objective	Frequency	Data Quality Indicator
Appropriate documentation	All Samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid

[1] If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

[2] Lower recoveries may be recorded for some semi-volatile organic analyses particularly including phenols.

9.6 Validation Criteria

9.6.1 Criteria

Soil validation criteria to be applied in the validation of the site will be, as identified in the decision rules, based on the applicable human health and ecological investigation levels published in the ASC NEPM for industrial use. Concentrations in the soil will be compared against published guidelines where available.

Criteria for E.coli and Total Coliform are derived from the NSW EPA – Use and Disposal of Biosolids Products (1999) and are presented in **Table 9-3** below.

While odour validation criteria (i.e. a set value in Odour Units) will not be adopted for the onsite treatment of malodourous soils, this material, if to be used at the surface of the site, must not be considered offensive to site users in accordance with ASC NEPM. There are no restrictions on odorous materials if placed beneath capping layers at the site. Intact poultry carcases are not the remain on the site, and if identified during validation inspections, additional excavation to remove this material is required.

pH of surface soils should be managed appropriately so as not to impact site vegetation post development. Advice should be obtained from a horticulturalist with respect to whether pH levels pose unacceptable risks for planned vegetation communities (e.g. garden beds created as part of the proposed development).

Assessment criteria for asbestos concentrations are sourced from the NEPC 2013 and are presented in **Table 9-4** below.

It is recognised that no NSW EPA endorsed thresholds for Total Nitrogen exists for commercial/industrial use. Considering that nitrogen is ubiquitous in the natural environment, total nitrogen concentrations will be compared against site derived background concentrations to assess if elevated concentrations exist in the context of potentially significant sources of groundwater contamination. No protection of human health or the environment based criteria has been identified for nitrogen in soil. Background Total Nitrogen concentrations will be established during pre-remediation data gap works and the acceptable Total Nitrogen concentration will be based largely on risks to groundwater and multiple lines of evidence.

Consideration is also given to aesthetic aspects (including odours), consistent with the ASC NEPM. Treatment of impacted soils may result in altered pH. Validation results of this material must be consistent with AS 2159-2009.

Table 9-3 Soil Investigation Criteria for Commercial/Industrial Land Use (Microbiological)

Analyte	Limit of Reporting	Health Investigation/ Screening Levels Commercial/Industrial Open Space
E.coli*	10 cfu/g	100 MPN/g
Total Coliforms*	10 cfu/g	1000 MPN/g

* NSW EPA 1997 Environmental Guidelines – Use and Disposal of Biosoilds – Stabilisation Grade A Biosolids

Table 9-4 Health Based Asbestos in Soil Criteria

	Limit of Reporting	Laboratory Method	Health Investigation/ Screening Levels Commercial/Industrial
Asbestos (<0.1 m bgs)	N/A	N/A	No asbestos capable of being detected via visual inspection.
AF/FA (<0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	0.001%
Bonded ACM (>0.1 m)	0.1 g/kg	PLM / Dispersion Staining	0.05%
AF/FA (>0.1 m bgs)	0.1 g/kg	PLM / Dispersion Staining	0.001%
Other contaminants (as identified in **Section 5**)	Numerous	Numerous	ASC NEPM HIL D and HSL D criteria ASC NEPM EILs and ESLs

The only exception to the above is the Farm 9 area, which represents the only identified AEC within the proposed E2 area. Results for this area will be compared to criteria based upon open space / recreational use (i.e. HIL/HSL C) and areas of ecological significance (i.e. EILs/ESLs).

If additional contamination is identified during the pre-remediation sampling, which is not consistent with previous findings, then additional criteria will need to be provided. This may include criteria for surface and groundwaters.

9.7 Reporting

9.7.1 Validation Report

A validation report(s) shall be prepared at the completion of the remediation works for each stage. This report shall:

- Update relevant portions of the site description and CSM as prepared in this RAP relevant to the validation assessment footprint;
- Present all sampling field notes and laboratory data including calibration certificates for field monitoring equipment, environmental monitoring etc.;
- Undertake an assessment of QA/QC of analytical data generated by the works and identify data that is reliable for use in characterising the applicable portion of the Site;
- Sort data into data sets as required by the decision rules;
- Assess whether sufficient data has been obtained to meet required limits on decision error;
- Undertake assessment to the decision rules and identify any environmental data which causes decision rules to be failed;
- Provide a summary of waste disposal activities and volumes of waste removed from the relevant portions of the Site including supply of all waste disposal dockets confirming final waste disposal/landfill destination;
- Provide a summary of any material importation activities, including material source, type, assessment of suitability, approximate quantities, date of importation and final placement location;
- Identify the requirements for the long term Environmental Management Plan (where appropriate) including inclusion of a survey clearly identifying the extent of the retained impacted material and associated capping; and
- Provide a comment on the suitability of the site for the proposed use and requirements for any ongoing monitoring/management (where applicable).

10. Contingency Plan

A review of the proposed contamination-related aspects of the works associated with the development of the Site has been undertaken and have identified a number of potential risks, which are outlined in the following sections, and has led to the development of contingencies that will be implemented to ensure that the objectives of this RAP are met.

The Contingency Plan is required to be part of the Principal Contractors Remediation Environmental Management Plan (REMP) and part of the Work Health and Safety Management Plan (WHSMP), as described in **Section 11**.

10.1 Unexpected Finds

The possibility exists that hazards that have not been identified to date are present within fill materials, natural soil or encountered groundwaters at the site. The nature of hazards which may be present, and which may be discovered at the site can be detectable through visual or olfactory means, for example:

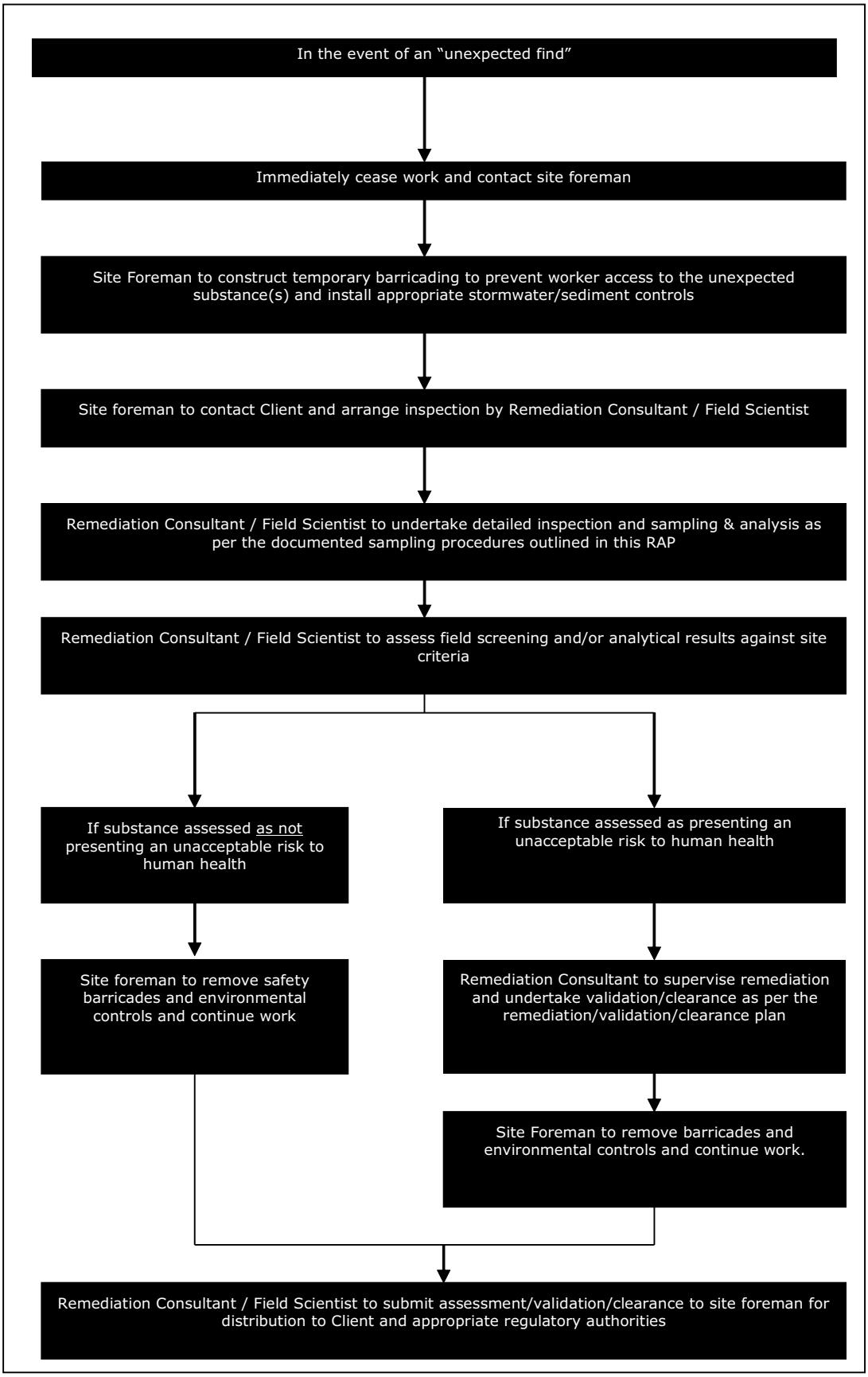
- The presence of significant aggregates of friable asbestos materials (visible);
- Evidence of animal carcasses (although initially expected to be an issue, carcasses were not discovered during JBS&G 2017 or the 2018 ESA);
- Excessive quantities of construction/demolition waste (visible);
- Hydrocarbon impacted materials (visible/odorous), including oily materials;
- Drums or USTs (visible); and
- Oily Ash and/or oily slag contaminated soils/fill materials (visible/odorous).

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances (or any other unexpected potentially hazardous substance) be identified, the procedure summarised in **Table 10-1** is to be followed.

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

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, is it at concentrations which pose an unacceptable risk to human health or the environment.

Table 10-1 Unexpected Finds Protocol



10.2 Contingency Scenarios

10.2.1 Pre-Remediation Data Gap Findings

As identified in **Section 5**, data gaps still exist with regard to contamination at the site and additional investigation works are to be conducted prior to remediation. At the conclusion of these works, or each stage of works, the remediation options should be revised if results are not consistent with the findings to date. Additional contaminants, additional contaminated media (i.e. surface water, groundwater, etc.), or an increased volume of impacted soil, may result in a remediation option becoming inappropriate. If this occurs, a re-evaluation of the remediation strategy should be conducted and this RAP should be revised.

10.2.2 Remedial Strategy Failure

In the event that the proposed remediation works do not meet the validation criteria, or if the selected remedial strategy is not able to proceed, works on site should cease and a reassessment of the remedial and validation options should be undertaken. Any deviations to the proposed remedial strategy should be coordinated to relevant stakeholders prior to preceding with the remedial works.

10.2.3 Identification of Oily Materials

In the event that oily materials are encountered, the provisions outlined in the unexpected finds protocol will be implemented, comprising inspection, testing and appropriate action as advised by the Field Scientist (**Section 10.1**).

Any suspected oily materials must be segregated from other excavated materials and placed in a designated area with appropriate odour and sediment controls until such time as appropriate assessment is completed and a methodology is confirmed for their appropriate management. In the event that the oily materials do not meet the Site Acceptance Criteria (see **Section 9.6**), then they shall be stored in a secure area for later treatment or classified and removed from the Site for treatment and/or disposal at an appropriately licensed facility.

10.2.4 Material Storage Breach

In the event that any materials storage containment controls are breached and stockpiled materials classified as asbestos contaminated soil or otherwise have escaped (or have the potential to escape), then the management controls shall be rectified and investigations undertaken to review the adequacy of the controls and any improvements implemented. The REMP (**Section 11.1.1**) shall include a documented process for identifying and responding to such incidents.

10.2.5 Emissions Complaints

Due to the nature of the activities and type of contaminants identified at the site, there is a potential for complaints to be received from members of the public relating to environmental emissions including:

- Noise and vibration arising from excavation works;
- Dust emissions arising from excavation, material handling and placement; and
- Visibly impacted surface water quality in stormwater system in proximity of the site.

Monitoring of all environmental emissions shall be undertaken during the works as detailed in the REMP (**Section 11.1.1**) and appropriate actions taken to further control emissions following receipt of a complaint. Additional controls should be detailed in the REMP (**Section 11.1.1**).

10.2.6 Severe Weather

Weather will be monitored on a daily basis via checking an internet-based weather service provider. Should severe weather that will impede the remedial works be forecast, works will stop until safe to

re-commence. All site management controls will be implemented to the extent practicable as outlined in **Section 11.1.1**)).

10.2.7 Insufficient Space for Onsite Containment

Unexpected increases of contaminated soil (owing to unexpected finds or cross contamination), or a reduction of available space to suitably cap contaminated material onsite (owing to changed design plans), may result in excess material being generated at the Site. If this occurs, reference should be made to **Section 6**, and a secondary remediation option selected based on the contaminant type and the volume of material.

11. Other Remediation Documents

11.1 Environmental Management

11.1.1 Preparation of a Remediation Environmental Management Plan

Prior to commencement of remediation works for any development stage, a Remediation Environmental Management Plan (REMP) shall be prepared by the Principal Contractor, which documents the environmental monitoring and management measures required to be implemented during the remediation and construction related activities associated with the development of the Site. The Remediation Contractor is required to have the REMP reviewed and endorsed as acceptable by the Environmental Consultant prior to the commencement of remediation works.

The REMP shall address each of the nominated items in **Section 11.1.2** and shall include the Contingency Plan, referred to in **Section 10**, above.

11.1.2 Required Elements/Procedures

An assessment of the proposed activities and the associated elements required to be incorporated into the REMP is provided in **Table 11-1**. The REMP is required to address each of the required elements and procedures in full detail and to include detailed monitoring processes and procedures, corrective actions and reporting requirements.

Table 11-1 Required Elements of the REMP

Element	Specific Minimum Requirements to be included in REMP
1. Dust and Airborne Hazard Control	Asbestos air monitoring. Provisions for dust control based on monitoring results (including water suppression). In accordance with DA/EPL conditions. Provisions for PID monitoring if significant volatiles expected (this would represent an unexpected find at this point in time). Provision of general dust/airborne hazard reduction procedures including instructions for soil truck loading, windy day management, etc.
2. Flora and Fauna	In accordance with DA conditions for Stage 2 works.
3. Heritage/Archaeological	In accordance with DA conditions for Stage 2 works.
4. Visual Impacts	Visual monitoring at site boundary. Specific colour requirements for various controls/measures, including PPE.
5. Emergency Response	As appropriate. Procedures required for spill incident response including material storage breach.
6. Noise Control	Hours of operation, consistent with the consent conditions. Boundary monitoring at commencement of work site activities with potential for environmental noise emissions. Potential noise monitoring at nearest receptors. Procedures for control and management of noise emissions, as appropriate (e.g., restricted hours).
7. Traffic	Controls on vehicle movements on public roads. Controls on transport of tar impacted materials. Reference should be made to Council requirements including loads covering and vehicle cleaning requirements.
8. Protection of Adjoining Structures	As appropriate and in accordance with any DA conditions (where relevant).
9. Odour Control	Enclosure of all potential odour generating activities (i.e. excavation of petroleum hydrocarbon contaminated soils if identified) with appropriate odour controls incorporating safeguards and monitoring. Daily monitoring of odour levels at boundary during handling of malodorous materials Procedures for addressing elevated odour monitoring results, including, but not limited to: reduction in earthworks activities within odorous material areas during adverse meteorological conditions; application of odour masking solutions at the odour source or between identified source(s) and receptor(s).
10. Handling of Contaminated Soil	Soil management (stockpiling, site access, reinstatement). Reference should be made to DA conditions.

Element	Specific Minimum Requirements to be included in REMP
	No wastewaters, chemicals or other substances harmful to the environment shall be permitted to discharge to Council's stormwater system. Only clean unpolluted water is permitted to discharge into the stormwater system.
11. Soil Storage/Placement Areas	Bunding. Signage and barricading of stockpiles. Heavy vehicle/personnel decontamination. Site drainage requirements, incorporating clean/dirty areas and modifications to existing surface water and drainage controls beneath retained pavements. Monitoring as required.
12. Sediment Control	Bunding. Collection/treatment/handling impacted sediments. Reference should be made to DA conditions.
13. Runoff of Impacted/Contaminated waters	Provision of drainage alterations during site works to preclude stormwaters from entering onsite natural water features. Capture of contaminated runoff for later treatment/disposal (i.e. containment ponds or settlement basins).
14. Operation of Site Office	As appropriate.
15. Decontamination of Heavy Equipment	As appropriate. Reference should be made to DA conditions.
16. Environmental Monitoring	Monitoring of dusts, noise, odour and fibres. Monitoring as required for vibration and water releases. Inspection checklists and field forms. Reference should be made to DA conditions.
17. Environmental Criteria	Soil criteria as sourced from RAP.
18. Material Classification	As detailed in this RAP. Materials tracking, including QA/QC inspection and sampling.
19. Community Relations Plan	Preparation of communications protocol. Nomination of specific contact persons & details and requirements for communications/response register. Reference should be made to DA requirements.
20. Incident Reporting	As appropriate, including standard form/checklist.
21. Security and Signage	Secure site perimeter. Site boundary signage.
22. EMP Review	As appropriate.
23. Training	As appropriate.
24. Contact Details	Company/personnel details, including names/phone numbers for: - Principal Contractor; - Remediation Consultant (JBS&G); - OH&S Compliance; - Environmental Compliance.

11.1.3 Certification

Prior to commencement of remediation works for any area, the early works Principal Contractor is required to have the REMP endorsed as acceptable by JBS&G.

11.1.4 Hours of Site Operation/Duration of Works

Remediation works shall be completed in accordance with the permissible hours of work and noise as nominated in the DA which is anticipated to be:

- All work generating noise is to be limited to Monday to Friday: 7:30 am to 5:30 pm and 7:30 am to 3:30 pm on Saturdays;
- Noisy works are limited to Monday to Friday: 9:00 am to 12:00 pm/1:00 to 4:30 pm and 9:00 am to 1:00 pm on Saturdays; and
- No work shall be completed on Sundays and Public Holidays.

The appointed remediation contractor will be required to include a proposed schedule of remediation works within the REMP submitted for endorsement as discussed above.

11.2 Health and Safety

11.2.1 Work Health and Safety Management Plan

A Work Health and Safety Management Plan (WHSMP) shall be prepared by the Principal Contractor prior to commencement of remediation works in any area. The WHSMP shall contain procedures and requirements that are to be implemented as a minimum during the works, in addition to the Contingency Plan, referred to in **Section 10**.

The objectives of the WHSMP will be to:

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

These objectives will be achieved by:

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

11.2.2 Additional Site-Specific Elements/Procedures

In addition to the normal construction-related matters, the WHSMP shall address the following site-specific specific hazards associated with the works relating to the management of contaminated soil:

- Under/aboveground services, including former petroleum infrastructure (if encountered);
- Use of plant and machinery within confined spaces (i.e. excavations);
- Contact to asbestos contaminated soils;
- Contact with contaminated environmental media, including requirements for specific Personal Protective Equipment (PPE); and
- Heat/cold stress.

11.2.3 Asbestos

The plan must be cognisant of the classification of the impacted materials across the extent of the site as potentially consisting of asbestos contaminated soil. Sampling and analysis of any fill materials must be undertaken to allow re-classification of materials on the site as not being asbestos contaminated soil prior to removal of requirements for working in the presence of asbestos impacted materials. The working procedures provided by Safe Work Australia and Work Cover NSW must be adhered to in the storage and handling of asbestos contaminated soil.

Air monitoring will be conducted during any ground disturbance activities within impacted soil at the site to verify that implementation of appropriate control measures have been successful at managing the risk of air borne fibre generation. Air monitoring will be undertaken in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC) Asbestos Code of Practice and Guidance Notes, in particular the *Guidance note for the estimation of airborne asbestos dust* [NOHSC 3002:2005].

Monitoring will be conducted in accordance with the NOHSC membrane filter method as approved by the National Association of Testing Authorities (NATA).

In establishing site trigger levels for evaluation of the monitoring results, reference is made to the appropriate Time Weighted Average (TWA) (NOHSC) levels:

- Amosite – 0.1 fibre/mL;
- Chrysotile – 0.1 fibre/mL;
- Crocidolite – 0.1 fibre/mL;
- Other forms of asbestos – 0.1 fibre/mL; and
- Any mixture of these, or where the composition is unknown – 0.1 fibre/mL.

With consideration to these levels the following trigger levels have been developed:

- If airborne fibre levels reach 0.01 fibres/mL the source of fibre release is to be found and rectified. Work in the affected area does not have to stop; and
- If airborne fibre levels reach 0.02 fibres/mL work in the work area should stop and additional controls measures employed. This will involve additional water spraying during excavations.

Air monitoring results will be obtained within 24 hours of sample collection on week days. While this precludes "real time" monitoring, inspections will be made during all excavation works and, if there are any visible dusts, light water sprays will be used to wet the excavation and prevent the release of any airborne asbestos fibres.

11.2.4 Additional Consideration of Chemical Contaminants

As a precautionary measure, the WHMSP should include the requirement for the plan to be revised in the event of an unexpected find of contaminated material during site remediation and/or development.

When working with contaminated materials in general, care needs to be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption. The WHSMP must detail the PPE and decontamination requirements to be followed to control the risks posed by potential exposure to chemical contaminants at the site.

11.3 Materials Tracking

It is anticipated that impacted materials will require removal between various areas of the Site, inclusive of potential movement between development stages. A Materials Compliance Management System (MCMS) shall be developed for the reuse of materials on the Site. It shall include two primary elements:

- Materials Management Guideline (material qualities); and
- Materials Tracking Plan (quantity/movement/location).

The MCMS also includes the following specific details:

- Definition of responsibilities, including the early works Principal Contractor(s), other contractor(s) and Remediation Consultant (JBS&G);
- Procedures for confirming material quality, summarising existing analytical (in-situ) data, additional analytical (ex-situ) data, additional observations to satisfy other acceptance criteria (e.g., occurrence of asbestos containing materials) and alignment of any environmental data to enable beneficial re-use of the material at the point of placement;
- Procedures for confirming where the materials have originated and what classification have they been given, noting that source depths are not critical if tied to material type, while placement depths are critical since tied to potential future exposures on the site;

- Procedures for recording where the materials have been placed (lateral & vertical limits) and inspections during placement;
- Identification of hold points where materials are proposed to be temporarily stockpiled;
- Procedures for recording the quantity of placed materials;
- Site grid squares or sub zones/site survey data (GPS/GIS), noting size of grid and elevations;
- Frequency of data collection, with consideration to both program (time) and area/material type;
- Material Tracking Records;
- Standard forms/documentation;
- Non-conformances/Unexpected Finds; and
- QA/QC.

The MCMS may also need to include or make reference to additional material placement requirements to meet design elements such as those relating to subsurface drainage or compatibility with service corridors, and engineering properties of materials to be placed, which are outside the scope of this RAP.

12. Conclusions and Recommendations

12.1 Conclusions

Overall, it is considered that the proposed actions outlined in this RAP conform to the requirements of the NSW Site Auditor Guidelines (EPA 2017) because they are: technically feasible; environmentally justifiable; and consistent with relevant laws policies and guidelines endorsed by NSW EPA.

It is noted that pre-remediation investigation works are to be undertaken prior to the implementation of this RAP. This RAP is subject to findings of this investigation being consistent with the findings to date, and if not, the RAP needs to be re-evaluated and amended.

Subject to the successful implementation of the measures described in this RAP and the recommendations below, it is concluded that the risks posed by contamination in the Stage 2 areas can be managed in such a way as to be adequately protective of human health and the environment, and that the site can be remediated to a level which is suitable for the proposed commercial / industrial use.

12.2 Recommendations

It is recommended that the processes outlined in this RAP be implemented and that the following documentation be developed and implemented to ensure the risks and impacts during remediation works are controlled in an appropriate manner:

- Development stage specific Sampling, Analysis and Quality Plan (SAQPs) which consider the SAQP framework provided in this RAP;
- Detailed Scope of Works documents for each stage of remediation to detail the development stage specific remediation and validation plan;
- A Remediation Environmental Management Plan (REMP) for each stage of the remediation, to document the monitoring and management measures required to control the environmental impacts of the works and ensure the validation protocols are being addressed; and
- A Work Health and Safety Management Plan (WHSMP) for each stage of the remediation to document the procedures to be followed to manage the risks posed to the health of the remediation workforce.

The REMP and WHSMP will require to be cognisant of the potential occurrence and storage/handling of asbestos contaminated soils on the site.

Upon completion of remediation works for each development stage, validation reports are required to be submitted by JBS&G to certify which portions of the site are suitable for the proposed use. A long term management plan (LTMP) should also be implemented at the conclusion of remediation works to manage the encapsulated impacted soils onsite into the future. The LTMP should be documented in accordance with **Appendix E.**

13. Limitations

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

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

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

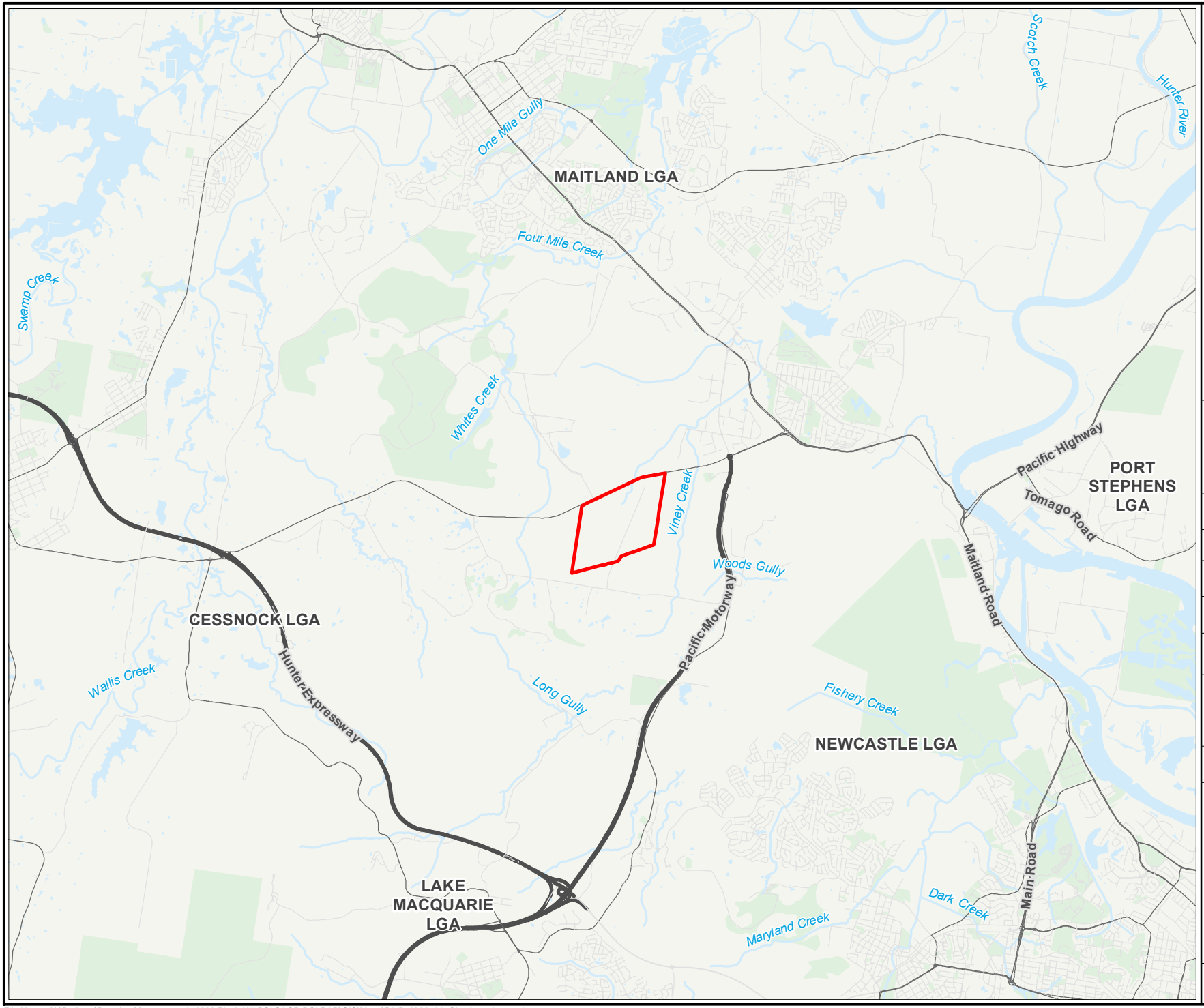
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the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

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

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

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

Figures



Legend:
Site boundary

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 30/07/2018
Drawn By: FH	Checked By: JS

Scale 1:100,000

0 1,100 2,200
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SITE LOCATION

FIGURE 1

File Name: N:\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_01_Site_Location.mxd
Reference:

Legend:
- Site boundary
- Zones

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 30/07/2018
Drawn By: FH	Checked By: JS
Scale 1:14,000	

0 160 320
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SITE ZONING

FIGURE 2

File Name: N:\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_02_Site_Layout.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- Infilled Pond
- Disturbed areas
- Concrete stockpile
- Farm extents
- Waterway

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 7/08/2018
Drawn By: FH	Checked By: SB

Scale 1:14,000

0 160 320

metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

GENERAL SITE FEATURES

FIGURE 3

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_03_Site_Features.mxd
Reference: Nearmap Imagery 2018

Legend:

Site boundary

Historic Area of Interest

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 30/07/2018
Drawn By: FH	Checked By: JS
Scale 1:14,000	

0 160 320

metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

AREAS OF ENVIRONMENTAL CONCERN (DP,2017)

FIGURE 4

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_04_Areas_of_environmental_Concern.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- JBS&G AOI
- Historic Area of Interest

Test Pit (JBS&G - 2017)

- No Waste
- Organic Waste
- Construction and General Waste
- ACM

Test Pit (Noel Arnold - 2013)

- No Waste
- Organic Waste
- Coliform and E Coli
- Construction and General Waste
- ACM

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: JS
Scale 1:5,500	

0 60 120
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

PREVIOUS
SITE INVESTIGATION
NORTH EAST

FIGURE 5a

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_05_DDP_Site_Investigation.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- JBS&G AOI
- Historic Area of Interest

Test Pit (JBS&G - 2017)

- No Waste
- Organic Waste
- Construction and General Waste
- ACM

Test Pit (Noel Arnold - 2013)

- No Waste
- Organic Waste
- Coliform and E Coli
- Construction and General Waste
- ACM

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: JS

Scale 1:5,500

0 60 120

metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

PREVIOUS SITE INVESTIGATION NORTH WEST

FIGURE 5b

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_05_DDP_Site_Investigation.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- JBS&G AOI
- Historic Area of Interest

Test Pit (JBS&G - 2017)

- No Waste
- Coliform and E Coli
- Construction and General Waste

Test Pit (Noel Arnold - 2013)

- No Waste
- Organic Waste
- Coliform and E Coli
- Construction and General Waste
- ACM

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: JS
Scale 1:5,500	

0 60 120
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

PREVIOUS
SITE INVESTIGATION
SOUTH EAST

FIGURE 5c

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_05_DDP_Site_Investigation.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- JBS&G AOI
- Historic Area of Interest

Test Pit (JBS&G - 2017)

- No Waste
- Coliform and E Coli
- Construction and General Waste
- ACM

Test Pit (Noel Arnold - 2013)

- No Waste
- Organic Waste
- Coliform and E Coli
- Construction and General Waste
- ACM

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: JS

Scale 1:5,500

0 60 120

metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

PREVIOUS
SITE INVESTIGATION
SOUTH WEST

FIGURE 5d

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_05_DDP_Site_Investigation.mxd
Reference: Nearmap Imagery 2018

Legend:

- Test Pit Locations
- Site boundary
- Farm extents

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: SB
Scale 1:2,000	

0 20 40
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SAMPLE LOCATIONS – FARM 19

FIGURE 6a

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_06a_SampleLocations_Farm19.mxd
Reference: Nearmap Imagery 2018

Legend:

- Test Pit Locations
- Site boundary
- Infilled Pond
- Farm extents

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: SB
Scale 1:2,400	

0 25 50
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SAMPLE LOCATIONS – INFILLED PONDS

FIGURE 6b

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_06b_SampleLocations_InfilledPonds.mxd
Reference: Nearmap Imagery 2018

Legend:

- Surface Smaple Locations
- Site boundary
- Farm extents

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 31/07/2018
Drawn By: FH	Checked By: SB

Scale 1:11,000

0 130 260

metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SAMPLE LOCATIONS – SURFACE SAMPLES

FIGURE 6c

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_06c_SampleLocations_Surface_Samples.mxd
Reference: Nearmap Imagery 2018

Legend:

- Site boundary
- Farm extents
- Proposed Extent of Vegetation Clearance

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 9/08/2018
Drawn By: FH	Checked By: SB
Scale 1:11,062	

0 130 260
metres

Coord. Sys. GDA 1994 MGA Zone 56

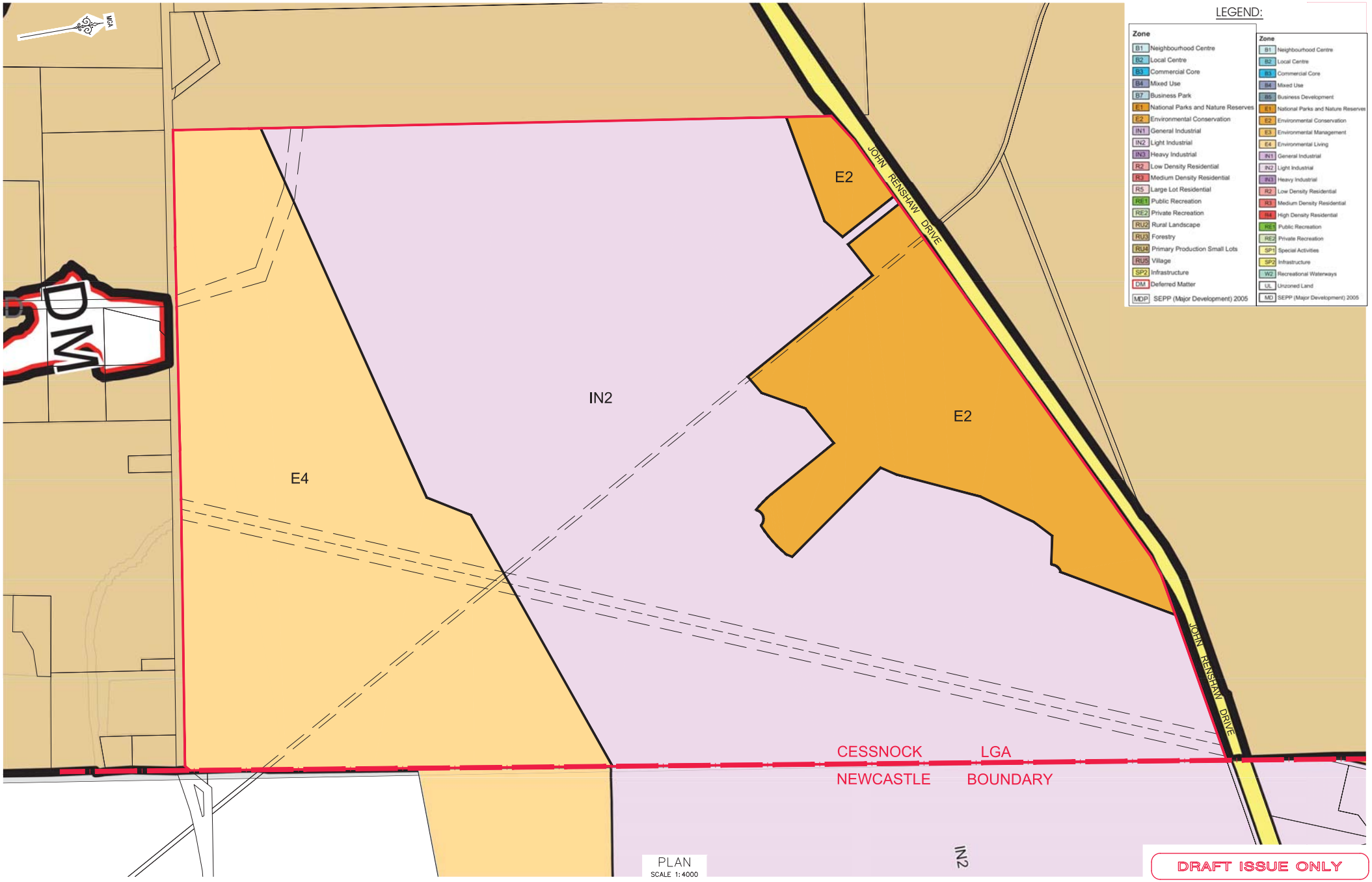
John Renshaw Drive
Black Hill, NSW

STAGE 1 WORKS – PROPOSED EXTENT OF VEGETATION CLEARING

FIGURE 7

File Name: \\008PMPMR001V001.jbsg.aust\Company Folder\JBS Environmental\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_07_Proposed_Vegetation_Clearance.mxd
Reference: Nearmap Imagery 2018

Appendix A Development Plans



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100mm AT FULL SIZE

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SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

DESIGN FILE N:\JOBNUMBER\Design\12D\

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CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson

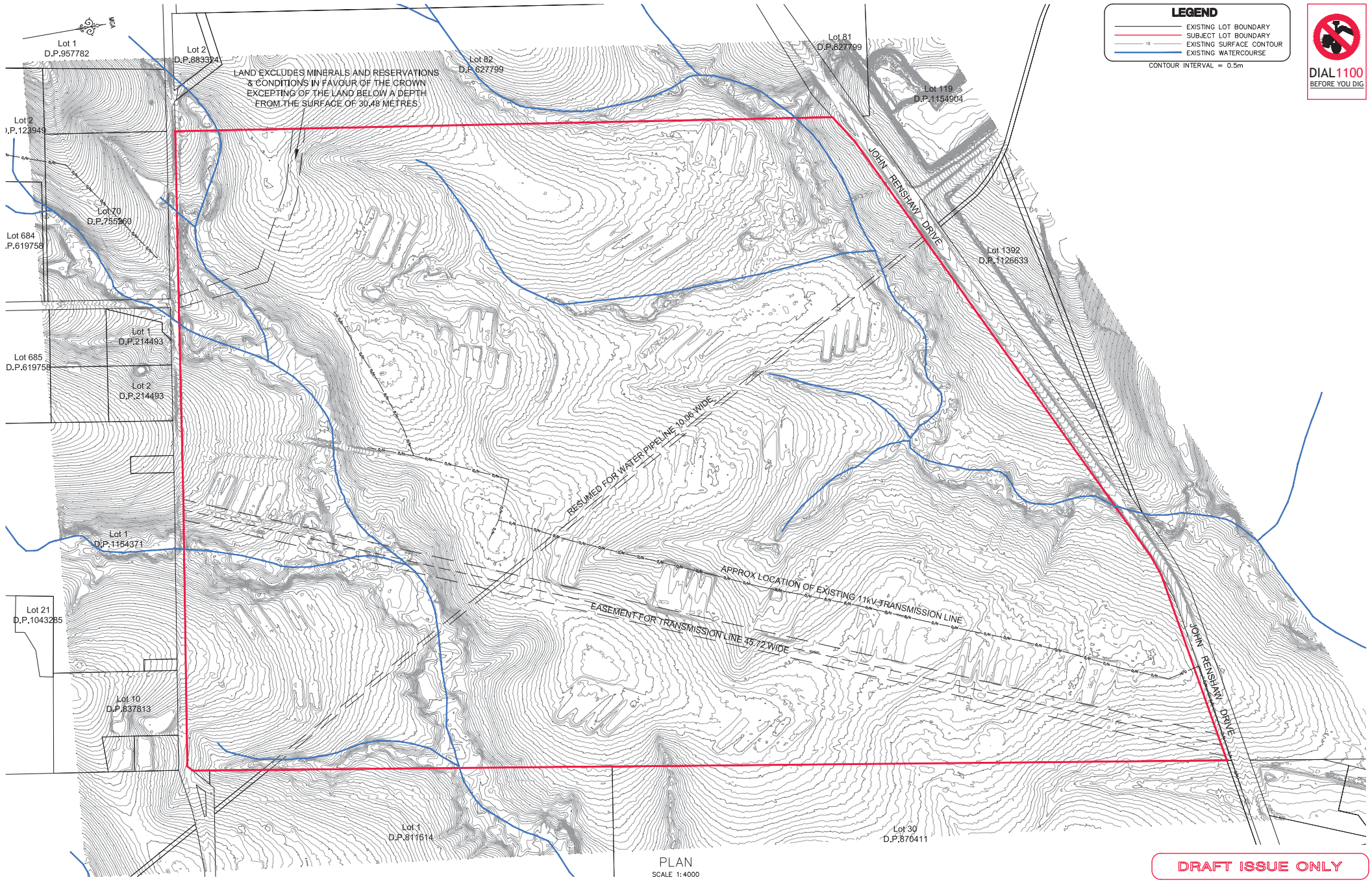
DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: TYPICAL ZONING PLAN

PROJECT No. 239590 – DISCIPLINE CENG – NUMBER 001 REV. C

Plotted By: zacj Plot Date: 25/09/17 – 17:23 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590-CENG-001(C).dwg



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100mm AT FULL SIZE

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B	14.08.2017	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	25.09.2017	UPDATE ROAD & PAD DESIGNS, ADD SERVICE SHEETS	Z.J.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

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CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson

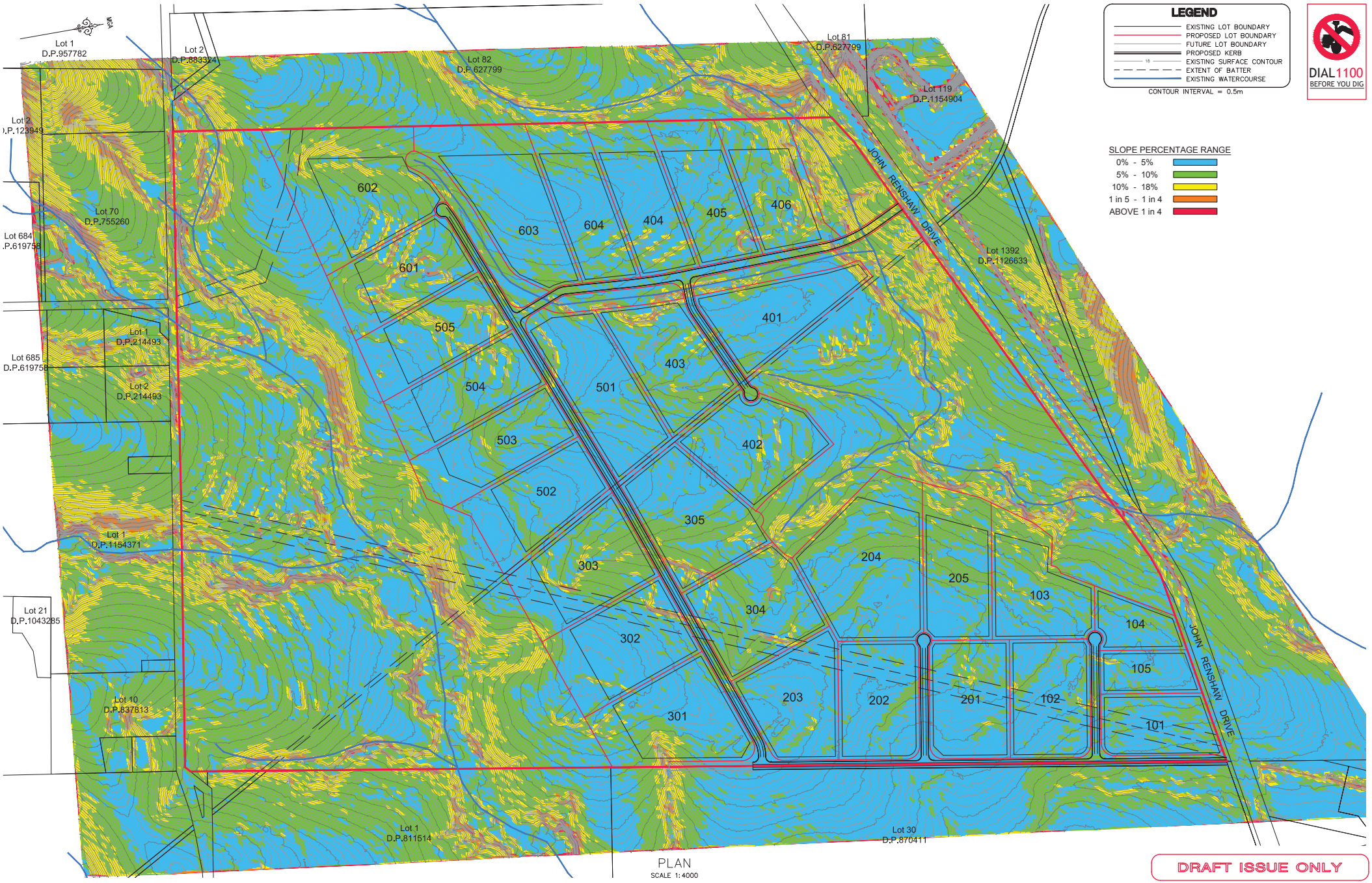
DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: OVERALL SITE PLAN (EXISTING CONTOURS)

PROJECT No.		DISCIPLINE		NUMBER	REV.
239590	-	CENG	-	002	C

Plotted By: zacj Plot Date: 25/09/17 - 17:23 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590-CENG-002(C).dwg



PLAN
SCALE 1:4000

DRAFT ISSUE ONLY

239590-CENG-003(C)

100mm AT FULL SIZE

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B	14.08.2017	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	25.09.2017	UPDATE ROAD & PAD DESIGNS, ADD SERVICE SHEETS	Z.J.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

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Plotted By: zacj Plot Date: 25/09/17 - 17:23 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590-CENG-003(C).dwg

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ABN 62 129 445 398

CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson

DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: EXISTING SITE GRADES

PROJECT No.	DISCIPLINE	NUMBER	REV.
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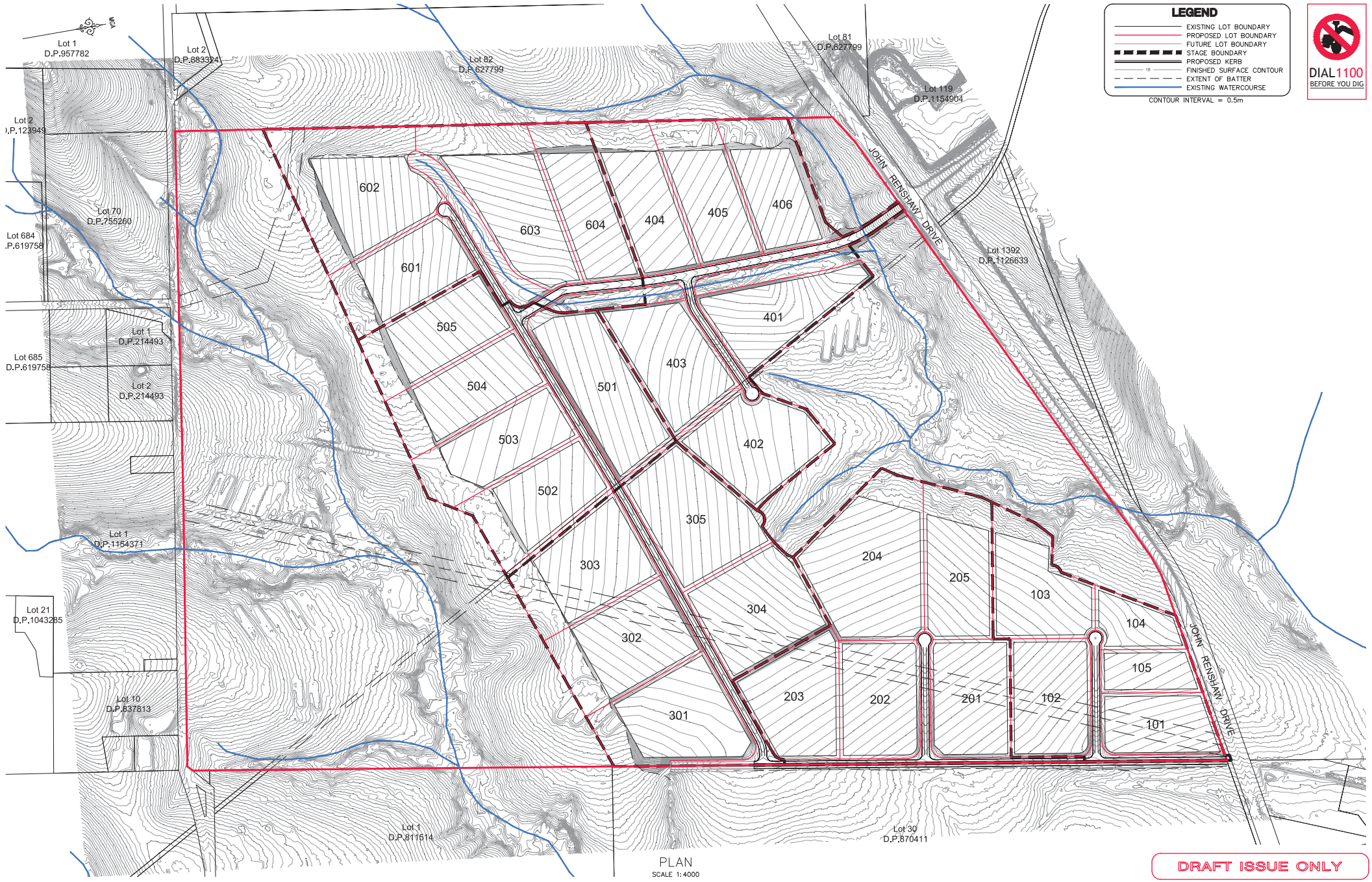

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SCALE 1:4000

DRAFT ISSUE ONLY

239590-CENG-004(C)

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B	14.08.2017	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	25.09.2017	UPDATE ROAD & PAD DESIGNS, ADD SERVICE SHEETS	Z.J.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

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CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: REGRADING PLAN (DESIGN CONTOURS)

SURVEYED	DATUM	PROJECT No.	DISCIPLINE	NUMBER	REV.
ADW Johnson	A.H.D.	239590	CENG	004	C

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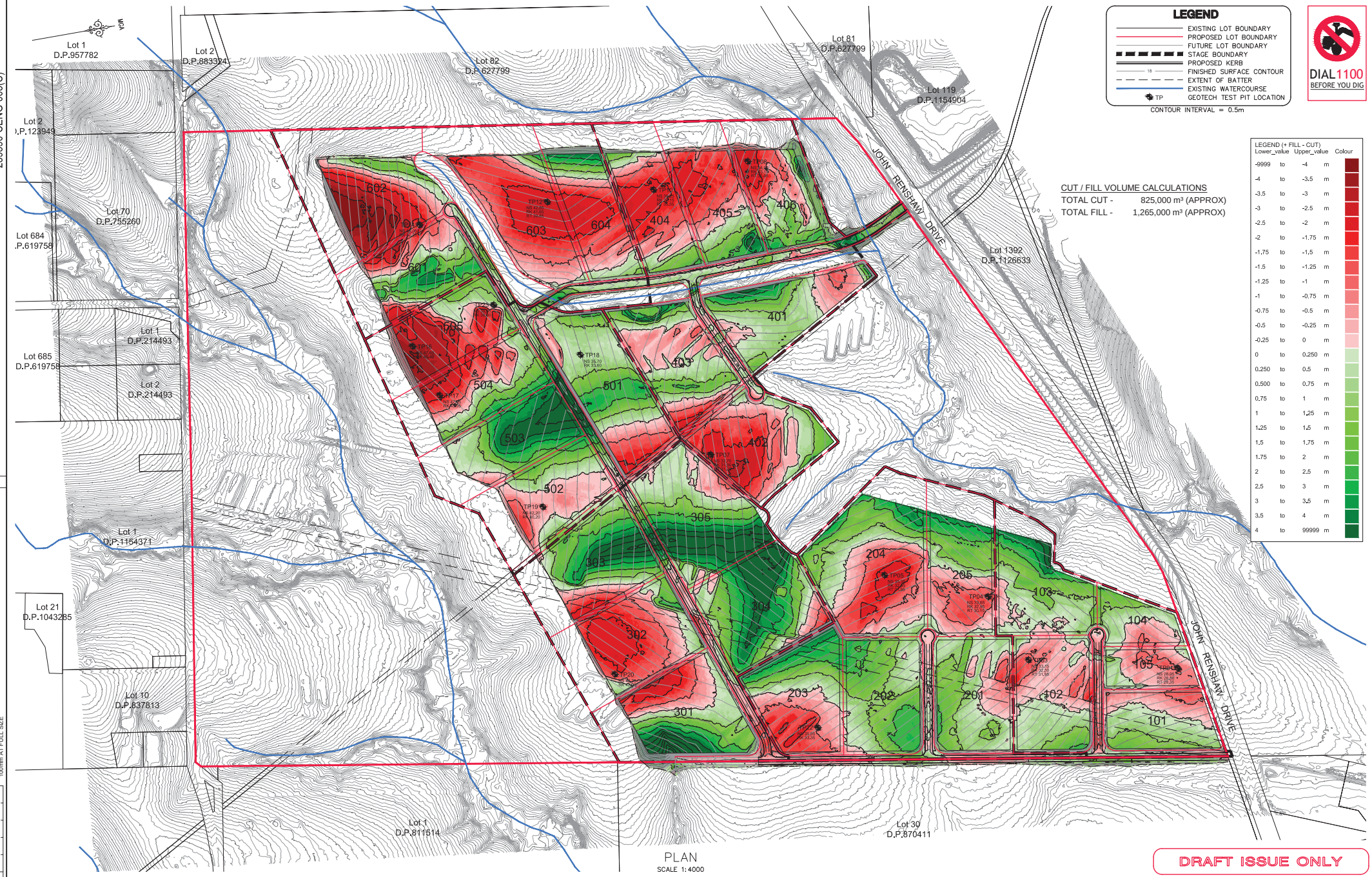

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100mm AT FULL SIZE

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B	14.08.2017	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	25.09.2017	UPDATE ROAD & PAD DESIGNS, ADD SERVICE SHEETS	Z.J.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

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ABN 62 129 445 398

CLIENT: F & F PROPERTIES

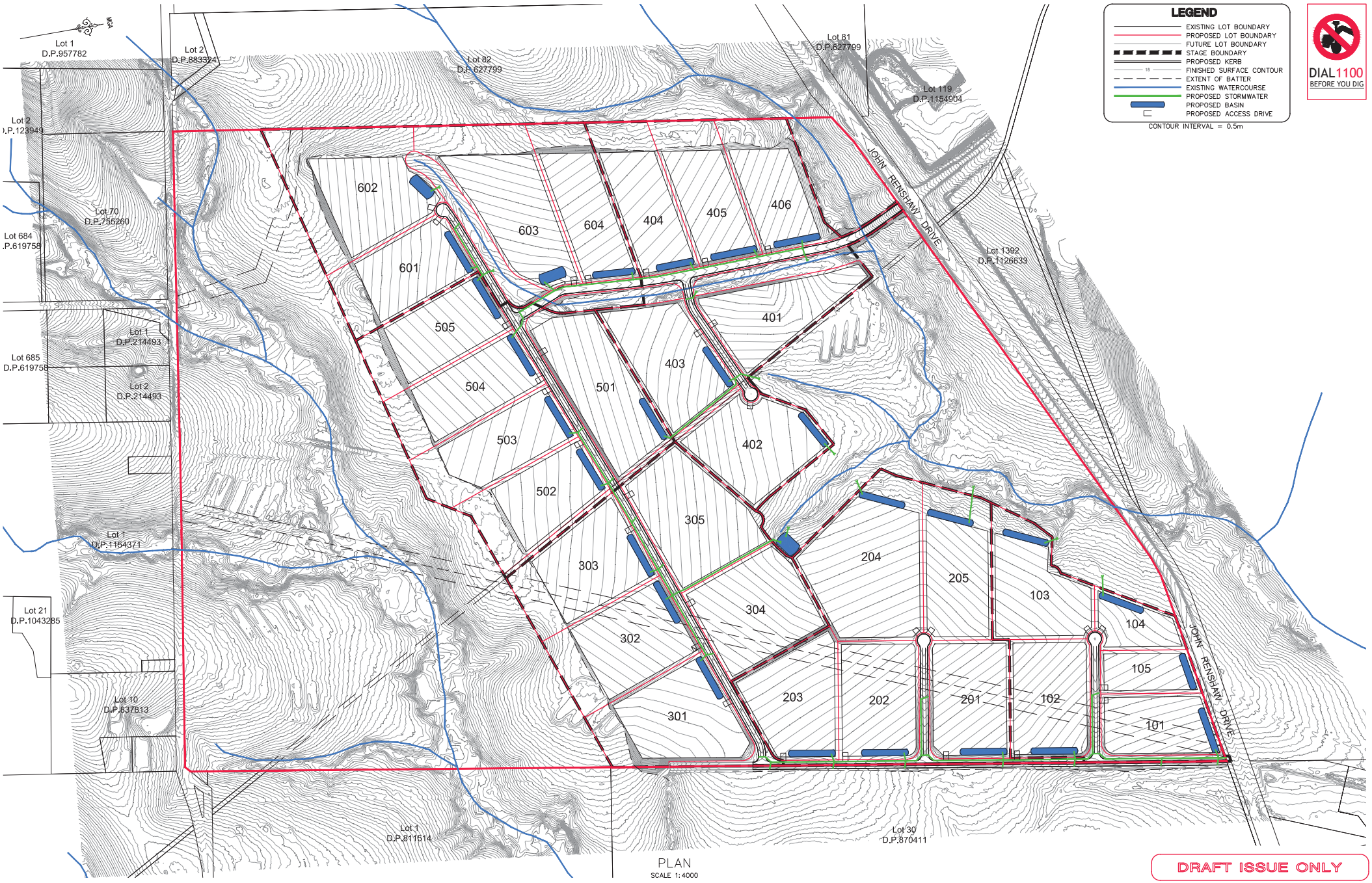
PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: EARTHWORKS PLAN

SURVEYED	DATUM	PROJECT No.	DISCIPLINE	NUMBER	REV.
ADW Johnson	A.H.D.	239590	CENG	005	C

Plotted By: zacj Plot Date: 25/09/17 - 17:24 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590-CENG-005(C).dwg



PLAN
SCALE 1:4000

DRAFT ISSUE ONLY

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B	14.08.2017	AMENDMENTS PER INSTRUCTION	Z.J.	R.K.	Z.J.	R.K.
C	25.09.2017	UPDATE ROAD & PAD DESIGNS, ADD SERVICE SHEETS	Z.J.	R.K.	Z.J.	R.K.

SCALES: 0 100 200 A1 / A3 1:4000 / 1:8000

DESIGN FILE N:\JOBNUMBER\Design\12D\

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www.adwjohnson.com.au
ABN 62 129 445 398

CLIENT: F & F PROPERTIES

PROPERTY DESCRIPTION: BLACK HILL INDUSTRIAL SUBDIVISION LOT 1131 D.P.1057179 JOHN RENSHAW DRIVE, BLACK HILL DEVELOPMENT APPLICATION

SURVEYED: ADW Johnson

DATUM: A.H.D.

PROJECT: BLACK HILL CONCEPT PLANS

PLAN TITLE: STORMWATER MANAGEMENT PLAN

PROJECT No.	DISCIPLINE	NUMBER	REV.
239590	CENG	006	C

239590-CENG-006(C)

100mm AT FULL SIZE

Plotted By: zacj Plot Date: 25/09/17 - 17:24 Cad File: N:\239590\Drawings\Engineering\Civil\CONCEPT\239590-CENG-006(C).dwg

Appendix B Douglas Partners 'Table 1' – Areas of Potential Environmental Concern (AEPC)

Table 1 – Areas of Interest

Area	Description	Photo
A	**Former Diagnostic Laboratory.** Former diagnostic laboratory, incinerator present at rear, used to incinerate lab wastes? Dead birds? No historical information provided to confirm details of incineration activities.	 *Photo 2*
	Incinerator observed to contain ash materials, glass laboratory equipment (test tubes, vaccine bottles, foil).	 *Photo 3*
	Ash materials also observed at surface behind the incinerator (including glass bottles, test tubes and foil).	 *Photo 4*
	Some building rubble (bricks/concrete) also present behind incinerator area to the rear of the incinerator appears to have been used for dumping of lab wastes.	

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
B1	**Boar Shed** Boar Shed – used for experimentation on various animals? Filling (wastes?) present at rear of shed. Discharge of drainage waters from shed via PVC pipe to creek at the rear. Pile of fibro fragments, metal, red 44 gallon drum (empty) plus scattered fill (concrete footing, timber post etc) Scattered rubbish, metal pipe, rubber matting, bricks, concrete, tarp along creek bank (building rubble)	 *Photo 5*  *Photo 6*
B2		
C	**Vaccine Lab** Former incinerator ? (incinerator currently not present). Used to incinerate dead birds from quarantine area? Ash disposal locations not known. Transpiration system present is similar to Farm 8 system. Possible contamination issues with transpiration area associated with lab activities.	 *Photo 7*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
	Vaccine lab	
D1	Bird digester tanks, details regarding contents and potential contamination not assessed.	*Photo 8*
D2	Burial trench north of Vaccine lab (contents unknown), between former sheds used to house birds for vaccine trials.	 *Photo 9*
	Farms 11, 12 and 15	
E1	Farm 12 – former pig farm. Series of small sheds in 1987 photo with only one remaining today. Former sheds comprised timber slatted floors. Green rectangular grass areas likely to be former shed areas. Truck wash located within Farm 12. Elevated contaminants/nutrients ground at the truck wash may be associated with the former pig farm activities. Sheds with timber slatted floors were likely to have a subfloor pit, which have since been filled? May contain demo waste. Subfloor pits may have been lined with asbestos materials similar to Farm 10.	 *Photo 10*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
E1 Continued	Depressions (possible burial trenches) evident west of the existing shed within E1 (Note: Farm 15 and 11 may also have been utilised for pig farming prior to chickens)	
E2	**Farm 11, 12 and 15** Former dams on pig farm. Collection of waste from pit farm and discharge to the gully? Series of dams (one large dam, several smaller dams). Some dams appear to be filled in, hummocky surface, possible demolition waste dumped. Dams likely to contain sludge/sediments from former site activities. Dam system appears to be similar to that at the Farm 10 (duck farm). Fibro fragments observed at top of large dam.	 *Photo 11*
E3	Possible burial area west of Farm 11. Potential for former pig sheds to be buried. Hummocky surface, former shed post with concrete footing and timber slats observed at surface. Abundant metal sheets, pipe, gates, mesh, car tyre, fibro fragments, timber posts and concrete footing, hummocky fill, metal pig troughs (western part of E3)	 *Photo 12*  *Photo 12A*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
E3 continued	Fibro sheet fragments (asbestos?) at surface adjacent to timber fence post (immediately south of E3) Building waste (roof sheets, timber, metal pipe/gate, wire, foam insulation, bricks, concrete, terracotta pipe within northern portion of E3	 *Photo 12C*
E4	Possible localised dump area for Farm 11. Hummocky surface, post with concrete footing at surface	 *Photo 13*
E5	Concrete footing, concrete, PVC pipe, steel wire, hummocky surface (building waste burial?)	 *Photo 12B*
F1	**Farm 14** Burial trench at rear. Mass bird burial?	 *Photo 14*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
G	**Farm 16** Dumped materials, building waste, metal gate, wire, concrete, metal, brick	 *Photo 16*
H1 **H2**	**Farm 17** Possible burial area, hummocky surface, grass covered mounds, roof sheets, wire, metal pipe etc. Building rubble, fibro fragments, metal, bricks, timber, hummocky surface	 *Photo 17*
I	**East of Farm 17** Dump area, fill stockpile, with concrete, bricks, terracotta pipe, timber posts, plastic drum, brick footing, and fibro fragments at surface. At least 2.5 m high.	 *Photo 18*
J	**Farm 8** Possible burial west of sheds, hummocky surface.	 *Photo 19*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
K	**Northern dump area** Rubber belting buried (formerly used above chicken grates).	 *Photo 20*
L1	**Farm 6** Possible burial area, hummocky surface.	 *Photo 21*
L2	Possible burial area, fill mound, demolition waste buried?	 *Photo 22*
L3	Possible burial area/trench, possible burial in auger hole.	 *Photo 23*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
M1	**North of Farm 18** Possible burial area, evidence of a series of auger holes? (depressions) may have been utilised for deceased bird burial. Also evidence of burial trench.	 *Photo 25*
	Fill mound, clay filling, litter, plastic bags and test tubes observed in auger hole (laboratory waste?)	 *Photo 25**
	Hummock surface, possible burial (near M1)	 *Photo 26*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
M2	**North of Farm 18** Possible burial area – auger holes? Auger size depressions observed.	 *Photo 27*
N1	**Southern Dump Area A** Bird burial in auger holes, numerous holes evident within wooded area, additional burial trenches also evident. Southern Dump Area A more extensive than initially thought.	 *Photo 28*
N2	Dumped and partially buried vehicle and building waste, steel, wire, timber, vehicle parts etc (possible asbestos?). A number of trenches were observed within the area, which contains regrowth	 *Photo 28A*
O	**Farm 1** former sheds (previously demolished) likely to be buried on the Farm 1 site, possibly containing asbestos materials.	 *Photo 29*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
P	**Southern Dump Area B** History of burial of formaldehyde	
Q	**Workshop** Former incinerator at rear of workshop? (no longer present), used for incineration of deceased chickens? Fibro fragments present at surface, together with metal, concrete etc. Fibro fragments, mechanical parts etc observed at surface.	 *Photo 30*  *Photo 31*
R	**Southern Dump Area** Building rubble buried within wooded area (demolition waste, metal rooting, steel, wire).	 *Photo 32*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
S	**South of Workshop** Possible burial area, hummocky surface.	 *Photo* 33
T	**Farm 10** Fill mounds adjacent to sheds, likely to contain demolition waste including asbestos materials.	 *Photo 34*
	Demolition waste may also be buried beneath concrete slab of northern most shed. Fibro fragments observed at the surface of fill, in addition to asbestos present at the former shed pits.	 *Photo 35*
	Farm 19	
U1	Hummocky surface, possible burial.	
U2	Possible burial of demolition waste, deep litter/manure?	

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
U3	Possible burial area, depression.	 *Photo 36*
V	**Farm 19** Former sheds possibly buried in this area, roof sheet evident at surface, hummocky surface.	 *Photo 37*
W	**Turkey lab** Aboveground diesel tank at front of turkey lab. Some hydrocarbon staining evident at base. Direct fuel line from tank to the turkey hatchery building (feeding heater/burner). Surface hydrocarbon spill evident	 *Photo 38*  *Photo 39*

Table 1 – Areas of Interest (Continued)

Area	Description	Photo
X	**NE of Farm 19** Dump site – trench and over land, metal parts, roof sheets cages etc, possible demolition waste.	 *Photo 40*
Y	**Farm 18** Ash materials – imported? used on many access roads across the site (ash does not appear to be from on-site incinerators).	 *Photo 41*
Z	**Northern Dump Area** Southern end of Northern Dump Area contains fibro fragments at the surface and in the vicinity of burial trenches.	 *Photo 42*

In addition to the above, recent test holes were drilled within a number of transpiration areas across the site. Many transpiration areas were observed to contain concentrated ash materials. The ash may contain elevated contaminants such as heavy metals and hydrocarbons, and therefore poses a potentail environmental liability at the site.

Based on the above information, further investigation will be required to assess environmental liabilities for the site.

Appendix C Sampling, Analysis and Quality Plan

54892_117170_Data Gap SAQP Rev 0

14 August 2018

Liam Buxton

Project Planner

Barr Property & Planning

Via email: LBuxton@barrpandp.com.au

Sampling, Analysis and Quality Plan (SAQP)

Part Lot 1131 DP1057179 – John Renshaw Drive, Black Hill, NSW

1. Introduction and Background

JBS&G Australia Pty Ltd (JBS&G) has been commissioned by Barr Property and Planning, care of Broaden Management Pty Ltd (Broden, the client), to prepare a Sampling, Analysis and Quality Plan (SAQP) in relation to data gap investigations for a portion of the former Steggles poultry farm located on John Renshaw Drive, Black Hill, NSW. The site is legally defined as part of Lot 1131 on DP 1057179 and occupies an area of approximately 220 hectares (refer to **Figure 1**).

The site is proposed for future development into an industrial estate, with general lot sizes between 2 ha and 9 ha. Stage 1 of the development is the clearing of remnant vegetation across the site, while Stage 2 is extensive cut and fill operations to sufficiently grade the site for industrial purposes.

Historical contamination investigations have been completed at the site by a range of consultants, although the latest report *Environmental Site Assessment* prepared by JBS&G (JBS&G, August 2018a), completed a data gap analysis of available previous reports (27 in total) and identified that further investigation was required for soil, surface water and groundwater as part of implementing a Remedial Action Plan (RAP).

Further information regarding the proposed development and historical contamination investigations is provided within the RAP which this SAQP has been appended to.

It is envisaged that the development and the remediation of the site is likely to be staged. As such, the completion of additional investigations in accordance with this SAQP are likely to be staged. It is envisaged that high level SAQPs may be prepared (on the basis of this SAQP) in relation to each development stage and that the overall sampling/analysis approach is likely to change as detailed investigation data is obtained and the necessary scope of future investigations is better informed. Any revisions to this SAQP, or preparation of development stage specific SAQPs, must be endorsed by a NSW EPA accredited Site Auditor.

2. Objective

The overall project objective is to remediate the site to render the area suitable for the proposed industrial development.

The objective of the data gap investigation works is to gather additional information prior to remediation of the site based on the data gaps identified in the 2018 ESA report.

3. Guidance Documents

The work described in this SAQP will be undertaken in accordance with guidance made or approved by the NSW EPA, inclusive of:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013* (the ASC NEPM);
- Office of Environment and Heritage, 1997/2011, *Guidelines for Consultants Reporting on Contaminated Sites*;
- Department of Environment and Conservation NSW, March 2007, *Guidelines for the Assessment and Management of Groundwater Contamination*;
- NSW Government, 2014, *Managing Asbestos in or on Soil*;
- NSW EPA, November 2014, *Waste Classification Guidelines Part 1: Classifying Waste*;
- NSW EPA, September 2015, *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*;
- NSW EPA, October 2016, *Addendum to the Waste Classification Guideline (2014) – Part 1: classifying waste*; and
- NSW EPA, October 2017, *Contaminated Land Management (Guidelines for the NSW Site Auditor Scheme)*.

4. Site Identification

The site details are summarised in the RAP which this SAQP is appended to.

5. Data Gap Analysis and Proposed Investigation Scope

As indicated above, the ESA report included a data gap analysis following a review of available historical data and previous investigation reports. The following table presents the remaining data gaps based upon the working CSM and refined CSM presented in the ESA report. The areas of concern referred to as well as historical investigation locations are presented in the figures within the RAP this SAQP has been appended to.

Table 5.1 on the following pages provides a summary of the data collected to date and provides comment on the required additional sampling to characterise the site for redevelopment.

Table 5.1: Data Gaps for Identified Areas of Environmental Concern

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
Farms				
Farm 1	10,000	2 central locations (2 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 2	16,500	7 locations on an approximate SW-NE transect (4.25 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 3	10,000	5 locations on two general SW-NE transects (5 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 4	16,500	7 locations on a SW-NE transect (4.24 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 5	16,500	6 locations on a SW-NE transect (3.64 per hectare) Asbestos data only for JBS&G locations.	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 6 including historical AOI L1	16,500	8 random locations (4.85 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 7	10,000	3 locations west and east (3 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Extent of contamination associated with construction and general waste identified at western rear of sheds. Increased sampling density in accordance with relevant guidance
Farm 8	10,000	1 location within building footprint (1 per hectare) (excluding historical AOI J and transpiration area 2)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 9	16,100	7 locations on a general N-S transect (4.35 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection and shed post preservation. Increased sampling density in accordance with relevant guidance
Farm 11	17,500	8 random locations (4.57 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria	Extent of contamination unclear. Coliform and E.coli contamination identified at single location. Possible burial area located to the west. Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 12	14,500	8 random locations (5.52 per hectare)	Three total coliforms exceedances of NSW EPA Biosolids criteria	Extent of contamination associated with former pig farm unclear. ACM, coliform and E.coli contamination identified. Possible nutrient contaminations associated with truck wash. Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
Farm 14	20,500	4 central locations (1.95 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 15	12,100	8 locations on two SW-NE transects (6.61 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 16	22,800	6 locations on an approximate S-N transect (2.6 per hectare)	Criteria exceedances not identified.	Extent of contamination associated with organic waste identified within historical AOI G unclear. Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 17	16,500	4 locations in north west/west of farm (2.42 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 18	23,500	3 random locations (1.27 per hectare)	Criteria exceedances not identified.	Possible use of hydrocarbons during shed disinfection. Increased sampling density in accordance with relevant guidance
Farm 19	21,800	15 gridded locations (6.90 per hectare)	Criteria exceedances not identified.	Additional investigations only required with respect to formaldehyde.
Waste dumps				
Western Dump Area	3,500	6 random locations (17.14 per hectare)	Criteria exceedances not identified.	Increased sampling density in accordance with relevant guidance
Northern dump area (including DP (2007) Historical AOI K and Z)	112,000	19 random locations (1.70 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria. ACM identified	Increased sampling density in accordance with relevant guidance to identify extent of individual contaminants
Southern Dump Area A (DP,2007)	12,000	5 random locations (4.17 per hectare)	One total coliforms exceedance of NSW EPA Biosolids criteria. Construction and general waste identified	Increased sampling density in accordance with relevant guidance to identify extent of biological contamination
Transpiration areas				
Transpiration Area 1 (DP,2007)	5,000	1 location (2 per hectare)	Criteria exceedances not identified. E Coli/Coliforms identified by NAA	Increased sampling density in accordance with relevant guidance to characterize nutrient impacts
Transpiration area 2 (DP,2007)	1,500	4 locations (26.67 per hectare)	Three total coliforms exceedances of NSW EPA Biosolids criteria. Visual signs of biological waste	Increased sampling density in accordance with relevant guidance to characterize extent of construction and general wastes and nutrient impacts.
Ponds				
Infilled Pond 1	1,100	1 location (9.10 per hectare)	Criteria exceedances not identified, noting the ESA identified elevated E.Coli / Coliforms and the potential for	Increased sampling density in accordance with relevant guidance.

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
			unidentified demolition wastes and animal carcasses.	
Infilled Pond 2	1,150	2 locations (17.40 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 3	3,000	3 locations (10.0 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 4	2,000	2 locations (10.0 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 5	800	2 locations (25.0 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 6	3,700	3 locations (8.11 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Infilled Pond 7	3,700	3 locations (8.11 per hectare)	As above.	Increased sampling density in accordance with relevant guidance.
Other areas (DP,2007)				
Q (Workshop) (DP,2007)	5,100	1 location (1.96 per hectare)	Criteria exceedances not identified. Identified ACM and possible incineration material	Increased sampling density in accordance with relevant guidance to characterise contamination from asbestos. Potential nutrient impact maybe associated with the presence of an incinerator.
D1 (DP,2007)	1,700	1 location (5.88 per hectare)	Criteria exceedances not identified. E Coli/ Coliforms identified by NAA	Increased sampling density in accordance with relevant guidance to characterize nutrients and biologicals impacts
D2 (DP,2007)	500	2 locations (40 per hectare)	Criteria exceedances not identified. E Coli/Coliforms identified by NAA	Increased sampling density in accordance with relevant guidance to characterize nutrients and biologicals impacts
E4 (DP,2007)	3,000	2 locations (6.66 per hectare)	Criteria exceedances not identified	Increased sampling density in accordance with relevant guidance
E5 (DP,2007)	1,500	4 locations (26.67 per hectare)	Criteria exceedances not identified. Visual signs of biological waste	Increased sampling density in accordance with relevant guidance to characterize biological and general waste impacts.
F1 (DP,2007)	700	5 locations (71.43 per hectare)	Criteria exceedances not identified. Construction and general waste identified	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
G (DP, 2007)	900	1 location (11.1 per hectare	Criteria exceedances not identified. Organic waste identified	Increased sampling density in accordance with relevant guidance to characterize organic and general waste impacts.
H1 (DP,2007)	2,4000	6 locations (25 per hectare)	Criteria exceedances not identified. Construction and general waste identified	Increased sampling density in accordance with relevant guidance to characterize asbestos and construction and general waste impacts
H2 (DP,2007)	400	3 locations (75 per hectare)	Criteria exceedances not identified. Surficial ACM identified	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts.

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
I (DP,2007)	2,200	2 locations (9.10 per hectare)	Criteria exceedances not identified. Surficial ACM identified	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts.
J (DP,2007)	300	2 locations (66.67 per hectare)	Criteria exceedances not identified. Visual signs of biological waste	Increased sampling density in accordance with relevant guidance to characterise nutrients and biological impacts associated with burial area
Chemical Store (DP,2007)	600	2 locations (33.33 per hectare)	Criteria exceedances not identified. ACM identified by NAA, but not by JBS&G	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts
M1 (DP,2007)	3,500	4 locations in an approximate SW-NE transect (11.4 per hectare)	Criteria exceedances not identified. Construction waste identified by JBS&G and organic waste identified by NAA	Increased sampling density in accordance with relevant guidance to identify extent of individual contaminants
M2 (DP,2007)	5,300	3 locations (5.6 per hectare)	Criteria exceedances not identified. Construction waste identified by JBS&G and organic waste identified by NAA	Increased sampling density in accordance with relevant guidance to identify extent of individual contaminants (construction waste and asbestos, organic waste, coliform and E.coli)
L2 (DP,2007)	716	No available data	No chemical data	NA
L3 (DP,2007)	1210	4 locations in an approximate N-S transect (33 per hectare)	Criteria exceedances not identified.	NA
Y (DP, 2007)	-	No available data	No chemical data	NA
Other areas (JBS&G,2017)				
JBS&G AOI – 1	485	1 location (20.6 per hectare)	Criteria exceedances not identified. ACM identified by JBS&G	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts
JBS&G AOI – 2	1,317	4 locations (30.4 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 3	948	2 locations (21.1 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 4	886	1 location (11.3 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 5.1	703	1 location (14.2 per hectare)	Criteria exceedances not identified. Minor construction waste	Increased sampling density in accordance with relevant guidance to characterize construction waste impacts
JBS&G AOI – 5.2	643	1 location (15.6 per hectare)	Criteria exceedances not identified. Minor construction waste	Increased sampling density in accordance with relevant guidance to characterize construction waste impacts
JBS&G AOI – 7	197	2 locations (101.5 per hectare)	Criteria exceedances not identified. ACM identified by JBS&G	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
JBS&G AOI - 8	2,284	4 locations (17.5 per hectare)	Criteria exceedances not identified. ACM identified by JBS&G	Increased sampling density in accordance with relevant guidance to characterize asbestos impacts
JBS&G AOI – 9	105	2 locations (190.5 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 10	40	2 locations (500 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 11	63	No available data	No chemical data. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 12	1,659	2 locations (6.0 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 13	202	2 locations (99.0 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 14.1	791	1 location (12.6 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction, organic and general waste impacts
JBS&G AOI – 14.2	643	1 location (15.6 per hectare)	Criteria exceedances not identified. Assumed construction waste	Increased sampling density in accordance with relevant guidance to characterize construction, organic and general waste impacts
JBS&G AOI – 14.3	580	No available data	No chemical data. Assumed construction waste	Increased sampling density in accordance with relevant guidance to characterize construction, organic and general waste impacts
JBS&G AOI – 14.4	675	No available data	No chemical data. Assumed construction waste	Increased sampling density in accordance with relevant guidance to characterize construction, organic and general waste impacts
JBS&G AOI – 14.5	3,070	3 locations (9.8 per hectare)	Criteria exceedances not identified. Minor construction and general waste	Increased sampling density in accordance with relevant guidance to characterize construction, organic and general waste impacts
JBS&G AOI – 14.6	858	6 samples (69.9 per hectare)	Criteria exceedances not identified. Surficial ACM identified by NAA and construction waste by JBS&G	Increased sampling density in accordance with relevant guidance to characterize construction and asbestos waste impacts
JBS&G AOI – 15	177	1 location (56.5 per hectare)	Criteria exceedances not identified. Construction and organic waste identified	Increased sampling density in accordance with relevant guidance to characterize construction and organic waste impacts
JBS&G AOI – 16	131	1 location (76.3 per hectare)	Criteria exceedances not identified. Visual	Extent of biological waste poorly delineated to the west, south and north. Increased

Area	Approximate Area (m^2)	Available Data	Previously identified impacts	Data Gaps/Recommendation
			signs of biological waste	sampling density in accordance with relevant guidance
JBS&G AOI – 17	259	2 locations (77.2 per hectare)	Criteria exceedances not identified. Minor construction and general waste.	Increased sampling density in accordance with relevant guidance to characterize construction and general waste impacts
JBS&G AOI – 18	1,440	2 locations (101.5 per hectare)	Criteria exceedances not identified. Surficial ACM identified by NAA	Increased sampling density in accordance with relevant guidance to characterize asbestos waste impacts
JBS&G AOI – 19	101	2 locations (101.5 per hectare)	Criteria exceedances not identified. Minor general waste.	Increased sampling density in accordance with relevant guidance to characterize general waste impacts

Groundwater contamination has previously been identified, although, at the time of preparing the ESA report, only relatively limited historical groundwater investigations had been completed. As such, the data gap analysis recommended that additional groundwater investigations be undertaken, particularly in the vicinity of dump areas and transpiration areas. Based on the available information, it is considered that these investigations should initially focused upon perched water above the bedrock. The need to investigate the water table aquifer would be reassessed based upon the findings of the perched water investigations, noting that considering the regional hydrogeological information this aquifer is likely to occur at significant depths (i.e. limits potential for vertical migration of contamination) and have a relatively low range of beneficial uses. The water table aquifer is also likely to be depressed as a result of nearby mining activities.

The data gap analysis had previous identified that surface water data had not been collected within the last 5 years and that additional data should be collected to assess current conditions.

6. Data Quality Objectives

Data quality objectives (DQOs) were developed for the data gap investigation, as discussed in the following sections.

6.1 State the Problem

The site is proposed to be redeveloped for an industrial land use, with a proposed E2 zone in the northern portion of the site. This historical use of the site is understood to have included chicken farming and demolition of asbestos containing structures. Historical timber and coal mining operations are also a concern. Historical contamination investigations have been undertaken, however, additional investigations are required to confirm the nature and extent of contamination.

It is critical to note here that:

- Investigations have been completed across the site to date and these investigations suggest a lack of gross and widespread contamination, with Asbestos Containing Material (ACM) in bonded form, microbiological contamination and elevated nutrients representing the primary concerns;
- The proposed development will comprise cut and fill across the majority of the site and the potential for unexpected finds following completion of the proposed development is considered to be very low.

The factors noted above have been considered when developing a judgemental sampling program for the AEC.

6.2 Identify the Decision

Based on the decision-making process for assessing urban redevelopment site detailed in NSW EPA (2017), the following decisions must be made:

- Are there any unacceptable risks to likely future on-site receptors from impacted environmental media?
- Are there any issues relating to local area background soil concentrations that exceed the appropriate soil criteria?
- Are there any additional aesthetic concerns in soil present at the site?
- Is there any evidence of, or potential for, migration of contaminants off-site?
- Is there sufficient information to prepare a development stage specific remediation plan in accordance with the Stage 2 RAP?

6.3 Identify Inputs to the Decision

Inputs to the decisions will be:

- The findings of the ESA;
- Field observations in relation to inspection of all test pits and surface samples for odours, sheen, discolouration, and other indicators of potential contamination;
- Environmental media data collected by sampling and analysis;
- Assessment criteria based upon the proposed commercial/industrial land use (as per **Section 6.8**); and
- Confirmation that data generated by field measurements and sample analysis are of a sufficient quality to allow reliable comparison to assessment criteria as undertaken by assessment of quality assurance / quality control (QA/QC) as per the data quality indicators established in **Section 6.6.**

6.4 Define the Study Boundaries

The investigation area for the purposes of this SAQP are all previously identified AEC as listed within **Table 5.1** and any additional AEC that may be identified as part of the proposed works.

6.5 Develop a Decision Rule

The decision rules adopted to answer the decisions identified in **Section 6.2** are summarised in **Table 6.1**.

Table 6.1: Summary of Decision Rules

Decision Rule to be made	Decision Rule
1. Are there any unacceptable risks to likely future on-site receptors from impacted environmental media?	Soil, surface water and groundwater analytical data will be compared against EPA endorsed criteria. Statistical analysis of the data will be completed in accordance with relevant guidance documents, as appropriate, to facilitate the decisions. The following statistical criteria will be adopted with respect to soil: Either: the reported concentrations will be below the site criteria; Or: the average site concentration for each analyte will be below the adopted site criterion; no single analyte concentration exceed 250% of the adopted site criterion; and the standard deviation of the results will be less than 50% of the site criterion. And: the 95% upper confidence limit (UCL[1]) of the average concentration for each analyte will be below the adopted site criterion. If the statistical criteria stated above

[1] *Sampling Design Guidelines*. NSW EPA. September 1995. (EPA 1995)

Decision Rule to be made	Decision Rule
	are satisfied, the answer to the decision is No. If the statistical criteria is not satisfied, the answer to the decision is Yes.
2. Are there any issues relating to the local area background soil concentrations that exceed appropriate soil criteria?	Soil analytical data will be compared against EPA endorsed criteria. If the 95% UCL of surface soils exceeded published background concentrations (ASC NEPM), the answer to the decision is Yes. Otherwise the answer to the decision is No.
3. Are there any aesthetics issues in fill soils at the site?	If there are any ACM fragments on the ground surface, any unacceptable odours or soil discolouration, the answer to the decision is Yes. Otherwise, the decision answer to the decision is No. If there are any animal carcasses on the ground surface or within buried wastes, the answer to the decision is Yes. Otherwise, the decision answer to the decision is No.
4. Is there any evidence of, or potential for, migration of contaminants off-site?	Are contaminants present within soils which would likely require additional leachable analysis? Is there evidence that groundwater contamination is present which could potentially move offsite? Is there evidence that high contaminant levels exist within surface water bodies which may migrate during rain events? If Yes, additional analysis should be undertaken, with the resulting results being compared to published background concentrations (ASC NEPM, or ANZECC/ARMCANZ 2000). If these criteria are exceeded, additional investigations may be required. Otherwise, the answer to the decision is No.
5. Is there sufficient information to prepare a development stage specific remediation plan in accordance with the Stage 2 RAP?	If the answer is Yes, then the development area specific remediation plans can be finalised in accordance with the Stage 2 RAP. If No, additional investigation works will be required.

6.6 Specify Limits of Decision Error

An assessment of quality assurance / quality control (QA/QC) shall be undertaken by calculation of data quality indicators (DQIs).

To assess the usability of the data prior to making decisions, the data is to be assessed against pre-determined DQIs established for the pilot trial as discussed below in relation to precision, accuracy, representativeness, comparability and completeness and sensitivity (PARCCS parameters), and are shown in **Table 6.2**.

- **Precision** – measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD)[2] of duplicate samples.
- **Accuracy** – measures the bias in a measurement system. The accuracy of the laboratory data that is generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the

[2] $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_0 is the analyte concentration of the original sample
C_d is the analyte concentration of the duplicate sample

site, and by using an adequate number of sample locations to characterise the site to the required accuracy.

- **Comparability** – expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted site assessment criteria.

Table 6.2: Summary of Quality Assurance / Quality Control Program

Data Quality Indicator	Frequency	Performance Target(s)
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<30% RPD[1]
Split duplicates (inter laboratory)	1 / 20 samples	<30% RPD[1]
Laboratory duplicates	1 / 20 samples	<30% RPD[1]
Accuracy		
Surrogate spike (organic analytes)	All samples	70-130%
Matrix spikes	1 per lab batch or 20 samples	70-130%
Laboratory control samples	1 per lab batch or 20 samples	70-130%
Trip spikes (each media when volatile compounds are a significant concern based on the available information)	1 per sampling event	70-130%
Trip blank (each media when volatile compounds being analysed are a significant concern based on the available information)	1 per sampling event	70-130%
Rinsate blank	1 per sampling event involving reusable sampling equipment	-
Representativeness		
Sampling appropriate for media and analytes		-
Laboratory blanks	1 per lab batch	<LOR
Samples extracted and analysed within holding times.	-	180 days for phosphorus and alkali metals 28 days for other metals and nitrogen derivatives 14 days for organics soil/water except where noted above/below 7 days TRH C_{10}-C_{40} and SVOCs in water 72 hours for E. Coli and Total Coliforms
Comparability		
Standard operating procedures for sample collection & handling	All samples	-
Standard analytical methods used for all analyses	All samples	-
Consistent field conditions, sampling staff and laboratory analysis	All samples	-
Completeness		
Soil description and COCs completed and appropriate and consistent	All samples	-
Appropriate documentation	All samples	-
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid
Sensitiveness		
Limits of reporting appropriate and consistent	All samples	-

1. If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgement will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

6.7 Optimise the Design for Obtaining Data

6.7.1 General

The following presents a framework for additional investigations based upon the available information. As stated previously, it is envisaged that development stage specific SAQP will be developed in the future. It is also envisaged that these documents will include figures showing proposed sampling locations.

6.7.2 Soil Sampling Methodology

The following soil sampling methodology will be adopted:

- Sampling will be undertaken in accordance with JBS&Gs standard operating procedures:
  - IMSP029 Soil Sampling – Test Pits;
  - IMSP027 Soil Sampling – Labelling, Security and Chain of Custody; and
  - IMSP025 Soil Sampling – Decontamination.
- The number of sampling locations to be established in each AEC is as documented within **Table 6.3.** Sample locations will be established to a depth applicable for delineating the previously identified impacts or potentially contaminating land use (i.e. natural soils beneath buried construction waste). All sample locations are envisaged to be test pits established by excavator or back hoe. An ASS4482.1 based grid sampling approach is recommended in order to minimise the potential for unexpected finds during remediation and civil works, noting that the number of samples to be analysed for each location should be based upon weight of evidence (see point below). Identifying asbestos contamination prior to any remediation and civil works is considered to be most critical based upon the available information in order to ensure that appropriate risk controls are established proactively (i.e. as opposed to reactively);
- **Table 6.3** includes Chemicals of Potential Concern (COPC). The number of samples to be analysed per location should be determined based upon field observations (i.e. visual/olfactory and PID evidence of contamination), historical results and relevant data collected for other areas as additional investigations progress. For example, if detailed investigation of Farms 2-6 shows consistent results, it may be reasonable to reduce the scope of analysis for other farm areas;
- In addition to the COPC noted in **Table 6.3**, additional investigations are also required to further assess salinity related issues. Salinity investigations are proposed to comprise representative sampling of soils at a rate of 1 location per hectare per soil unit. Samples will be analysed for electrical conductivity.

Table 6.3: Proposed Soil Investigation

Area	Approximate Area (m^2)	Proposed Additional Locations	Justification	COPC
Farms				
Farm 1	10,000	19 gridded locations (2 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 2	16,500	21 gridded locations (6 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 3	10,000	16 gridded locations (5 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 4	16,500	21 gridded locations (6 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 5	16,500	21 gridded locations (6 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 6 including historical AOI L1	16,500	20 gridded locations (7 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 7	10,000	19 gridded locations (2 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 8	10,000	20 gridded locations (1 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 9	16,100	21 gridded locations (5 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 11	17,500	8 gridded locations (20 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 12	14,500	18 gridded locations (7 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 14	20,500	27 gridded locations (4 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 15	12,100	5 gridded locations (8 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 16	22,800	28 gridded locations (5 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 17	16,500	24 gridded locations (3 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Farm 18	23,500	31 gridded locations (3 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms

Area	Approximate Area (m^2)	Proposed Additional Locations	Justification	COPC
Farm 19	21,800	17 gridded locations (15 locations previously established)	Complies with AS recommended density	TRH, BTEXN, formaldehyde, asbestos, nutrients, E. Coli and Total Coliforms
Waste dumps				
Western Dump Area	3,500	4 gridded locations (6 locations previously established)	Complies with AS recommended density	TRH, BTEX, PAHs, VOCs/SVOCs, Heavy Metals, Asbestos
Northern dump area (including DP (2007) Historical AOI K and Z)	112,000	114 gridded locations (19 locations previously established)	Complies with AS recommended density	TRH, BTEX, PAHs, VOCs/SVOCs, Heavy Metals, Asbestos
Southern Dump Area A (DP,2007)	12,000	18 gridded locations (5 locations previously established)	Complies with AS recommended density	TRH, BTEX, PAHs, VOCs/SVOCs, Heavy Metals, Asbestos
Transpiration areas				
Transpiration Area 1 (DP,2007)	5,000	12 gridded locations (1 location previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms
Transpiration area 2 (DP,2007)	1,500	3 gridded locations (4 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms
Ponds				
Infilled Pond 1	1,100	6 gridded locations (1 location previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 2	1,150	5 gridded locations (2 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 3	3,000	6 gridded locations (3 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 4	2,000	5 gridded locations (2 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 5	800	4 gridded locations (2 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 6	3,700	8 gridded locations (3 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Infilled Pond 7	3,700	8 gridded locations (3 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, metals
Other areas (DP,2007)				
Q (Workshop) (DP,2007)	5,100	13 gridded locations (1 location previously established)	Complies with AS recommended density	TRH, BTEX, PAH, metals, asbestos
D1 (DP,2007)	1,700	6 gridded locations (1 location previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms

Area	Approximate Area (m^2)	Proposed Additional Locations	Justification	COPC
D2 (DP,2007)	500	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms
E4 (DP,2007)	3,000	7 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, OCPs
E5 (DP,2007)	1,500	3 gridded locations (4 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms
F1 (DP,2007)	700	1 gridded location (5 locations previously established)	Complies with AS recommended density	Asbestos, metals
G (DP, 2007)	900	5 gridded locations (1 location previously established	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, asbestos, metals
H1 (DP,2007)	2,400	2 gridded locations (6 locations previously established)	Complies with AS recommended density	Asbestos, metals
H2 (DP,2007)	400	2 gridded locations (3 locations previously established)	Complies with AS recommended density	Asbestos
I (DP,2007)	2,200	6 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos
J (DP,2007)	300	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, asbestos, metals
Chemical Store (DP,2007)	600	4 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, TRH, OCPs
M1 (DP,2007)	3,500	6 gridded locations (4 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, asbestos, metals
M2 (DP,2007)	5,300	11 gridded locations (3 locations previously established)	Complies with AS recommended density	Nutrients, E. Coli and Total Coliforms, asbestos, metals
Other areas (JBS&G,2017)				
JBS&G AOI – 1	485	4 gridded locations (1 location previously established)	Complies with AS recommended density	Asbestos
JBS&G AOI – 2	1,317	3 gridded locations (4 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 3	948	4 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 4	886	5 gridded locations (1 location previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 5.1	703	5 gridded locations (1 location previously established)	Complies with AS recommended density	Asbestos, metals

Area	Approximate Area (m^2)	Proposed Additional Locations	Justification	COPC
JBS&G AOI – 5.2	643	5 gridded locations (1 location previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 7	197	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos
JBS&G AOI - 8	2,284	4 gridded locations (4 locations previously established)	Complies with AS recommended density	Asbestos
JBS&G AOI – 9	105	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 10	40	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 11	63	5 gridded locations (0 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 12	1,659	5 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 13	202	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 14.1	791	5 gridded locations (1 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 14.2	643	5 gridded locations (1 locations previously established)	Complies with AS recommended density	Asbestos, metals, nutrients, E. Coli and Total Coliforms
JBS&G AOI – 14.3	580	6 gridded locations (0 locations previously established)	Complies with AS recommended density	Asbestos, metals, nutrients, E. Coli and Total Coliforms
JBS&G AOI – 14.4	675	6 gridded locations (0 locations previously established)	Complies with AS recommended density	Asbestos, metals, nutrients, E. Coli and Total Coliforms
JBS&G AOI – 14.5	3,070	7 gridded locations (3 locations previously established)	Complies with AS recommended density	Asbestos, metals, nutrients, E. Coli and Total Coliforms
JBS&G AOI – 14.6	858	0 gridded locations (6 locations previously established)	Complies with AS recommended density	-
JBS&G AOI – 15	177	4 gridded locations (1 locations previously established)	Complies with AS recommended density	Asbestos, metals, nutrients, E. Coli and Total Coliforms
JBS&G AOI – 16	131	4 gridded locations (1 locations previously established)	Complies with AS recommended density	E. Coli and Total Coliforms
JBS&G AOI – 17	259	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals
JBS&G AOI – 18	1,440	5 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos

Area	Approximate Area (m^2)	Proposed Additional Locations	Justification	COPC
JBS&G AOI – 19	101	3 gridded locations (2 locations previously established)	Complies with AS recommended density	Asbestos, metals

- When attending site, sampling locations will be marked in the field using sample flags (or similar) and coordinates will be recorded using a hand-held GPS;
- Soil samples will be logged in accordance with AS1726-1993, Geotechnical Site Investigations[3];
- Hand tools will be decontaminated with Decon 90 and deionised water between sampling locations;
- Soils will be screened for contamination using visual/olfactory observations and Photo-Ionisation Detector (PID) readings;
- Soil samples will be collected at regular intervals (e.g. 0-0.1 m, 0.5-0.6 m, 1.0-1.1 m, 1.5-1.6 m, 2.0-2.1 m and every metre thereafter if applicable), changes in stratigraphy and/or where field evidence of contamination is identified; and
- Collected samples will be stored and transported in a chilled cool box to the laboratory for selected chemical analysis under chain of custody (COC) documentation.

6.7.3 Groundwater Well Installation and Sampling Methodology

The following groundwater sampling methodology will be adopted:

- Sampling will be undertaken in accordance with JBS&Gs standard operating procedures:
  - IMSO 007 – Groundwater Gauging;
  - IMSO 009 – Calibration and Decon; and
  - IMSO 010 – Groundwater Sampling.
- Groundwater investigations will be completed in accordance with **Table 6.4** below. A range has been provided for the number of wells on the basis that the groundwater investigations are completed following completion of detailed soil investigations for the relevant AEC. The need for groundwater investigations will be assessed on a case by case basis following the completion of detailed soil investigations. The assessment will consider multiple lines of evidence, the analytical results from the detailed soil investigation data, the evidence of perched water identified during the detailed soil investigations, the likely depth to groundwater and the sensitivity of groundwater receptors;

Table 6.4: Proposed Groundwater Investigation

Area	Number of Wells	General Position	Proposed Depth	COPC
Northern Dump Area	0-6 new wells	2 x NW, 1 x NE, 2 x SE, 1 x SW	To the surface of bedrock (i.e. approx. 6 m)	TRH, BTEX, formaldehyde, PAH, metals, nutrients, E. Coli and Total Coliforms, TDS
Southern Dump Area A	0-8 new wells	2 x N, 2 x E, 2 x S, 2 x W	To the surface of bedrock (i.e. approx. 6 m)	TRH, BTEX, formaldehyde, PAH, metals, nutrients, E. Coli and Total Coliforms, TDS

[3] Based upon Section 8.2.2 of ASC NEPM. Logging will be conducted for environmental purposes only and the logs will not be suitable for geotechnical purposes.

Area	Number of Wells	General Position	Proposed Depth	COPC
Western Dump Area	0-4 new wells	1 x N, 1 x E, 1 x S, 1 x W	To the surface of bedrock (i.e. approx. 6 m)	TRH, BTEX, formaldehyde, PAH, metals, nutrients, E. Coli and Total Coliforms, TDS
Transpiration Area 1	0-4 new wells	1 x N, 1 x E, 1 x S, 1 x W	To the surface of bedrock (i.e. approx. 6 m)	Nutrients, E. Coli and Total Coliforms, TDS
Transpiration Area 2	0-4 new wells	1 x N, 1 x E, 1 x S, 1 x W	To the surface of bedrock (i.e. approx. 6 m)	Nutrients, E. Coli and Total Coliforms, TDS
General Back Ground Areas	0-8 new wells	2 x upgradient locations (i.e. W boundary), 2 x downgradient locations (i.e. E and N boundary), 4 x general background areas (i.e. Farm 1, Farm 5, Farm 12, Farm 14)	To the surface of bedrock (i.e. approx. 6 m)	TRH, BTEX, formaldehyde, PAH, metals, nutrients, E. Coli and Total Coliforms, TDS

- The new groundwater monitoring wells will be established by a licenced driller using a Geoprobe (or similar). All monitoring wells will be advanced through the surface sediments and into the surface of the bedrock (suspected to be approximately 3-6 m). The well will be constructed using Class 18 uPVC casing with a machine slotted screen. The annulus between the PVC and the bore hole will be backfilled with washed 8/16" sand to at least 0.5 m above the slotted screen. A bentonite plug of minimum thickness 0.5 m will be placed above the sand, with the well completed with cement / bentonite grout and a flush mounted cover;
- The observed soil will be logged in accordance with AS1726-1993, Geotechnical Site Investigations;
- Soil samples will be screened in the field for potential volatile contaminants using a calibrated photoionisation detector (PID). Soil analysis may be conducted depending upon the findings of detailed soil investigations completed in the respective areas previously;
- The wells will be developed following installation to ensure good connectivity with the aquifer. Development will be conducted using a submersible electric pump. During development, water quality parameters pH, electrical conductivity, dissolved oxygen, redox potential, turbidity and temperature will be collected. Development will continue until the well is dry, the water is clear, or ten well volumes have been removed;
- The location and elevation of the wells will be surveyed to MGA coordinates and AHD elevation by a surveyor to facilitate groundwater flow direction estimates;
- A minimum of 1 week will be allowed between construction and sampling to allow for a suitable stabilisation. A discrete gauging event of the all new and existing wells will be completed using an interface probe prior to any purging or sampling, to assess the water levels and for the presence of LNAPL or DNAPL;
- Gauging and sampling will be completed at all newly installed groundwater monitoring well locations (it is presumed that the former monitoring wells have been destroyed or buried). Wells will be gauged with an electronic interface probe to measure the depth to water and the total depth of the well, as well as to determine whether any phase separated hydrocarbon (PSH) is present;

- Wells will be purged using low flow sampling techniques prior to being sampled. Field measurements of dissolved oxygen (DO), electrical conductivity (EC), temperature, oxygen redox potential and pH, will be recorded during purging, using a calibrated TPS water quality meter, to ensure that a representative sample of the shallow aquifer is obtained;
- Field measurements, as well as any visual and/or olfactory evidence of contamination, will be noted on the field sampling sheets;
- Samples will be collected in appropriately preserved (where applicable) sample bottles provided by the primary laboratory;
- Samples for dissolved heavy metals analysis will be filtered through a 0.45 micron filter prior to preservation;
- All samples will be stored and transported in a chilled cool box to the laboratory for selected chemical analysis under COC documentation; and
- Sampling equipment will be decontaminated with Decon 90 and deionised water between sampling locations.

6.7.4 Surface Water Sampling Methodology

The following surface water sampling methodology will be adopted:

- Sampling will be undertaken in accordance with JBS&Gs standard operating procedures:
  - IMSO 009 – Calibration and Decon; and
  - IMSO 040 – Surface Water Sampling.
- Surface water investigations proposed for these investigations are summarised in **Table 6.5** below. The Pond 1 and 7 related sampling is to inform a dewatering procedure. The sampling of onsite surface water features is to confirm the results presented in NAA (2013) and provide a baseline of surface water conditions prior to the commencement of remediation works;
- **Table 6.5** includes COPC. These COPC may be revised based upon the findings of additional soil and/or groundwater investigations.

Table 6.5: Proposed Surface Water Investigation

Surface Water Body	Number of Samples	Proposed Analysis
Pond 1	1	TRH, BTEX, PAH, metals, nutrients, E. Coli and Total Coliforms
Pond 7	1	TRH, BTEX, PAH, metals, nutrients, E. Coli and Total Coliforms
Any other water features identified during the field works	10	TRH, BTEX, PAH, metals, nutrients, E. Coli and Total Coliforms

- Surface water samples will be collected using a swing sampler. Care will be taken to collect water samples without disturbing sediments. Field measurements of dissolved oxygen (DO), electrical conductivity (EC), temperature, oxygen redox potential and pH, will be recorded prior to the collection of the sample;
- Samples will be collected in appropriately preserved (where applicable) sample bottles provided by the primary laboratory;
- Samples for dissolved heavy metals analysis will be filtered through a 0.45 micron filter prior to preservation;
- All samples will be stored and transported in a chilled cool box to the laboratory for selected chemical analysis under COC documentation; and

- Sampling equipment will be decontaminated with Decon 90 and deionised water between sampling locations.

6.8 Assessment Criteria

6.8.1 Regulatory Guidelines

Development of site assessment criteria for the proposed work identified above was undertaken with consideration to aspects of the following guidelines, as relevant:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013* (the ASC NEPM);
- Office of Environment and Heritage, 1997/2011, *Guidelines for Consultants Reporting on Contaminated Sites*;
- Department of Environment and Conservation NSW, March 2007, *Guidelines for the Assessment and Management of Groundwater Contamination*;
- NSW Government, 2014, *Managing Asbestos in or on Soil*;
- NSW EPA, November 2014, *Waste Classification Guidelines Part 1: Classifying Waste*;
- NSW EPA, September 2015, *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*;
- NSW EPA, October 2016, *Addendum to the Waste Classification Guideline (2014) – Part 1: classifying waste*; and
- NSW EPA, October 2017, *Contaminated Land Management (Guidelines for the NSW Site Auditor Scheme)*.

6.8.2 Assessment Criteria – Soil Contamination

Concentrations of contaminants in the soil across the site will be compared against published land use criteria as sourced from the following:

- ASC NEPM Health based Investigation Levels (HILs) for commercial/industrial land use – HIL D;
- ASC NEPM Health Screening Levels (HSLs) for petroleum hydrocarbons considering potential for vapour intrusion, coarse grained soil for commercial/industrial land use (HSL D);
- AEC NEPM HSLs for asbestos levels in soil for commercial/industrial land use (HSL D) including friable asbestos and asbestos fines (AF/FA);
- CRC Care Direct Contact HSLs for direct contact with petroleum hydrocarbons for commercial/industrial land use (HSL D) and for Intrusive Maintenance Workers;
- ASC NEPM Ecological Investigation/Screening Levels (EILs/ESLs) for coarse grained soils for commercial/industrial land use;
- Management limits presented in the ASC NEPM for commercial/industrial land use; and
- NSW EPA Use and Disposal of Biosolids Products, criteria for Stabilisation Grade A Microbiological Standards.

EILs have been derived during the ESA using site specific data reported for pH, cation exchange capacity (CEC), and clay content, consistent with the ASC NEPM.

The results of asbestos analysis will be assessed in general accordance with the HILs provided in the ASC NEPM.

The only exception to the above is the Farm 9 area, which represents the only identified AEC within the proposed E2 area. Results for this area will be compared to criteria based upon open space / recreational use (i.e. HIL C) and areas of ecological significance (i.e. EILs/ESLs).

6.8.3 Assessment Criteria – Sediment Contamination

Sediment criteria was derived with guidance from ANZECC/ARMCANZ (2000)[4]. Relevant criteria from *Table 3.5.1 Recommended Sediment Quality Guidelines* (ISQG-Low) will be adopted.

6.8.4 Assessment Criteria – Water Contamination

In accordance with DEC NSW (2007), JBS&G considered the environmental values (EVs) which are applicable to waters at the site. The following EVs were evaluated:

- Aquatic Ecosystems: This EV is considered to be applicable both on and offsite considering there are water bodies present at the site, along with a seasonal flowing creek system, and onsite waters flow offsite into receiving bodies including creek and river systems;
- Aquaculture and human consumers of food: This EV is considered unlikely to be realised onsite based on the current (vacant) and proposed (industrial development) land use. This EV is also considered unlikely to be realised offsite owing to the surrounding land use primarily being vacant forested land or mining activities;
- Agricultural water: This EV is considered unlikely to be realised onsite based on the current (vacant) and proposed (industrial development) land use. This EV is also considered unlikely to be realised offsite owing to the surrounding land uses and the fact that all monitoring bores within a 1km radius are used for "monitoring" purposes;
- Recreation and Aesthetics: This EV is considered to be possible both on and off site;
- Drinking water: This EV is unlikely to be realised onsite based on the current (vacant) and proposed (industrial development) land use, and the fact the reticulated potable water will be made available. This EV is also considered unlikely to be realised offsite owing to the surrounding land uses and the fact that all monitoring bores within a 1km radius are used for "monitoring" purposes; and
- Industrial Water: This EV is unlikely to be realised onsite as the proposed development is unlikely to consist of heavy industry, and also that reticulated potable water will be available. It is also considered unlikely to be realised offsite as all monitoring bores within a 1km radius are used for "monitoring" purposes.

Based on the above evaluation, water criteria was derived with guidance from ASC NEPM, ANZECC/ARMCANZ (2000) and NHRMC (2008)[5]. The following water assessment criteria will be adopted:

- *Slightly to moderately disturbed system – 95% level of protection for fresh water* (ANZECC/ARMCANZ 2000);
- *Drinking water guidelines value multiplied by a factor of 10 for recreational use* (NHMRC 2008); and
- *Aesthetic parameters* (NHMRC 2008).

[4] *Australian and New Zealand guidelines for fresh and marine water quality,* Australian and New Zealand Environment and Conservation Council, October 2000 (ANZECC/ARMCANZ 2000).
[5] *Guidelines for Managing Risks in Recreational Water,* National Health and Medical Research Council, 2008 (NHRMC 2008).

The 95% protection level for fresh water was considered the most appropriate level of protection for the site given the slightly to moderately disturbed nature of the site and surrounds.

6.9 Reporting

Results of the field investigation will be reported in a DSI report which will include a description of the field works methodology, a summary of field and laboratory analytical results, a discussion of results and the impact on the proposed development, and recommendations for any additional works. Following the completion of the data gap investigations, this additional information will be used to finalise the Stage 2 works RAP which identifies the proposed remediation and validation methodology.

6.10 Closure

Should you have any questions regarding this letter, please contact the undersigned.

Yours sincerely:

John Scott

Senior Environmental Consultant

JBS&G Australia Pty Ltd

Reviewed/Approved by:

Kane Mitchell

Managing Principal QLD

JBS&G Australia Pty Ltd

Attachments:
Figure 1 – Site Location
Attachment A – Limitations

Attachment A– Limitations

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

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

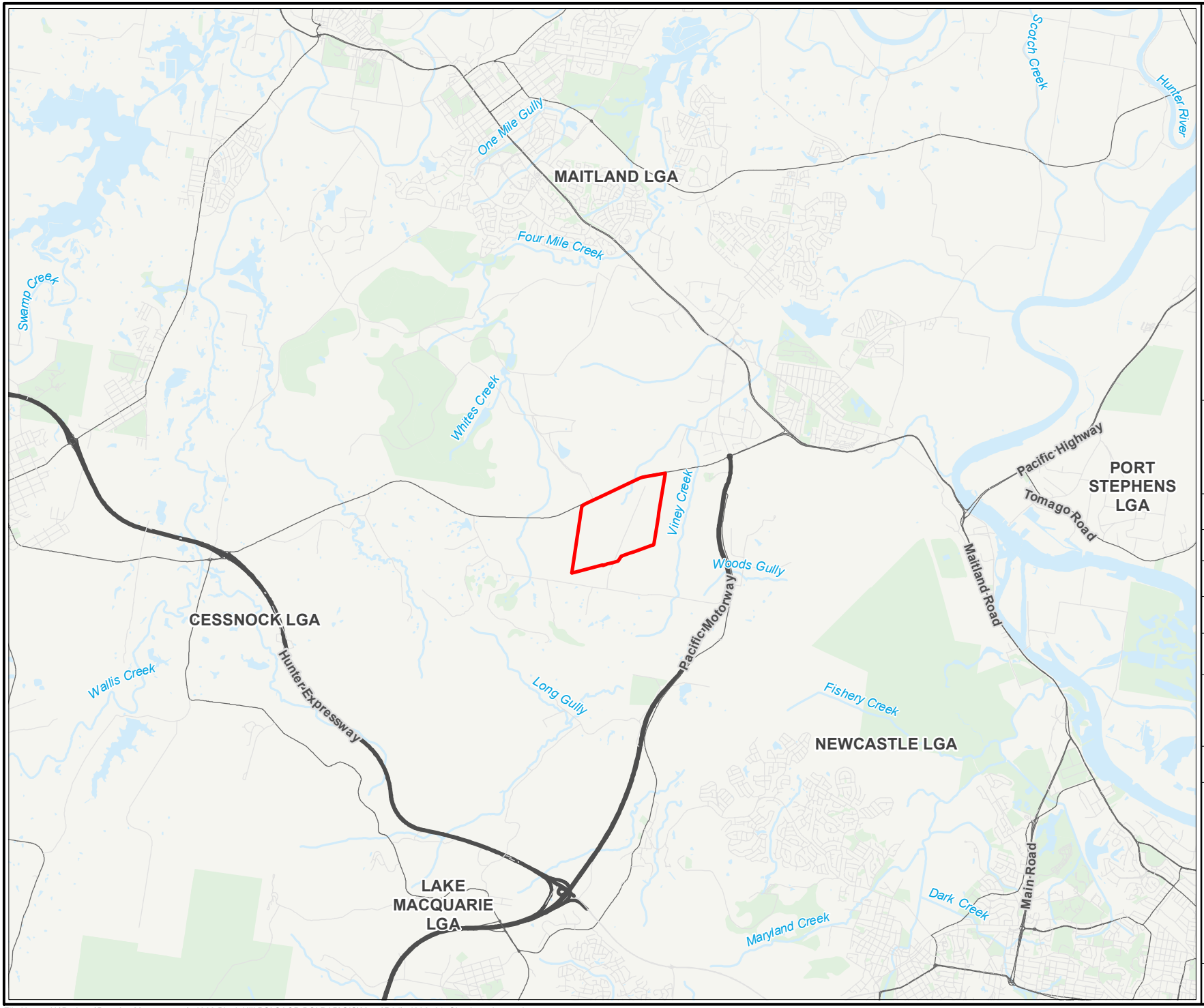
JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties,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

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

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

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

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



Legend:
Site boundary

JBS&G

Job No: 54892	
Client: Broaden Management	
Version: R01	Date 30/07/2018
Drawn By: FH	Checked By: JS

Scale 1:100,000

0 1,100 2,200
metres

Coord. Sys. GDA 1994 MGA Zone 56

John Renshaw Drive
Black Hill, NSW

SITE LOCATION

FIGURE 1

File Name: N:\Projects\Broaden Management\54892 Black Hill PSI SAQP DSI RAP\GIS\Maps\R01\54892_01_Site_Location.mxd
Reference:

Appendix D Remediation Area Calculations

Area of Potential Environmental Concern		Area (m2)	Depth (m)	Estimated Area / Volume		Waste Type	
Farm Shed Footprints	No Sheds			%	Volume (m3)*		Remediation Driver
Farm 1	2?	8000	0.2	50%	800	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 2	4	12500	0.2	50%	1250	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 3	2	6500	0.2	50%	650	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 4	4	13000	0.2	50%	1300	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 5	4	12500	0.2	50%	1250	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 6	2	6500	0.2	50%	650	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 7	2	7000	0.2	50%	700	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 8	1	2000	0.2	50%	200	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 9	5	14000	0.2	50%	1400	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 11	5	18600	0.2	50%	1860	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 12	multiple small sheds	14375	0.2	50%	1438	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 14	4	14500	0.2	50%	1450	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 15	3	8500	0.2	50%	850	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 16	4	15000	0.2	50%	1500	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 17	4	11500	0.2	50%	1150	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 18	3 or 4	12500	0.2	50%	1250	SWA	No direct evidence of ACM or FA/AF. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis, including potential TRH impacts.
Farm 19	None known	21800	0.1	50%	1090	SWA	No direct evidence of ACM or FA/AF.
D1	Bird digester tanks	1774.29	0.25	100%	444	Nutrient / Bacteria	E Coli/Coliforms identifiied by NAA. Likelihood of high nutrient levels.
TP1	Transpiration Area 2 adjacent D1 (excluding JBS&G AOI - 12)	1774	0.2	10%	35	Nutrient / Bacteria	NAA identifieid visual and olfactory signs of biological waste. Area poorly delineated to west, south and north.
D2	Burial trench	351.01	1	100%	351	Nutrient / Bacteria	E Coli/Coliforms identifiied by NAA. Likelihood of high nutrient levels.
JBS&G AOI - 7	E1 - Surface ACM and swale fill	197	0.4	100%	79	SWA	ACM identified by JBS&G. Lateral extent based on limited scope visual field observations.
JBS&G AOI - 8	E1 - Surface ACM	2284	0.3	100%	685	SWA	ACM identified by JBS&G. Lateral extent based on limited scope visual field observations.
JBS&G AOI - 2	Tip in E3	1317	0.9	50%	593	SWA	Construction and general waste, but no direct evidence of ACM. Estimate based on unlikely scenario that ACM contamination exists.
JBS&G AOI - 3	Soil Mounds in E3	948	0.3	50%	142	SWA	Construction and general waste, but no direct evidence of ACM. Estimate based on unlikely scenario that ACM contamination exists.
E4	Farms 11, 12 and 15	2739	0.05	20%	27	SWA	No obvious waste material. NAA identified hummocky surface, but no fill in soil identified. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis.
E5	Farms 11, 12 and 15 (excluding JBS&G AOI - 9, 10 and 11)	-391	0.2	10%	-8	Nutrient / Bacteria	NAA identifieid visual and olfactory signs of biological waste. Extent appears limited based on other test pits results
JBS&G AOI - 9	E5 - Soil mounds	105	0.6	50%	32	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 10	E5 - Soil mounds	40	0.3	50%	6	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 11	E5 - Soil mounds	63	0.5	50%	16	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
F1	Farm 14	192	0.6	50%	58	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
G	Farm 16	905	0.5	100%	453	Nutrient / Bacteria	Organic waste identifiied by NAA. Likelihood of high nutrient levels.
H1	Farm 17	2400	0.1	50%	120	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 13	H1 - Soil Mound	202	0.5	50%	51	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
H2	Farm 17	465	0.5	100%	233	SWA	ACM identified by JBS&G. Lateral extent based on limited scope visual field observations
I	East of Farm 17	2227	3	100%	6681	SWA	NAA identified ACM. Confirmed by JBS&G.
J	Farm 8	333	0.45	100%	150	Nutrient / Bacteria	NAA and JBS&G identifieid visual and olfactory signs of biological/organic waste. Extent appears limited based on other test pits results
JBS&G AOI - 14.1	Northern dump area	791	1.5	50%	593	SWA and Nutrients/Bacteria	Burial trench. Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 14.2	Northern dump area	643	1.5	50%	482	SWA and Nutrients/Bacteria	Burial trench. No construction waste observed, but inferred as entire trench not inspected and infered based on historical reports
JBS&G AOI - 14.3	Northern dump area	580	1.5	50%	435	SWA and Nutrients/Bacteria	Burial trench. No construction waste observed, but inferred as entire trench not inspected and infered based on historical reports
JBS&G AOI - 14.4	Northern dump area	675	1.5	50%	506	SWA and Nutrients/Bacteria	Burial trench. No construction waste observed, but inferred as entire trench not inspected and infered based on historical reports
JBS&G AOI - 14.5	Northern dump area	3070	1.2	50%	1842	SWA and Nutrients/Bacteria	Burial trench. Construction and organic waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 14.6	Northern dump area	858	1.7	100%	1459	SWA and Nutrients/Bacteria	NAA identified ACM. No visual ACM identified on surface by JBS&G but considerable construction waste
K	Northern dump area - east	4634	0.2	50%	463	SWA	No obvious trenches, but construction waste identified by NAA. No direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
Northern Dump Area	Northern Dump Area (excluding K, Z and JBS&G AOI - 14.1-14.6)	11210	1.5	50%	8408	SWA and Nutrients/Bacteria	Residual area of Northern Dump Area per NAA. No direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
Z	Northern Dump Area	872	0.3	50%	131	SWA	NAA identified fibro cement but did not sample for ACM. No ACM observed by JBS&G and natural from surface. Worst case based on unlikely scenario that ACM contamination exists
L1	Farm 6	10134	0.35	75%	2660	SWA	NAA identified ACM in north eastern portion. No visual ACM identified on surface by JBS&G but considerable construction waste
L2	Farm 6	719	0	10%	0	SWA	NAA idenfitied as a potential fill area but not observe any fill. JBS&G observed all natural vegetation. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis.
L3	Farm 6	1210	0.5	10%	61	SWA	NAA idenfitied as a potential fill area but not observe any fill. JBS&G observed all natural vegetation. Estimate takes into account residual uncertainty due to limited scope sampling/anlaysis.
M1	North of Farm 18 (excluding JBS&G AOI - 15)	3465	1.2	50%	2079	SWA and Nutrients/Bacteria	JBS&G identified construction waste. NAA identified organic waste. No ACM observed on surface. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 15	M1	177	1.2	100%	212	SWA	JBS&G identified construction waste. NAA identified organic waste. No ACM observed on surface. Worst case based on unlikely scenario that ACM contamination exists
M2	North of Farm 18	5255	0.1	50%	263	SWA and Nutrients/Bacteria	JBS&G identified construction waste. NAA identified organic waste. No ACM observed on surface. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 19	N2	101	0.5	10%	5	SWA	Small mounds of metal waste, rusted car wreck; Natural from surface JBSG&G Investigation
O	Farm 1	-	-	-	-	-	Captured above in Farm 1 area
Q	Workshop	6134	2	50%	6134	SWA	NAA reported oxidised material possibly derived from inceneration process - "crunchy tactility" and ACM on ground
Y	Farm 18	-	-	-	-	-	Reflects road base used all over site. Minor imported ash road base material according to NAA
SDA	Southern Dump Area A (N1)	12645	0.2	50%	1265	SWA and Nutrients/Bacteria	Construction and general waste, but no direct evidence of ACM.Also bio logical waste. Worst case based on unlikely scenario that ACM contamination exists
WDA	Western Dump Area	3750	0.2	50%	375	SWA and Nutrients/Bacteria	NAA idenfitied as a potential fill area but not observe any fill. JBS&G observed all natural vegetation. Contingency estimate as anecdotal evidence of dump has not been confirmed by NAA or JBS&G test pits.
TP2	Transpiration Area 1 adjacent J (excluding JBS&G AOI - 12)	3751	0.3	100%	1125	Nutrient / Bacteria	E Coli/Coliforms identifiied by NAA. Likelihood of high nutrient levels.
JBS&G AOI - 12	Drainage fill - gravels	1659	0.5	10%	83	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
CS	Chemical Store	377	0.25	50%	47	SWA	NAA identified ACM . No visual ACM identified on surface by JBS&G
JBS&G AOI - 1	Farm 4 Farm House	485	0.1	50%	24	SWA	ACM identified by JBS&G. Lateral extent based on limited scope visual field observations
JBS&G AOI - 4	Surfical material on Farm 7	886	0.3	50%	133	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 5.2	Swale fill in farm 2	643	0.35	50%	113	SWA	JBS&G identified construction waste. No ACM observed on surface. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 5.1	Swale fill in farm 2	703	0.7	50%	246	SWA	JBS&G identified construction waste. No ACM observed on surface. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 16	NAA TP 84	131	0.6	100%	79	Nutrient / Bacteria	NAA identifieid visual and olfactory signs of biological waste. Area poorly delineated to west, south and north
JBS&G AOI - 17	NAA TP57 and 58	259	0.65	50%	84	SWA	Construction and general waste, but no direct evidence of ACM. Worst case based on unlikely scenario that ACM contamination exists
JBS&G AOI - 18	FC04 and FC05	1440	0.1	50%	72	SWA	Surficial ACM identified by NAA. Not observed by JBS&G
Infilled Pond 1	-	1100	1.5	50%	825	Nutrient / Bacteria	Depth assumed. Single frag of ACM identified adjacent pond.
Infilled Pond 2	-	1150	1.65	50%	949	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond.
Infilled Pond 3	-	3000	0.3	50%	450	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond.
Infilled Pond 4	-	2000	1.6	50%	1600	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond. Does not include JBS&G AOI-3.
Infilled Pond 5	-	800	1.5	50%	600	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond.
Infilled Pond 6	-	3700	1.5	50%	2775	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond.
Infilled Pond 7	-	3700	0.3	50%	555	Nutrient / Bacteria	Depth calculated based on average backfill identified in pond.
				TOTAL	66065		

* Volume does not consider bulking

SWA	37977
Nutrient / Bacteria	10382
SWA and Nutrients/Bacteria	17706
TOTAL	66065

Appendix E Long Term Management Plan

A LTMP will need to be implemented at the site following the completion of remedial works, to ensure that the encapsulated impacted soils are managed into the future. A number of LTMPs may be prepared as contaminated materials are likely to be retained below multiple lots with different owners. The LTMP should contain, but not be limited to, the following sections:

- Introduction;
- Site Background;
    - Site Identification;
    - Site History; and
    - Environmental Status of the Site (including clear definition of containment area/s and nature of hazard).
- SMP Responsibilities;
    - Site Owner;
    - Contractors/Others; and
    - Training.
- Environmental Management and Maintenance Strategy;
    - Site Use;
    - Provision of LTMP to Appropriate Persons;
    - Surface Capping and Protective Barriers;
    - Underground Services;
    - Soil Excavation and Removal;
    - Unexpected Contamination;
    - Emergency Preparedness and Response; and
    - General Environmental Protection.
- Monitoring and Reporting; and
- Revision of the SMP.

Document Distribution

Rev No.	Copies	Recipient	Date
A	1 x electronic	Liam Buxton, Barr Planning & Property Fiona Robinson, Ramboll	01/08/2018
B	1 x electronic	Liam Buxton, Barr Planning & Property Fiona Robinson, Ramboll	13/08/2018
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