Site Audit Report

AEC 39: Luddenham Road, Luddenham NSW

Audit Number: MP181_4

30 March 2023

Document Information

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Disclaimer and Limitations:

Senversa acknowledges the traditional custodians of the land on which this work was created and pay our respect to elders past and present.

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List of Acronyms

Acronym	Definition
Measures	
%	per cent
µg/L	Micrograms per Litre
ha	Hectare
km	Kilometres
m	Metre
mbgl	Metres below ground level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
ppm	Parts Per Million
General	
ABC	Added Background Concentrations
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
ADWG	Australian Drinking Water Guidelines
AF	Asbestos Fines
AST	Aboveground Storage Tank
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines
BaP	Benzo(a)pyrene
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes & Naphthalene

Acronym	Definition
CLM Act	NSW Contaminated Land Management Act 1997
COC	Chain of Custody
Council	Penrith City Council
DA	Development Application
DGV	Default Guideline Value
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EIL	Ecological Investigation Level
Envirolab	Envirolab Services Pty Ltd
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
Eurofin	Eurofin | mgt
FA	Fibrous Asbestos
GIL	Groundwater Investigation Level
HIL	Health Investigation Level
HSL	Health Screening Level
IAA	Interim Audit Advice
LCS	Laboratory Control Sample
LOR	Limit of Reporting
Mercury	Inorganic mercury unless noted otherwise

Acronym	Definition
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
ML	Management Limits
MS	Matrix Spike
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEHF	National Environmental Health Forum
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NL	Non-Limiting
n	Number of Samples
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons

Acronym	Definition
PCBs	Polychlorinated Biphenyls
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
RSL	Regional Screening Level
SAQP	Sampling Analysis and Quality Plan
SAR	Site Audit Report
SAS	Site Audit Statement
SCEW	Standing Council on Environment and Water
SWL	Standing Water Level
TRHs	Total Recoverable Hydrocarbons
USEPA	United States Environmental Protection Agency
-	On tables is "not calculated", "no criteria" or "not applicable"

1.0 Introduction

A site contamination audit has been conducted in relation to the site at Luddenham Road, Luddenham NSW (known as 'AEC 39').

The site is part of the Sydney Metro – Western Sydney Airport rail line that will extent approximately 23 km from St Marys to the Western Sydney Aerotropolis. The Surface & Civil Alignment Works (SCAW) package is between Orchard Hills and Western Sydney Airport.

Areas of environmental concern (AECs) have been identified along the SCAW corridor requiring investigation. The current site is known as AEC 39. The remaining AECs will be subject to separate audits.

The audit was conducted to provide an independent review by an EPA Accredited Auditor of whether the land is suitable for any specified use or range of uses i.e. a "Site Audit" as defined in Section 4 (1) (b) (iii) of the NSW Contaminated Land Management Act 1997 (the CLM Act).

1.1 Scope of the Audit

Details of the Audit are:

Requested by:	[redacted] on behalf of CPB Contractors Pty Ltd and United Infrastructure Pty Ltd (CPBUI JV)
Request/Commencement Date:	7 June 2022
Auditor:	Melissa Porter
Accreditation No.:	0803

The scope of the audit included:

- Review of the following reports:
  - 'Environmental Impact Statement' dated October 2020 by Sydney Metro (EIS).
  - 'Sampling and Analysis Quality Plan (SAQP), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 17 August 2022 by Douglas Partners (SAQP).
  - 'Report on Detailed Site Investigation (Contamination), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 12 December 2022 by Douglas Partners (DSI).
- A site visit by the auditor on 29 November 2022.
- Discussions with CPBUI JV and with Douglas Partners who undertook the investigation.

Previous investigations by Golder Associates Pty Ltd (Golder)/Douglas Partners dated 19 February 2021 and 3 August 2021 were undertaken for a larger area that included the current site. Seven sample locations were positioned within the western portion of the site. A remediation action plan (RAP) was also prepared for a larger area that include the current site by JBS&G Australia Pty Ltd (JBS&G) dated 9 December 2016. The Golder/Douglas Partners reports and JBS&G RAP were not provided for auditor review, Douglas Partners included relevant information within the reports listed above.

Several Interim Audit Advice (IAA) have been issued for the site (Appendix C) providing comments on the various reports. IAA No. 3 issued on 20 December 2022 confirmed that the DSI could be finalised.

2.0 Site Details

2.1 Location

The site locality is shown on Attachment 1, Appendix A.

The site details are as follows:

Street address:	Luddenham Road, Luddenham, NSW 2745
Identifier:	Part Lot 201, Part Lot 203 and Part Lot 205 Deposited Plan (DP) 1280188
Local Government:	Penrith City Council
Owner:	Sydney Metro
Site Area:	Approximately 14.6 ha

The boundaries of the site are not well defined by streets/adjoining properties. A survey plan of the site has been provided (Attachment 2, Appendix A).

2.2 Zoning

The current zoning of the site as provided by Douglas Partners is MU: Mixed Use and an area along the proposed railway which is not zoned.

2.3 Adjacent Uses

The site is located within an area of rural land. Cosgroves Creek is located approximately 0.5 km to the south east of the site.

2.4 Site Condition

Douglas Partners noted the following at the site:

- The site slopes generally down to the northwest with the southern end sloping to the southeast.
- The site is used for grazing paddocks.
- A road crosses through the south of the site.
- Three farm dams are located within the site (the southwestern corner, western boundary and centrally).
- The EIS noted that an asbestos containing material (ACM) pipeline is possibly present at the site along a dirt road.
- No power poles, cattle yards, site office or other rural property infrastructure is visible at the site.

The following was noted by the auditor during the site visit on 29 November 2022:

- The site appeared to be consistent with the descriptions provided by Douglas Partners.
- The site is used for grazing with three dams.
- There were no visible signs of the previous infrastructure within and adjacent to the site.

2.5 Proposed Development

It is understood that the site is to be redeveloped by CPBUI JV as a railway line constructed as a viaduct and passive open space associated with the railway corridor for the Sydney Metro – Western Sydney Airport line. The Sydney Metro – Western Sydney Airport line development includes approximately 10km of railway track from Orchards Hills to the Western Sydney Airport, embankments/ noise barriers, a stabling yard and maintenance facility, station and passive open space adjacent to the rail corridor.

For the purposes of this audit, the ‘commercial/industrial’ land use scenario will be assumed.

3.0 Site History

Douglas Partners provided a summary of the site history based on the EIS review of aerial photographs, site photographs and NSW EPA records. Consistent with the current condition, the site has been rural land for pastoral use since at least 1955. Rural residential houses and sheds were present adjacent to the site and included an underground storage tank (UST) located next to the central eastern boundary. Also associated with the adjacent rural property was an above ground storage tank (AST) within a shed located within the site at the central eastern boundary and an ACM pipeline running through the eastern portion of the site. The rural property infrastructure was demolished between 2016 and 2022. A road was constructed between 2018 and 2019 at the southern end of the site.

It is understood from Douglas Partners that assessment, remediation and validation has been completed by JBS&G at the adjacent rural property and associated infrastructure within the audit boundaries, including the AST and asbestos pipeline. Douglas Partners provided a copy of an email from Penrith City Council regarding the site remediation however did not obtain the validation report. The email indicated a validation report dated 11 July 2018 by JBS&G was submitted to Penrith City Council.

The email from Penrith City Council stated that the validation report by JBS&G reported that all remediation works had been completed within the rural property, including in the audit site boundary, except for at a site office, several power poles and the cattle yard shelters. It was recommended by Council, that prior to the demolition of the site offices, that a hazardous materials survey prepared by JBS&G be implemented and that validation be undertaken on the soil adjacent to remaining power poles following removal. The Council noted that an addendum RAP had been prepared by JBS&G and was to be implemented. No further validation report is cited by Douglas Partners or Council. Drawings provided by Douglas Partners from JBS&G show that the cattle yards and remaining power poles were located outside of the current site. Douglas Partners noted that the site office, cattle yard and power poles are not visible within the audit site boundary.

The auditor considers that the former rural property and associated infrastructure within the audit site boundary has likely been adequately remediated and validated. The power poles where remediation is unknown are shown to be located down-gradient to the north of the site. The cattle yards are to the west of the site and are not considered to be up-gradient given the presence of a creek between the yards and the site.

In the auditor's opinion, the site history provides an adequate indication of past activities. There is some uncertainty regarding the validation of the former structures given that the JBS&G validation report was not been reviewed by Douglas Partners, however the auditor considers that these have been compensated for by the investigations discussed in this Site Audit Report.

4.0 Contaminants of Concern

Douglas Partners provided a list of the contaminants of concern and potentially contaminating activities. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Area	Activity	Potential Contaminants
Location of former buildings/structures.	Contaminated ground from former buildings and structures. (EIS noted: ACM pipelines and isolated ACM in soil from former building, and isolated zinc exceedance in soil).	Metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides (OCP), organophosphorus pesticides (OPP), polychlorinated biphenyls (PCB), phenols and asbestos.

Given that no cropping was evident historically at the site, Douglas Partners considered that impacts from perfluoroalkyl and polyfluoroalkyl substances (PFAS) were unlikely.

An isolated zinc exceedence was noted by EIS as being of concern within AEC 39. Douglas Partners stated that this location was outside of the audit boundaries. The auditor considers that sufficient investigation has been undertaken to assess potential zinc impacts within the audit boundaries.

The auditor considers that the analyte list used by Douglas Partners adequately reflects the site history and condition.

5.0 Stratigraphy and Hydrogeology

Following a review of the reports provided, a summary of the site stratigraphy and hydrogeology was compiled as follows.

5.1 Stratigraphy

The sub-surface profile of the site is summarised in Table 5.1.

Table 5.1: Stratigraphy

Depth (mbgl)	Subsurface Profile
0.0 – 0.2	Fill (sandy silt) and topsoil (silty clay). Two locations encountered brick fragments, terracotta and fibreglass. One location adjacent to the road at the southern end of the site encountered fill (sand and sandy gravel) and a pipe at 1.2 m. The auditor considers it likely that the pipe is associated with the road which was constructed between 2018 and 2019 and unlikely to be asbestos containing. Douglas Partners stated that no asbestos containing material was observed at the site.
0.2 – 4.0	Silty clay.
4.0 to depth	Siltstone and sandstone.

mbgl – metres below ground level

The site is not within an area of associated with a risk of acid sulfate soil (ASS).

The auditor considers that the depth of fill and underlying stratigraphy have been adequately characterised.

5.2 Hydrogeology

Groundwater investigations have been undertaken at the site. Depth to groundwater over the site is generally between 2.4 mbgl and 8.2 mbgl with one groundwater well measuring 0.1 mbgl. Groundwater is considered likely to flow to the northwest in the north and central parts of the site and to the southeast in the southern parts of the site. There are no registered bores within a 500 m radius of the site.

The nearest surface water receptor is Cosgroves Creek located approximately 500 m to the southeast of the site. Douglas Partners reported that surface water from the site is likely to flow to a series of dams within the site and wider rural area, ultimately flowing to Cosgroves Creek.

The auditor considers that the hydrogeology has been adequately characterised.

6.0 Evaluation of Quality Assurance and Quality Control

The auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The auditor's assessment follows in Tables 6.1 and 6.2.

Table 6.1: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) Douglas Partners defined specific DQOs in accordance with the seven-step process outlined in EPA (2017) Guidelines for the NSW Site Auditor Scheme.	These were considered appropriate for the investigations conducted.
Sampling pattern and locations Soil: Investigation locations were spaced to gain coverage of the majority of the site. Locations were also placed to target the former ACM pipeline and former AST/shed. Groundwater: Monitoring wells were located across the site, with one down-gradient, one cross-gradient and three up-gradient (in the northern and southern areas of the site). Sediment/Surface Water: Investigation locations were placed within each of the three samples located on the site.	These investigation locations adequately target the main areas of concern.
Sampling density Soil: The sampling density of 161 locations over approximately 14.6 ha does not meet the minimum recommended by EPA (2022) Sampling Design Guidelines of 165 locations. The coverage however does provide a 95% confidence of detecting a residual hot spot of approximately 35.5 m diameter which is similar the largest hot spot area listed by EPA (2022). One of these locations targeted the former ACM pipeline and one targeted the former AST/shed. Samples analysed for asbestos were generally not collected as outlined in NEPM (2013) (Schedule B1). However, test pit locations where anthropogenic items (such as terracotta and brick fragments) were identified have been sampled as per NEPM (2013) and 500ml samples were collected for analysis of fibrous asbestos from all locations. Groundwater: A total of five groundwater wells were installed at the site. Sediment/Surface Water: Three sediment and surface water samples were collected, one from each dam.	The number of locations is just under the minimum recommended by EPA (2022) Sampling Design Guidelines. The 95% confidence of detecting a hot spot however is sufficient for a large site. Overall, the sampling density was adequate.
Sample depths Soil samples were collected and analysed from a range of depths, with the primary intervals being within the shallow fill (0.0-0.1 mbgl) and at and around the fill/clay interface (0.3-0.4 mbgl). Sediment samples were collected and analysed from the near surface.	This sampling strategy was appropriate and adequate to characterise the primary material types present on site.
Well construction Groundwater: The monitoring wells were typically installed to depths of 6.5 – 15 mbgl, with screen intervals of approximately 4 – 13 m placed in sand/gravel. Wells were constructed of 50 mm uPVC. A bentonite seal of 0.5-2.5 m thickness was placed above the screen and the well backfilled with grout to the ground surface. The standing water level (SWL) did not intersect the screen interval in two of the five wells.	As light non-aqueous phase liquids were not of concern, the screen depth being below the SWL at two wells is not considered to affect the results.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Sample collection method Soil: Sample collection was by hand from the excavator bucket returns and hand auger. Groundwater: Wells were installed by solid flight augers and rotary drilling methods, developed with a Twister plastic pump and samples were collected by a low flow peristaltic pump with dedicated sample tubing. Sediment: Sample collection was by hand auger. Surface water: Sample collection was **by** grab sampler.	The sample collection method was found to be acceptable.
Decontamination procedures Soil/Sediment: New gloves were reportedly used for each new sample. Decontamination of hand auger between locations was not explicitly reported. Groundwater: Sampling equipment was cleaned with tap water, 5% Liquinox and then demineralised water prior to sampling and between sampling events to prevent cross contamination. The use of new gloves for each new sample was not reported. Surface water: The use of new gloves for each new sample was not reported.	Decontamination was not reported between hand auger sampling events, as such cross-contamination could have occurred. Analytical results do not indicate impacts at the site. Therefore, the levels of contamination between sampling locations by hand auger are unlikely to have been underrepresented. Given the consistent groundwater and surface water conditions with site history, field observations and soil/sediment results, the limited information about gloves for groundwater and surface water sampling does not affect the quality of the data. Overall, decontamination procedures were acceptable.
Sample handling and containers Samples were placed into prepared and preserved sampling containers provided by the laboratory and chilled during storage and subsequent transport to the labs. Samples for asbestos analysis were placed in plastic zip-lock bags. Groundwater samples to be analysed for heavy metals were field filtered.	Acceptable.
Chain of Custody (COC) Completed chain of custody forms were provided in the report.	Acceptable.
Detailed description of field screening protocols Soil: Field screening for volatiles was undertaken using a PID. Groundwater: Field parameters were measured during well sampling and development.	Acceptable.
Calibration of field equipment The report stated that calibration had been undertaken prior to use. Calibration certificates from the equipment supplier were not provided.	Acceptable.
Sampling logs Soil logs are provided within the report, indicating sample depth, PID readings and lithology. Material descriptions were provided within the report for sediment samples. Groundwater and surface water field sampling records were provided, indicating SWL, field parameters, methodology and observations.	Acceptable.

Table 6.2: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
Field quality control samples Field quality control samples including trip blanks, trip spikes, rinsate blanks, field intra-laboratory and inter-laboratory duplicates were undertaken. Rinsate banks were not undertaken for hand auger soil sampling.	Given the similar soil sample results between the excavator return and hand auger soil sampling events, the lack of a rinsate sample does not detract from the overall data accuracy. Overall, the field quality control samples are acceptable.
Field quality control results The results of field quality control samples were generally within appropriate limits. The following exceptions were noted: RPDs for the inter-laboratory soil duplicate samples for six metals ranged from 31% to 88%. RPDs for intra-laboratory soil duplicate samples for three metals ranged from 31% to 57%. RPDs for inter–laboratory groundwater duplicate sample for one metal (67%) and TRH F2 (83%). Two rinsate samples for groundwater sampling detected trace metals. The highest of the primary and duplicate sample result has been used in assessment of the site.	Overall, in the context of the dataset reported, the elevated RPD results are not considered significant and the field quality control results are acceptable.
NATA registered laboratory and NATA endorsed methods Laboratories used included: Envirolab and Eurofins | mgt. Laboratory certificates were NATA stamped.	Acceptable
Analytical methods Analytical methods were included in the laboratory test certificates. Both Envirolab and SGS provided brief method summaries of in-house NATA accredited methods used based on USEPA and/or APHA methods (excluding asbestos) for extraction and analysis in accordance with the NEPM (2013). Asbestos identification was conducted by Envirolab using polarised light microscopy with dispersion staining by method AS4964-2004 Method for the Qualitative Identification of Asbestos Bulk Samples.	The analytical methods are considered acceptable for the purposes of the site audit, noting that the AS4964-2004 is currently the only available method in Australia for analysing asbestos. DOH (2009) and enHealth (2005) state that "until an alternative analytical technique is developed and validated the AS4964-2004 is recommended for use".
Holding times Review of the COCs and laboratory certificates indicate that the holding times had been met. Douglas Partners also reported that holding times have been met.	Acceptable
Practical Quantitation Limits (PQLs) Soil/Sediment: PQLs (except asbestos) were less than the threshold criteria for the contaminants of concern. Asbestos: The limit of detection for asbestos in soil was 0.01% w/w. Groundwater/Surface Water: The following guideline value was less than the PQLs: Anthracene 0.1µg/L, guideline value 0.01 µg/L	Soil (except asbestos): Overall the soil PQLs are acceptable. Asbestos: In the absence of any other validated analytical method, the detection limit for asbestos is considered acceptable. A positive result would be considered to exceed the "no asbestos detected in soil" criteria, providing this is applied within a weight of evidence approach to assess the significance of the exceedance, accounting for the history of the site and frequency of the occurrence. Groundwater: The elevated PQL was only marginally elevated above the guidelines value and in the context of the results reported and site history, overall the discrepancy does not materially affect the outcome of the audit.

Field and Lab QA/QC	Auditor's Opinion
Laboratory quality control samples Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken by the laboratory. Envirolab did not analyse duplicates for two batches.	Most of the laboratory reports did include duplicates as part of laboratory quality control samples. As such overall, sufficient quality control samples have been analysed to assess laboratory accuracy. .
Laboratory quality control results The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: RPDs for laboratory duplicate for arsenic (40-57%), cadmium (40-110%), chromium (31-65%), copper (37%), lead (33-46%), nickel (40-80%), zinc (35 - 55%), various PAHs (37-110%) and an OCP (34%). Spike recovery was elevated for an OCP.	The slightly elevated spike recovery is not considered to affect the usability of the data as OCPs were not detected above guidelines in any of the samples analysed. In the context of the dataset reported, the elevated RPD is not considered significant, and the laboratory quality control results are acceptable.
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) Predetermined data quality indicators (DQIs) were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes, surrogate spikes and internal standards. These were discussed with regard to the five category areas. There was limited discussion regarding actions required if data do not meet the expected objectives.	An assessment of the data quality with respect to the five category areas has been undertaken by the auditor and is summarised below.

In considering the data as a whole the auditor concludes that:

- The data is representative of the overall conditions of the site.
- The data is complete.
- There is a high degree of confidence that data is comparable for each sampling and analytical event.
- The primary laboratory provided sufficient information to conclude that data is of sufficient precision.
- The data is likely to be accurate however no decontamination was undertaken in between hand auger soil sampling events and a rinsate sample was not collected for the hand auger soil sampling. This may have resulted in unknown cross-contamination. Given soil sampling from the excavator bucket returns and the hand auger reported similar analytical results and that the soil results do not indicate widespread contamination this does not appear to have affected the overall accuracy of the data.

7.0 Environmental Quality Criteria

The auditor has assessed the results against Tier 1 criteria from National Environmental Protection Council (NEPC) National Environmental Protection (Assessment of Site Contamination) Measure 1999, as Amended 2013 (NEPM, 2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed development, the criteria for 'commercial/industrial land use' has been referred to.

The auditor has assessed the **soil** data provided with reference to Tier 1 (screening) criteria from the following:

- Human Health Assessment
  - Health Based Investigation Levels (HIL D)
  - Soil Health Screening Levels (HSL D) for Vapour Intrusion. The most conservative criteria were adopted i.e., assumed depth to source < 1 m and sand.
  - CRC CARE (2011) Direct Contact (HSL D and intrusive maintenance worker).
  - Asbestos Health Screening Levels (HSL D).
  - HEPA, 2017. PFAS National Environmental Management Plan (NEMP) released by the National Chemicals Working Group of the Heads of EPAs Australia and New Zealand (HEPA).
- Ecological Assessment
  - Ecological Screening Levels (ESL Commercial/Industrial) assuming coarse/fine soil.
  - Ecological Investigation Levels (EIL Commercial/Industrial). In the absence of site-specific soil data on pH, clay content, cation exchange capacity and background concentrations, the published range of the added contaminant values have been applied as an initial screen.
- Management Limits (ML Commercial/Industrial) assuming coarse soil.
- Aesthetics
  - The auditor has considered the need for remediation based on the 'aesthetic' contamination as outlined in the NEPM (2013).

The auditor has assessed the **sediment** data provided with reference to Tier 1 (screening) criteria from the following:

- Human Health Assessment:
  - Health Based Investigation Levels (HIL D).
  - Soil Health Screening Levels (HSL D) for Vapour Intrusion. The most conservative criteria were adopted i.e., assumed depth to source < 1 m and sand.
  - CRC CARE (2011) Direct Contact (HSL D, and intrusive maintenance worker).
  - Asbestos Health Screening Levels (HSL D).
- Ecological Assessment:
  - The ANZECC 2000 guidelines have been updated in ANZG (2022) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. (Available at www.waterquality.gov.au/anz-guidelines). The Default Guideline Values (DGV) provided are concentrations of toxicants that should have no significant adverse effects on the aquatic ecosystem.

- Ecological Assessment, where no ANZG values exist:
  - Ecological Screening Levels (ESL Commercial/Industrial) assuming coarse/fine soil.
  - Ecological Investigation Levels (EIL Commercial/Industrial). In the absence of site-specific soil data on pH, clay content, cation exchange capacity and background concentrations, the published range of the added contaminant values have been applied as an initial screen.

The auditor has assessed the **groundwater** and **surface water** data provided with reference to Tier 1 (screening) criteria from the following:

- Human Health Assessment
  - NEPM (2013) Groundwater Health Screening Levels (HSL D) for vapour intrusion (sand, 2 to <4 m)
  - NHMRC and NRMMC (2011) Australian Drinking Water Guidelines (ADWG) for potable use.
  - WHO (2008) Petroleum Products in Drinking-water. applicable where HSLs are not applicable.
  - WHO (2011) Guidelines for drinking-water quality, fourth edition, applicable where the ADWG are not available.
- Ecological Assessment
  - Groundwater Investigation Levels (GILs) listed in NEPM (2013) for protection of aquatic ecosystems referenced in ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. The ANZECC 2000 guidelines have been updated in ANZG (2022) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. (Available at www.waterquality.gov.au/anz-guidelines). The Default Guideline Values (DGV) provided are concentrations of toxicants that should have no significant adverse effects on the aquatic ecosystem. The marine/fresh water 95% level of protection was adopted. Some have been modified based on bioaccumulation or acute-toxicity or potential toxicity to particular species.

8.0 Evaluation of Soil and Sediment Analytical Results

8.1 Soil

Soil samples were analysed for a variety of contaminants including metals, petroleum hydrocarbons, pesticides, PCBs, phenols and asbestos. The analytical results are summarised below in Table 8.1.

The results have been assessed against the environmental quality criteria. Soil sampling locations are shown as Attachments 3 to 8, Appendix A.

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

Analyte	N	Detections	Maximum	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
Lead	186	186	44	0 above HIL D of 1500 mg/kg	0 above Generic ACL of 1800 mg/kg
Benzene	186	0	<PQL	0 above HSL D 0-1 m, sand of 3 mg/kg	0 above ESL (commercial/industrial) (coarse) of 75 mg/kg
Toluene	186	0	<PQL	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse) of 135 mg/kg
Ethyl benzene	186	0	<PQL	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse) of 165 mg/kg
Total Xylenes	186	0	<PQL	HSL D, Non limiting	0 above ESL (commercial/industrial) (fine) of 95 mg/kg
TRH C6-C10	186	0	<PQL	0 above ML (commercial/industrial) of 700 mg/kg	-
TRH C10-C16	186	0	<PQL	0 above ML (commercial/industrial) of 1000 mg/kg	-
F1 (TRH C6–C10 minus BTEX)	186	0	<PQL	0 above HSL D 0-1 m, sand of 260 mg/kg	0 above ESL (commercial/industrial) (coarse/fine) of 215 mg/kg
F2 (TRH >C10–C16 minus naphthalene)	186	0	<PQL	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse/fine) of 170 mg/kg
F3 (TRH C16-C34)	186	0	<PQL	0 above ML (commercial/industrial) of 3500 mg/kg	0 above ESL (commercial/industrial) (coarse) of 1700 mg/kg
F4 (TRH C34-C40)	186	0	<PQL	0 above ML (commercial/industrial) of 10,000 mg/kg	0 above ESL (commercial/industrial) (coarse) of 3300 mg/kg

Analyte	N	Detections	Maximum	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
Naphthalene	186	0	<PQL	HSL D, Non limiting	0 above Generic EIL (commercial/industrial) of 370 mg/kg
Benzo(a)pyrene	186	2	0.1	-	0 above ESL (commercial/industrial) (coarse/fine) of 1.4 mg/kg
BaP TEQ	186	0	<PQL	0 above HIL D 40 mg/kg	-
Total PAHs	186	3	1.1	0 above HIL D 4000 mg/kg	-
Total Phenols	186	0	<PQL	0 above HIL D 240000 mg/kg	-
Arsenic	186	178	27	0 above HIL D 3000 mg/kg	0 above Generic EIL (commercial/industrial) of 160 mg/kg
Cadmium	186	0	<PQL	0 above HIL D 900 mg/kg	-
Chromium	186	186	46	0 above HIL D 3600 mg/kg	0 above most conservative ACL for commercial/industrial of 310 mg/kg
Copper	186	186	39	0 above HIL D 240000 mg/kg	0 above most conservative ACL for commercial/industrial of 85 mg/kg
Mercury	186	0	<PQL	0 above HIL D 730 mg/kg	-
Nickel	186	185	19	0 above HIL D 6000 mg/kg	0 above most conservative ACL for commercial/industrial of 55 mg/kg
Zinc	186	186	**230**	0 above HIL D 400000 mg/kg	**1 above most conservative ACL for commercial/industrial of 110 mg/kg**
Total OCPs	186	0	<PQL	0 above HIL D	0 above EIL (DDT only)
Total OPPs	186	0	<PQL	0 above HIL D	-
PCBs	186	0	<PQL	0 above HIL D 7 mg/kg	-
Asbestos (FA/AF)	172	0	<0.001%	0 above HSL 0.001% w/w	-
Asbestos (ACM >7mm)	172	0	Not detected	0 above HSL B 0.05% w/w	-

n number of samples

- No criteria available/used

NL Non-limiting

<PQL Less than the practical quantitation limit

*Note: The numbers presented in the above table have been complied and transcribed manually from data tabulated by the consultants and thus some errors may be present. Any such errors are not considered by the auditor to be significant in the overall context and amount of data reviewed and conclusions drawn regarding the site during the audit.

Fill and natural soil at the site is characterised by low level detections of metals. Zinc was reported above the ecological criteria in one sample within the surface fill. This is unlikely to pose an unacceptable ecological risk given the conservative criteria used by the auditor and the proposed commercial/industrial land use.

PAHs (generally as BaP) were detected in three samples in the shallow surface fill however well below site criteria. TRH, BTEX, OCPs, OPPs, PCB, phenols and asbestos were all reported below detection. PID results were below 5 ppm. The potential asbestos pipelines were not identified during intrusive works at the site. No odours, staining or potential asbestos containing material were observed at the site.

Soil samples were collected during previous investigations by Golder/Douglas Partners at seven locations within the site. Metals were detected in fill and natural soil samples however below site criteria. PFAS was detected in one surface topsoil sample however below site criteria. TRH, BTEX, PAHs, OCPs, OPPs, PCB, phenols, VOCs and asbestos reported below detection.

In the auditor's opinion, the soil analytical results are consistent with the site history and field observations. The auditor is satisfied that no further investigations are needed and that the site criteria for commercial/industrial land uses have been met.

8.2 Sediment

Sediment samples were analysed for a variety of contaminants including metals, petroleum hydrocarbons, pesticides, PCBs, phenols and asbestos.

The results have been assessed against the environmental quality criteria. Sediment sampling locations are shown as Attachments 3 to 8, Appendix A.

Table 8.2: Evaluation of Sediment Analytical Results – Summary Table (mg/kg)

Analyte	N	Detections	Maximum	n > ANZG (2018)	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
Lead	3	3	21	-	0 above HIL D of 1500 mg/kg	0 above Generic ACL of 1800 mg/kg
Benzene	3	0	<PQL	-	0 above HSL D 0-1 m, sand of 3 mg/kg	0 above ESL (commercial/industrial) (coarse) of 75 mg/kg
Toluene	3	0	<PQL	-	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse) of 135 mg/kg
Ethyl benzene	3	0	<PQL	-	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse) of 165 mg/kg
Total Xylenes	3	0	<PQL	-	HSL D, Non limiting	0 above ESL (commercial/industrial) (fine) of 95 mg/kg
TRH C6-C10	3	0	<PQL	-	0 above ML (commercial/industrial) of 700 mg/kg	-

Analyte	N	Detections	Maximum	n > ANZG (2018)	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
TRH C10-C16	3	0	<PQL	-	0 above ML (commercial/industrial) of 1000 mg/kg	-
F1 (TRH C6–C10 minus BTEX)	3	0	<PQL	-	0 above HSL D 0-1 m, sand of 260 mg/kg	0 above ESL (commercial/industrial) (coarse/fine) of 215 mg/kg
F2 (TRH >C10–C16 minus naphthalene)	3	0	<PQL	-	HSL D, Non limiting	0 above ESL (commercial/industrial) (coarse/fine) of 170 mg/kg
F3 (TRH C16-C34)	3	0	<PQL	-	0 above ML (urban residential) of 3500 mg/kg	0 above ESL (commercial/industrial) (coarse) of 1700 mg/kg
F4 (TRH C34-C40)	3	0	<PQL	-	0 above ML (urban residential) of 10,000 mg/kg	0 above ESL (commercial/industrial) (coarse) of 3300 mg/kg
Total TPHs	3	0	<PQL	0 above ANZG (2018) of 280 mg/kg		
Naphthalene	3	0	<PQL	-	HSL D, Non limiting	0 above Generic EIL (commercial/industrial) of 370 mg/kg
Benzo(a)pyrene	3	0	<PQL	-	-	0 above ESL (commercial/industrial) (coarse/fine) of 1.4 mg/kg
BaP TEQ	3	0	<PQL	-	0 above HIL D 40 mg/kg	-
Total PAHs	3	0	<PQL	0 above ANZG (2018) of 10,000 mg/kg	0 above HIL D 4000 mg/kg	-
Total Phenols	3	0	<PQL	-	0 above HIL D 240000 mg/kg	-
Arsenic	3	2	12	0 above ANZG (2018) of 20 mg/kg	0 above HIL D 3000 mg/kg	0 above Generic EIL (commercial/industrial) of 160 mg/kg
Cadmium	3	0	<PQL	0 above ANZG (2018) of 1.5 mg/kg	0 above HIL D 900 mg/kg	-
Chromium	3	3	22	0 above ANZG (2018) of 80 mg/kg	0 above HIL D 3600 mg/kg	0 above most conservative ACL for commercial/industrial of 310 mg/kg

Analyte	N	Detections	Maximum	n > ANZG (2018)	n > Human Health Screening Criteria (NEPM, 2013)	n > Terrestrial Ecological Screening Criteria (NEPM, 2013)
Copper	3	3	21	0 above ANZG (2018) of 65 mg/kg	0 above HIL D 240000 mg/kg	0 above most conservative ACL for commercial/industrial of 85 mg/kg
Mercury	3	0	<PQL	0 above ANZG (2018) of 0.15 mg/kg	0 above HIL D 730 mg/kg	-
Nickel	3	3	8	0 above ANZG (2018) of 21 mg/kg	0 above HIL D 6000 mg/kg	0 above most conservative ACL for commercial/industrial of 55 mg/kg
Zinc	3	3	32	0 above ANZG (2018) of 200 mg/kg	0 above HIL D 400000 mg/kg	0 above most conservative ACL for commercial/industrial of 110 mg/kg
Total OCPs	3	0	<PQL	0 above ANZG (2018)	0 above HIL D	-
Total OPPs	3	0	<PQL	-	-	0 above EIL (commercial/industrial)
PCBs	3	0	<PQL	0 above ANZG (2018) of 34 mg/kg	0 above HIL D 7 mg/kg	-
Asbestos (FA/AF)	3	0	<PQL	-	0 above HSL D 0.07%	-
Asbestos (presence/absence)	3	0	<PQL	-	-	-

n number of samples

- No criteria available/used

NL Non-limiting

<PQL Less than the practical quantitation limit

*Note: The numbers presented in the above table have been complied and transcribed manually from data tabulated by the consultants and thus some errors may be present. Any such errors are not considered by the auditor to be significant in the overall context and amount of data reviewed and conclusions drawn regarding the site during the audit.

Low levels of metals were detected in all three sediment samples however well below site criteria. Results were reported below detection for TRH, BTEX, PAHs, OCPs, OPPs, PCB, phenols and asbestos.

In the auditor's opinion, the sediment analytical results are consistent with the site history and surface water results (see Section 9.2). The auditor is satisfied that no further investigations are needed and that the site criteria for commercial/industrial land uses have been met.

9.0 Evaluation of Groundwater and Surface Water Analytical Results

9.1 Groundwater

Groundwater samples were collected from three wells. These were submitted for analytes including metals, petroleum hydrocarbons, pesticides, PCBs and VOCs. The analytical results are summarised below in Table 9.1.

The results have been assessed against the environmental quality criteria. Groundwater sampling locations are shown as Attachments 3 to 8, Appendix A.

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

Analyte	n	Detections	Maximum	n > ANZG (2018)	n > HSL D (<2-4 mbgl)	n > DWG (ADWG 2011, WHO 2008, WHO 2011)
TRH C_6-C_{10} less BTEX (F1)	5	0	<PQL	-	0 above 6000 µg/L	0 above 90 µg/L
TRH >C_{10}-C_{16} less naphthalene (F2)	5	0	<PQL	-	NL	0 above 900 µg/L
TRH >C16-C34 (F3)	5	0	<PQL	-	-	0 above 900 µg/L
TRH >C34-C40 (F4)	5	0	<PQL	-	-	0 above 900 µg/L
Benzene	5	0	<PQL	0 above 950 µg/L	0 above 5000 µg/L	0 above 1 µg/L
Toluene	5	0	<PQL	-	NL	0 above 800 µg/L
Ethyl benzene	5	0	<PQL	-	NL	0 above 300 µg/L
Xylene	5	0	<PQL	0 above 200 µg/L	NL	0 above 600 µg/L
Naphthalene	5	0	<PQL	0 above 16 µg/L	NL	-
Benzo(a)pyrene	5	0	<PQL	0 above 0.1 µg/L	-	-
Anthracene	5	0	<PQL	0 above 0.01 µg/L	-	-
Fluoranthene	5	0	<PQL	0 above 1 µg/L	-	-
Phenanthrene	5	1	0.1	0 above 0.6 µg/L	-	-
Total Phenols	5	0	<PQL	-	-	-
Arsenic	5	5	12	0 above 13 µg/L	-	0 above 10 µg/L

Analyte	n	Detections	Maximum	n > ANZG (2018)	n > HSL D (<2-4 mbgl)	n > DWG (ADWG 2011, WHO 2008, WHO 2011)
Cadmium	5	4	0.8	0 above 0.2 µg/L	-	0 above 2 µg/L
Chromium	5	0	<PQL	0 above 0.2 µg/L	-	0 above 50 µg/L
Copper	5	5	**3**	**4 above 1.4 µg/L**	-	0 above 2000 µg/L
Lead	5	0	<PQL	0 above 3.4 µg/L	-	0 above 10 µg/L
Mercury	5	1	0.2	0 above 0.06 µg/L	-	0 above 1 µg/L
Nickel	5	5	**66**	**5 above 11 µg/L**	-	**4 above 20 µg/L**
Zinc	5	5	**710**	**5 above 8 µg/L**	-	0 above 3000 µg/L
Total OCPs	5	0	<PQL	-	-	-
Total OPPs	5	0	<PQL	-	-	-
PCBs	5	0	<PQL	-	-	-
Chloroform	5	1	**4**	0 above 360 µg/L	-	**1 above 3 µg/L**
Other VOCs	5	0	<PQL	-	-	-

n number of samples

- No criteria available/used

<PQL Less than the practical quantitation limit

*Note: The numbers presented in the above table have been complied and transcribed manually from data tabulated by the consultants and thus some errors may be present. Any such errors are not considered by the auditor to be significant in the overall context and amount of data reviewed and conclusions drawn regarding the site during the audit.

Metals were detected in all groundwater wells. Copper, nickel and zinc reported above the ecological criteria and nickel above the drinking water criteria. Douglas Partners considered the detections of metals to be representative of background concentrations. The auditor notes the levels are consistent in up and down gradient wells at the site and therefore are likely to be regional background concentrations.

Chloroform was also detected in one well above the drinking water criteria. Douglas Partners considered the detection of chloroform to be below the converted drinking water to recreational water criteria and as such did not pose a risk at the site. The auditor understands that the groundwater will not be accessed for drinking water given the sites proposed use as a railway track via viaduct and passive open space. The levels of chloroform are not considered likely to pose an unacceptable risk.

TRH, BTEX, PAHs, OCPs, OPPs, PCB, phenols and other VOCs reported below detection. No odours or phase separated hydrocarbons were identified within the groundwater.

In the auditor's opinion, the groundwater analytical results are consistent with the site history, field observations and soil analytical results. The auditor is satisfied that no further investigations are needed and that the site criteria for commercial/industrial land uses have been met.

9.2 Surface Water

Surface water samples were analysed for a variety of contaminants including metals, petroleum hydrocarbons, pesticides, PCBs and VOCs.. The analytical results are summarised below in Table 9.2.

The results have been assessed against the environmental quality criteria. Surface water sampling locations are shown as Attachments 3 to 8, Appendix A.

Table 9.2: Summary of Surface Water Investigation Analytical Results (µg/L)

Analyte	n	Detections	Maximum	n > ANZG (2018)	n > HSL D (<2-4 mbgl)	n > DWG (ADWG 2011, WHO 2008, WHO 2011)
TRH C_6-C_{10} less BTEX (F1)	3	0	<PQL	-	0 above 6000 µg/L	0 above 90 µg/L
TRH >C_{10}-C_{16} less naphthalene (F2)	3	1	120	-	NL	0 above 900 µg/L
TRH >C16-C34 (F3)	3	1	200	-	-	0 above 900 µg/L
TRH >C34-C40 (F4)	3	0	<PQL	-	-	0 above 900 µg/L
Benzene	3	0	<PQL	0 above 950 µg/L	0 above 5000 µg/L	0 above 1 µg/L
Toluene	3	1	4	-	NL	0 above 800 µg/L
Ethyl benzene	3	0	<PQL	-	NL	0 above 300 µg/L
Xylene	3	0	<PQL	0 above 200 µg/L	NL	0 above 600 µg/L
Naphthalene	3	1	0.05	0 above 16 µg/L	NL	-
Benzo(a)pyrene	3	0	<PQL	-	-	-
Anthracene	3	0	<PQL	0 above 0.01 µg/L		
Fluoranthene	3	0	<PQL	0 above 1 µg/L		
Phenanthrene	3	0	<PQL	0 above 0.6 µg/L		
Total Phenols	3	0	<PQL			
Arsenic	3	2	3	0 above 13 µg/L	-	0 above 10 µg/L
Cadmium	3	0	<PQL	0 above 0.2 µg/L	-	0 above 2 µg/L
Chromium	3	0	<PQL	0 above 0.2 µg/L	-	0 above 50 µg/L
Copper	3	3	**4**	**2 above 1.4 µg/L**	-	0 above 2000 µg/L
Lead	3	0	<PQL	0 above 3.4 µg/L	-	0 above 10 µg/L

Analyte	n	Detections	Maximum	n > ANZG (2018)	n > HSL D (<2-4 mbgl)	n > DWG (ADWG 2011, WHO 2008, WHO 2011)
Mercury	3	0	<PQL	0 above 0.06 µg/L	-	0 above 1 µg/L
Nickel	3	2	2	0 above 11 µg/L	-	0 above 20 µg/L
Zinc	3	3	8	0 above 8 µg/L	-	0 above 3000 µg/L
Dieldrin	3	1	**0.04**	**1 above 0.01 µg/L**	-	0 above 0.3 µg/L
Other OCPs	3	0	<PQL	-	-	-
Total OPPs	3	0	<PQL	-	-	-
PCBs	3	0	<PQL	-	-	-
VOCs	3	0	<PQL	-	-	-

n number of samples

- No criteria available/used

<PQL Less than the practical quantitation limit

*Note: The numbers presented in the above table have been complied and transcribed manually from data tabulated by the consultants and thus some errors may be present. Any such errors are not considered by the auditor to be significant in the overall context and amount of data reviewed and conclusions drawn regarding the site during the audit.

Low levels of metals were detected in all three surface water samples. Copper was detected above the ecological criteria. Dieldrin (an OCP) was also detected above the ecological criteria, all remaining OCPs were below detection. The exceedences of the ecological criteria are unlikely to pose an unacceptable ecological risk given the proposed commercial/industrial land use. There are no detections of OCPs within the soil, sediment or groundwater at the site including the sediment sample collected from the same dam as the surface water sample. Widespread impacts from cooper have also not been detected in the soil or sediment and groundwater levels are considered background concentrations.

Results were below detection for TRH, BTEX, PAHs, OPPs, PCB, phenols and asbestos. No odours were reported in surface water.

In the auditor's opinion, the surface water analytical results are consistent with the site history and field observations. The auditor is satisfied that no further investigations are needed and that the site criteria for commercial/industrial land uses have been met.

10.0 Evaluation of Conceptual Site Model

A conceptual site model is a representation of the source, pathway and receptor linkages at a site. Consultant has/has not developed a conceptual site model and has used the CSM iteratively throughout the site assessment to inform decisions around investigation. The CSM was initially developed in the SAQP and has been updated as new information became available. Table 10.1 provides the auditors review of the final CSM used by Douglas Partners to conclude on site suitability.

Table 10.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Contaminated ground from former buildings and structures. (EIS noted: ACM pipelines and isolated ACM in soil from former building, and isolated zinc exceedence in soil).	Adequate.
Affected media	Soil. Sediment. Groundwater. Surface water	Adequate.
Receptor identification	Construction workers (for the proposed development). Future site workers including maintenance workers (post-development) Pedestrians and commuters. Adjacent site users. Surface water bodies. Groundwater. Terrestrial ecosystems. In ground structures.	Adequate. The auditor notes receptors in surface water bodies would include aquatic ecosystems.
Exposure pathways	Ingestion. Direct contact. Inhalation of dust. Inhalation of vapours. Surface run-off. Leaching of contaminants into groundwater and lateral migration of groundwater.	Adequate.
Presence of preferential pathways for contaminant movement	Not specified.	The auditor considers the preferential pathways are likely to be direct contact during construction works and migration into groundwater/ run-off to surface water.
Evaluation of data gaps	No data gaps identified.	Adequate.

11.0 Contamination Migration Potential

The potential for off-site migration of contaminants, including asbestos, in surface water or dust is considered low due to the relatively flat nature of the site and the grassed surfaces. No significant levels of contaminants were detected over the site and therefore there is little or no potential for migration of contamination from the site or vertically to groundwater.

In the auditor's opinion, there is no evidence of significant migration of contamination and little potential for future migration.

12.0 Assessment of Risk

Based on assessment of results against relevant guidelines and consideration of the overall investigation, it is the auditor's opinion that the risks to human health and the environment are low.

The auditor considers that the risk of any undetected contamination is low. The expected conditions at the site are fill (silty sand) overlying natural (silty clay) and siltstone/sandstone with no odour or staining.

Douglas Partners note that there is the possibility that asbestos pipelines may remain undetected at the site. It is understood an unexpected finds protocol will be implemented during excavation works at the site.

13.0 Compliance with Regulatory Guidelines and Directions

The auditor has used guidelines currently approved by the EPA under Section 105 of the NSW Contaminated Land Management Act 1997 (Appendix C).

The investigation was generally conducted in accordance with SEPP (Resilience and Hazards) 2021 and reported in accordance with the NSW EPA (2020) Consultants Reporting on Contaminated Sites Contaminated Land Guidelines. The checklist included in that document has been referred to. The EPA's Checklist for Site Auditors using the EPA Guidelines for the NSW Site Auditor Scheme 2017 (October 2017) has also been referred to.

14.0 Conclusions and Recommendations

Douglas Partners considers that the site is “suitable for proposed site”. Based on the information presented in Douglas Partners reports and observations made on site, and following the Decision-Making Process for Assessing Urban Redevelopment Sites in NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme, the Auditor concludes that the site is suitable for the purposes of a “railway track, embankments/ noise barriers, a stabling yard and maintenance facility, station and passive open space adjacent to the rail corridor”.

15.0 Other Relevant Information

This audit was conducted on the behalf of CPBUI JV for the purpose of assessing whether the land is suitable for the proposed commercial/industrial uses i.e. a “Site Audit” as defined in Section 4 (definition of a ‘site audit’ (b)(iii)).

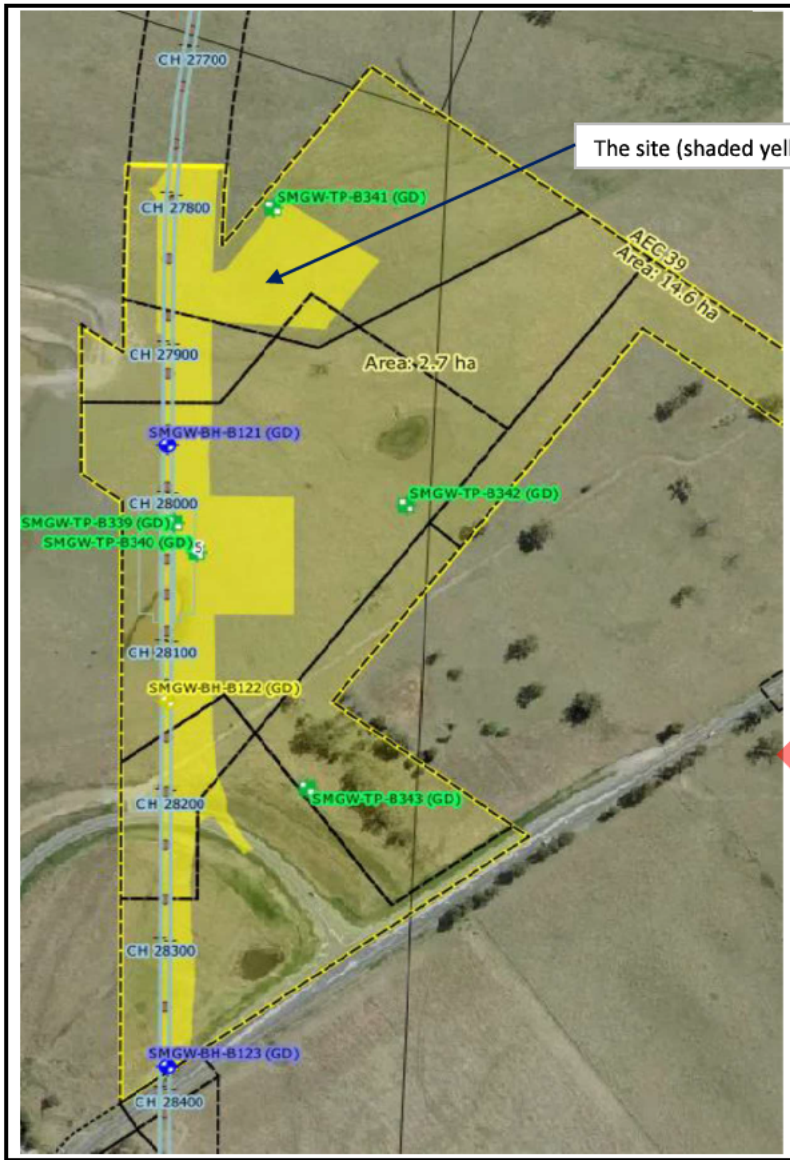
This summary report may not be suitable for other uses. Douglas Partners included limitations in their report. The audit must also be subject to those limitations. The auditor has prepared this document in good faith, but is unable to provide certification outside of areas over which the auditor had some control or is reasonably able to check.

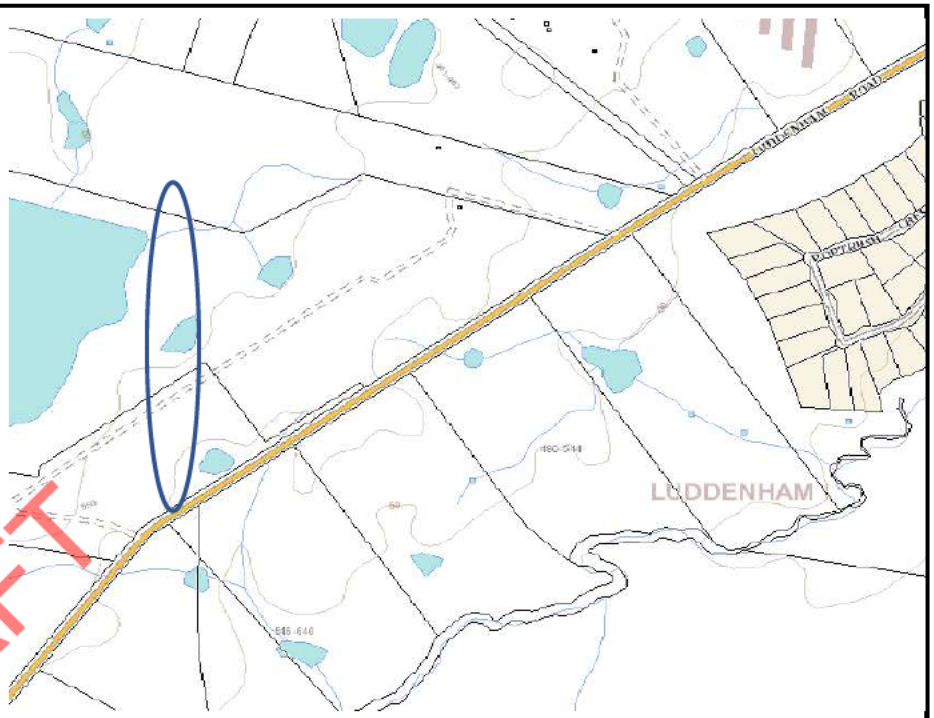
In drawing conclusions, the auditor used reasonable care to avoid reliance upon data and information that may be inaccurate, however a degree of uncertainty is inherent in all subsurface investigations and there remains the possibility that variations may occur between sample locations. The audit and this report are limited by and rely upon the scope of the review, and the information provided by the Client and their consultants and representatives through documents provided to the auditor. The audit is based on a review of the subsurface condition of the site at the time of assessment, as described in the assessment reports attached to the audit report and site inspections conducted by the auditor and their representatives. The auditor’s conclusions presented in this report are therefore based on the information made available to them and arising from their own observations conducted during the audit. If the auditor is unable to rely on any of those documents, the conclusions of the audit could change.

It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

In reaching their conclusions about the site, the Client and NSW EPA may use this audit report and site audit statement. The scope of work performed as part of the audit process may not be appropriate to satisfy the needs of any other person. Any other person’s use of, or reliance on, the audit document and report, or the findings, conclusions, recommendations or any other material presented or made available to them, is at that person’s sole risk.

Appendix A: Attachments





DRAFT

Site Location

N

Approximate scale

0 80 m

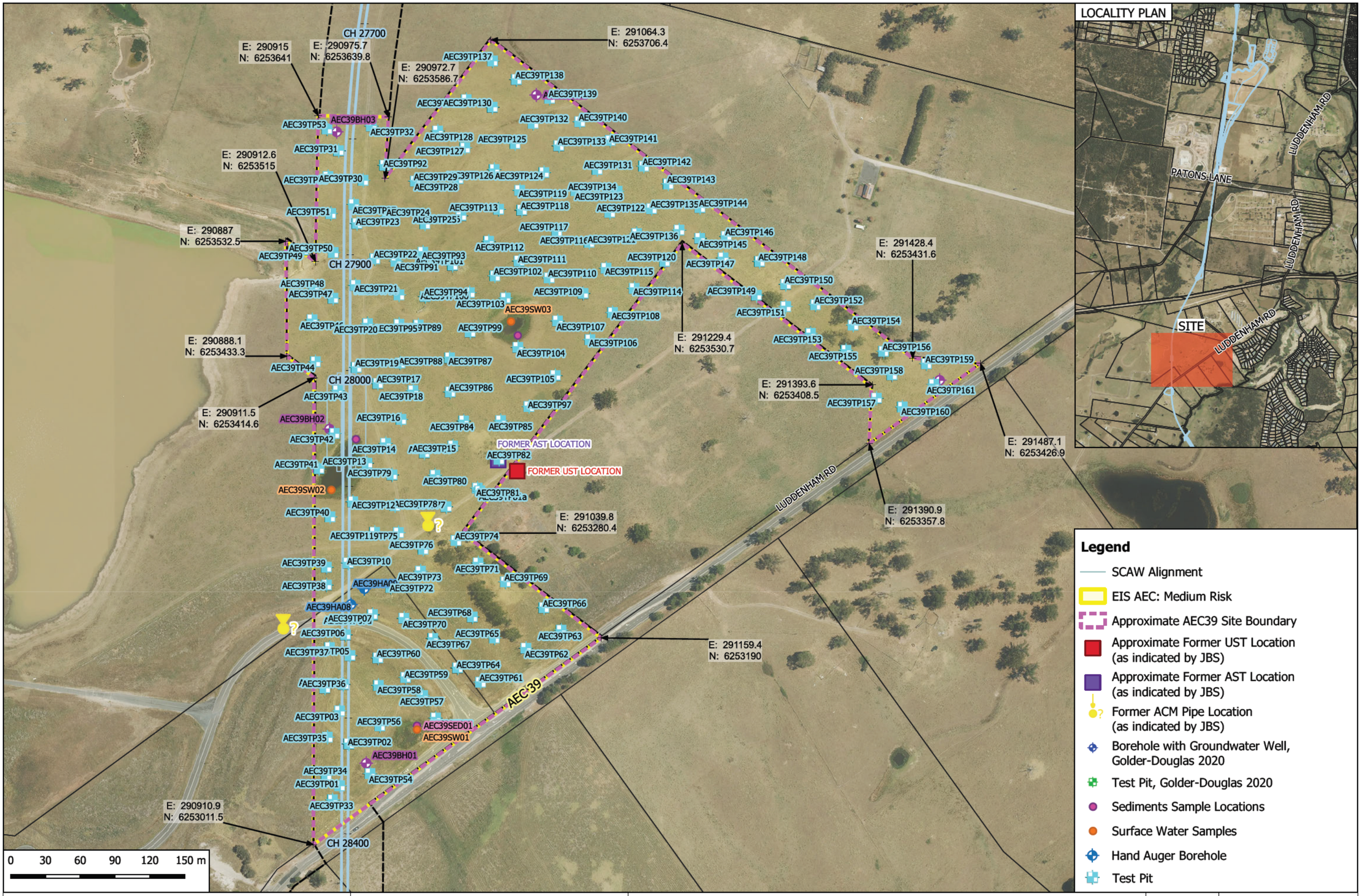
Legend

Areas of Environmental Concern (AEC)
EIS Chapter 16

High

Medium

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: CPB Contractors Pty Ltd OFFICE: Sydney DATE: 12 May 2022	**Site Location** **Surface & Civil Alignment Works Package for Sydney Metro - Western Sydney Airport** **Area of Environmental Concern (AEC) 39** **Luddenham Road, Luddenham**	PROJECT No: 204814.01 DWG No: 1 REVISION: 0

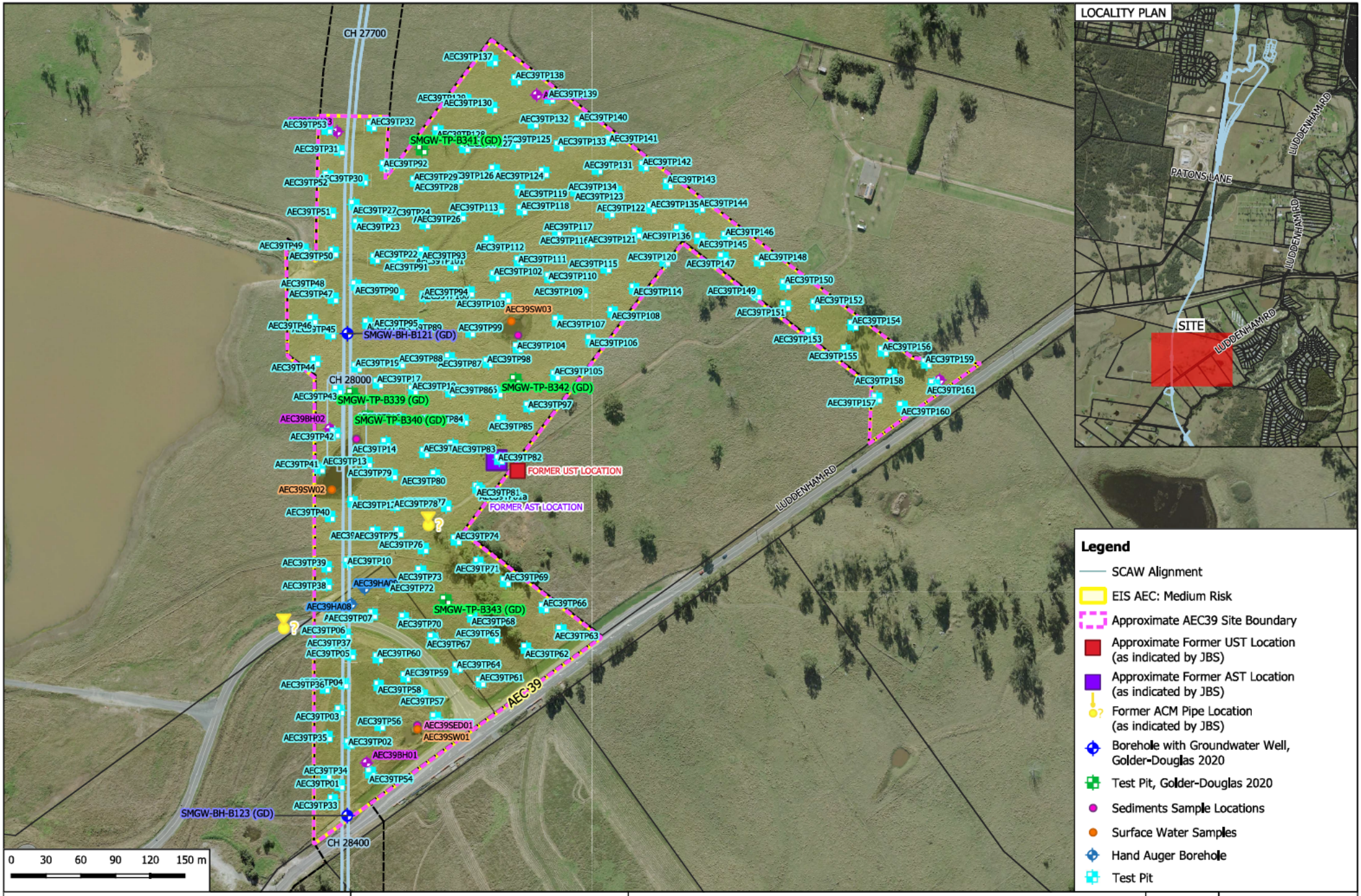


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	CPBUI JV		
OFFICE:	Sydney	DRAWN BY:	MG
SCALE:	1:3000 @ A3	DATE:	15/03/2023

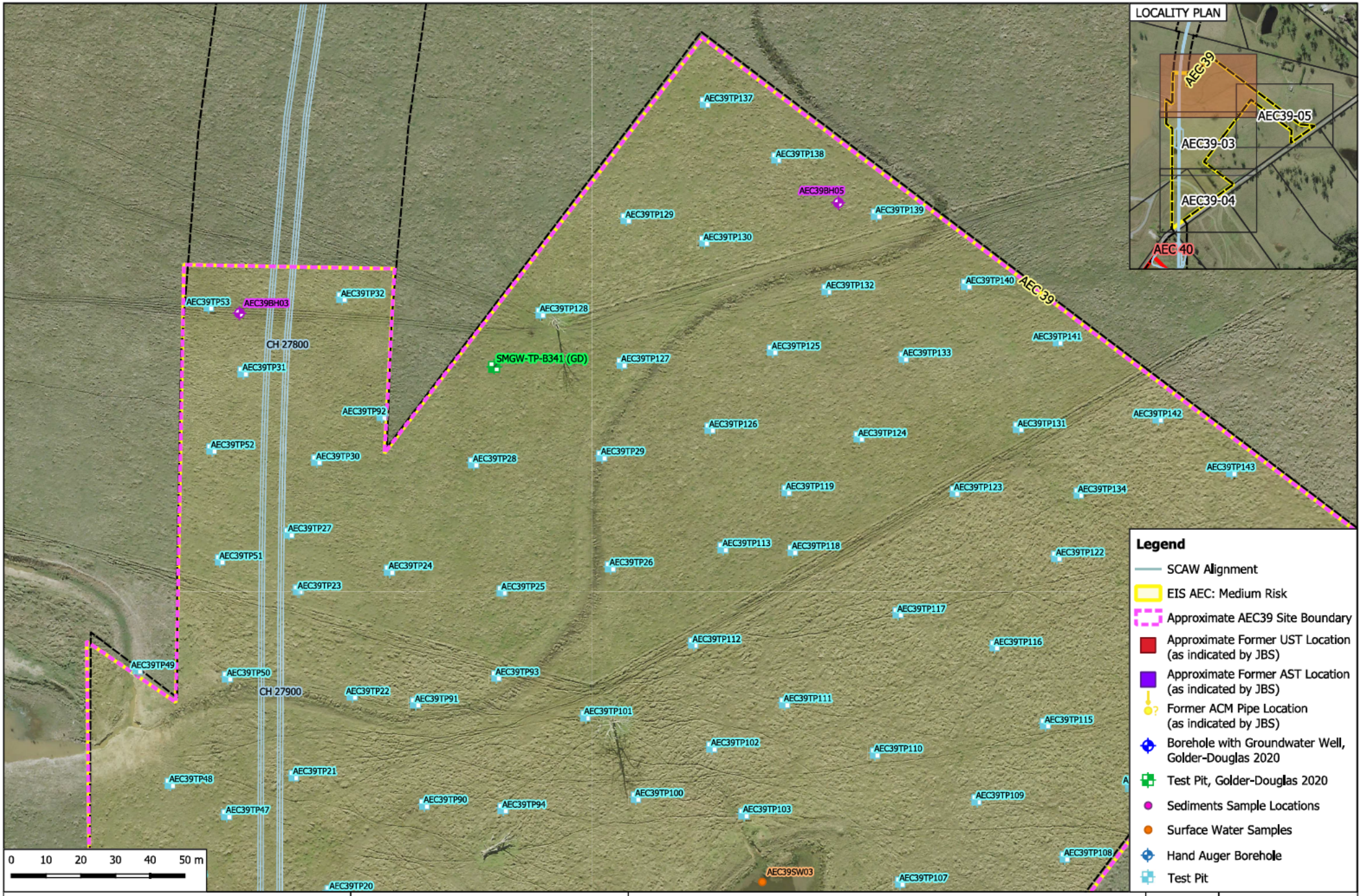
TITLE: **AEC39 Test Location Plan**
Sydney Metro Western Sydney Airport - SCAW
Elizabeth Drive, Badgerys Creek

PROJECT No:	204814.01
DRAWING No:	AEC39-01
REVISION:	Rev 1



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: CPBUI JV		TITLE: AEC39 Test Location Plan Sydney Metro Western Sydney Airport - SCAW Elizabeth Drive, Badgerys Creek	PROJECT No: 204814.01
OFFICE: Sydney	DRAWN BY: MG		DRAWING No: AEC39-01
SCALE: 1:3000 @ A3	DATE: 26/10/2022		REVISION: Rev 0



Douglas Partners
Geotechnics / Environment / Groundwater

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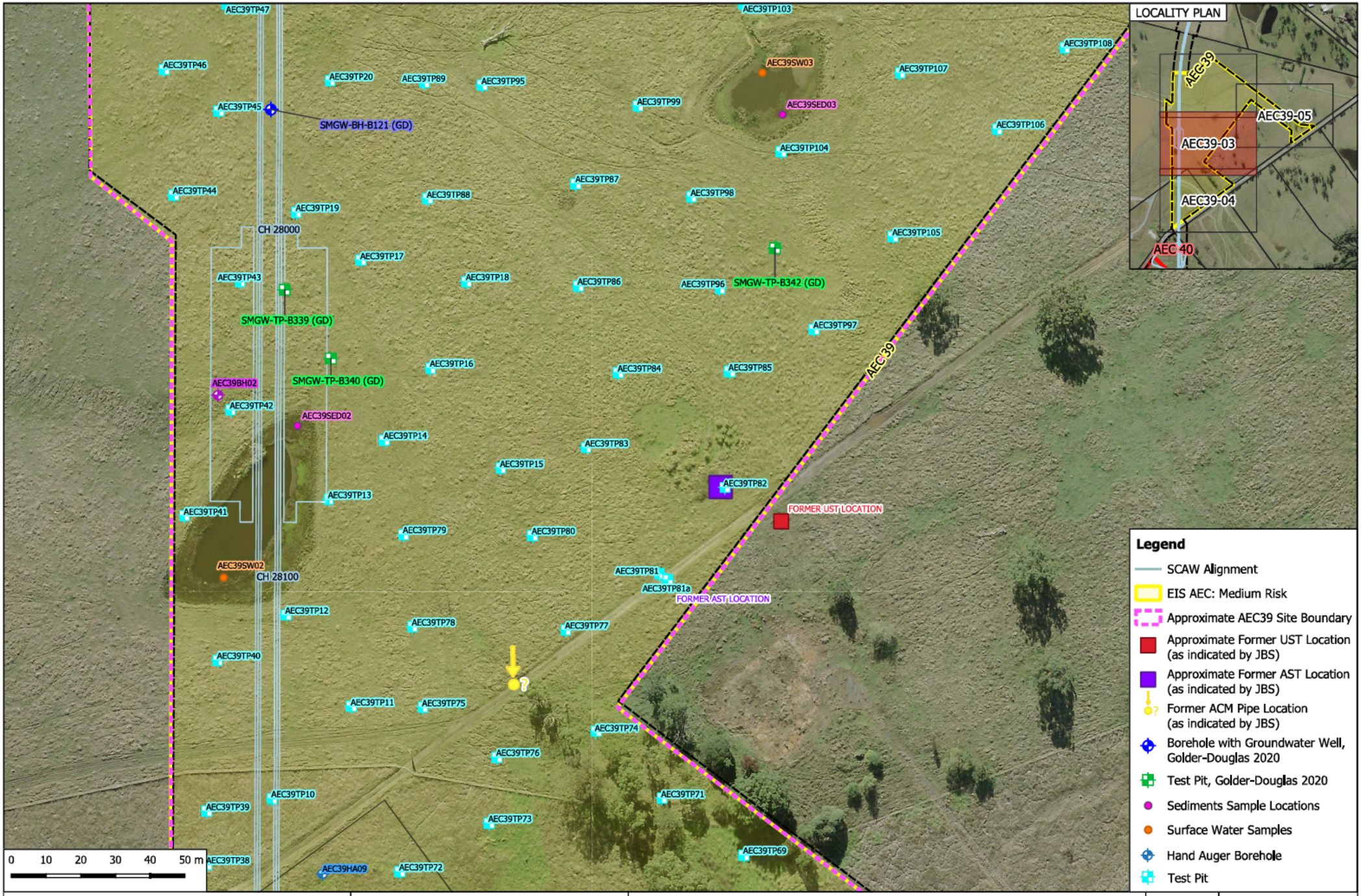
OFFICE:	Sydney	DRAWN BY:	MG
SCALE:	1:1000 @ A3	DATE:	26/10/2022

TITLE: **AEC39 Test Location Plan**
Sydney Metro Western Sydney Airport - SCAW
Elizabeth Drive, Badgerys Creek

PROJECT No:	204814.01
DRAWING No:	AEC39-02
REVISION:	Rev 0

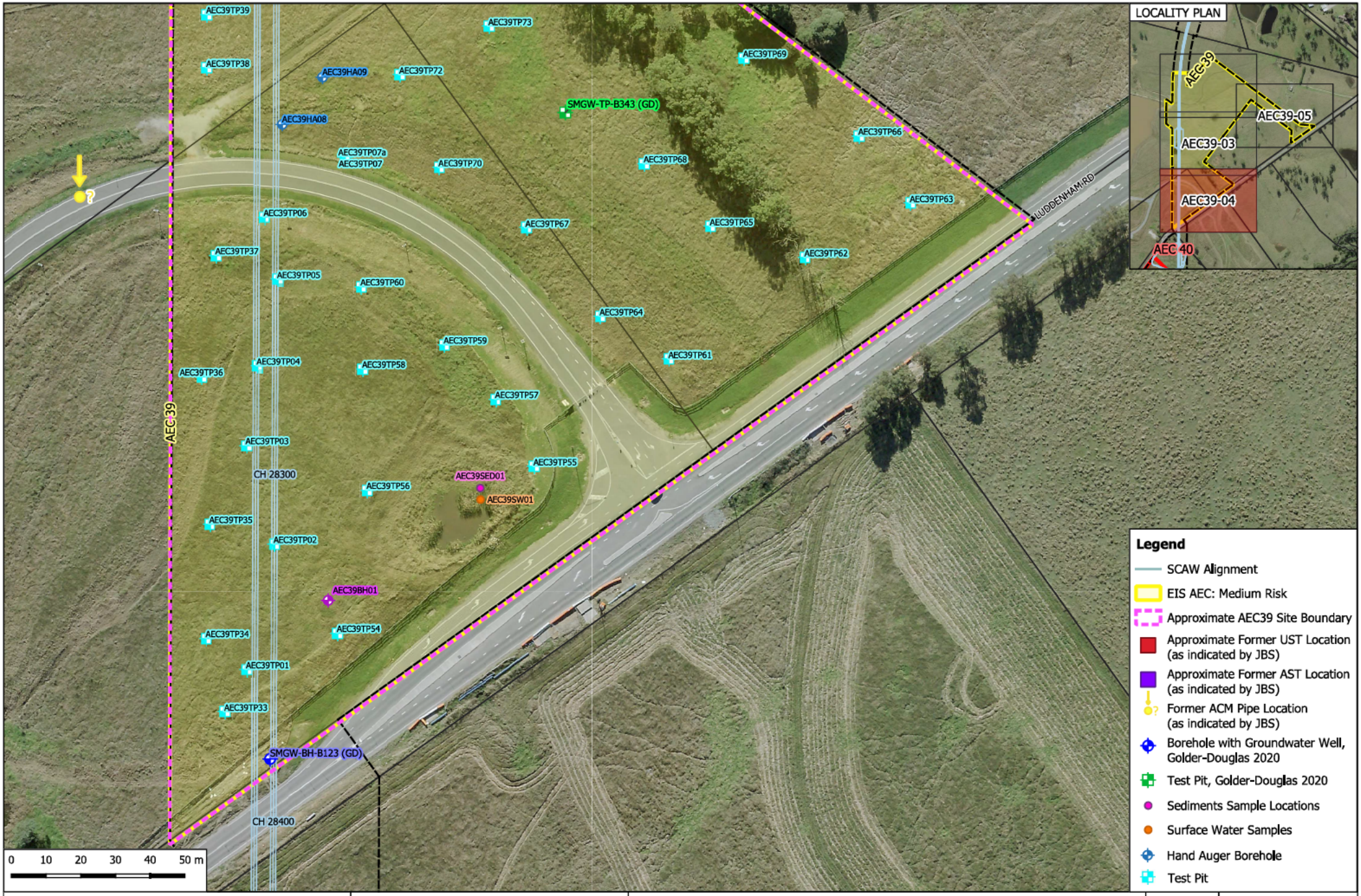


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	CPBUI JV		
OFFICE:	Sydney	DRAWN BY:	MG
SCALE:	1:1000 @ A3	DATE:	26/10/2022

TITLE: **AEC39 Test Location Plan**
Sydney Metro Western Sydney Airport - SCAW
Elizabeth Drive, Badgerys Creek

PROJECT No:	204814.01
DRAWING No:	AEC39-03
REVISION:	Rev 0

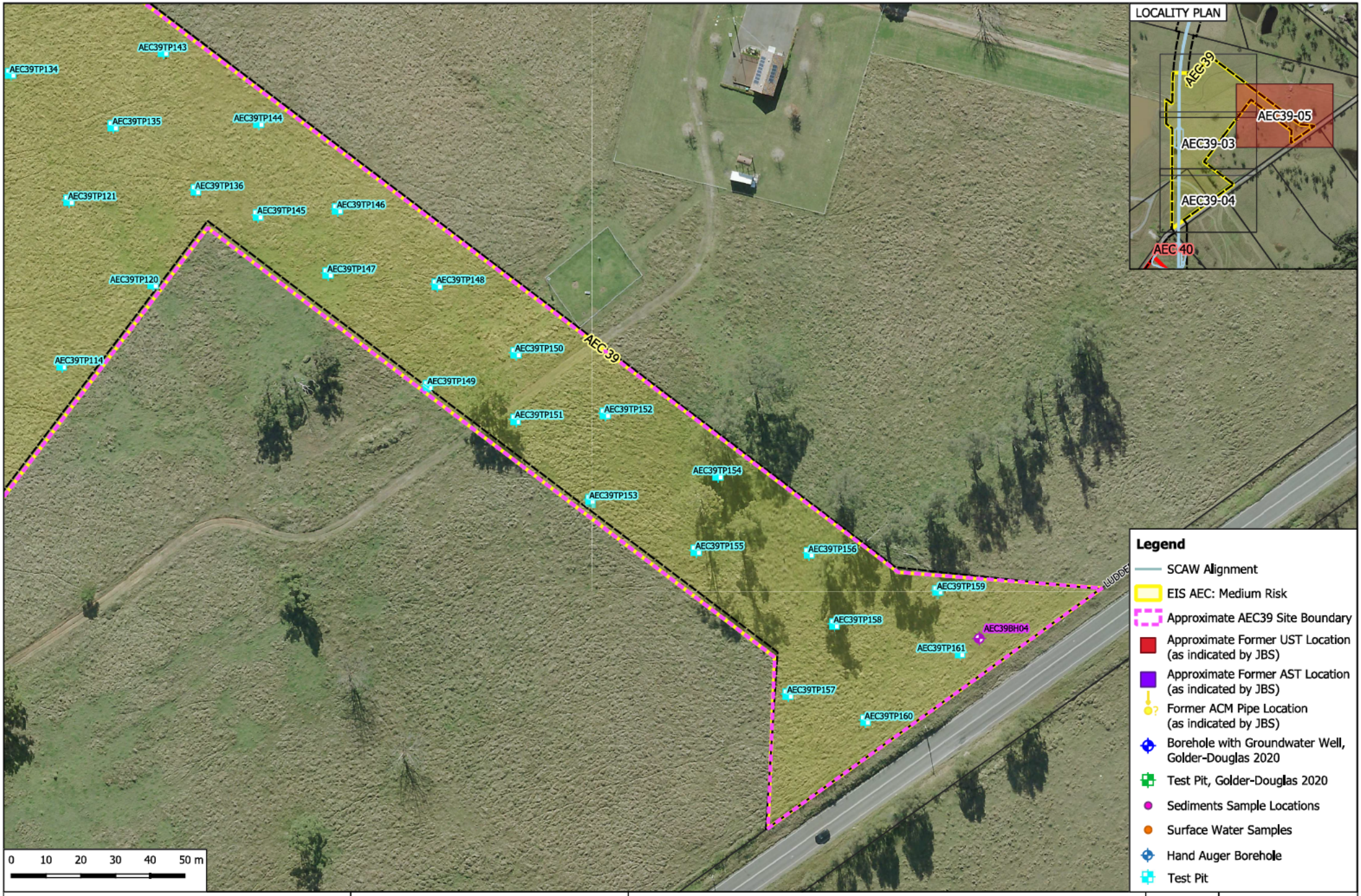


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	CPBUI JV		
OFFICE:	Sydney	DRAWN BY:	MG
SCALE:	1:1000 @ A3	DATE:	26/10/2022

TITLE: **AEC39 Test Location Plan**
Sydney Metro Western Sydney Airport - SCAW
Elizabeth Drive, Badgerys Creek

PROJECT No:	204814.01
DRAWING No:	AEC39-04
REVISION:	Rev 0



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	CPBUI JV		
OFFICE:	Sydney	DRAWN BY:	MG
SCALE:	1:1000 @ A3	DATE:	26/10/2022

TITLE: **AEC39 Test Location Plan**
Sydney Metro Western Sydney Airport - SCAW
Elizabeth Drive, Badgerys Creek

PROJECT No:	204814.01
DRAWING No:	AEC39-05
REVISION:	Rev 0

Appendix B: EPA Guidelines

Guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997*

(as of: 12 August 2022)

Section 105 of the Contaminated Land Management Act 1997 (CLM Act) allows the EPA to make or approve guidelines for purposes connected with the objects of the Act. The EPA must consider these guidelines whenever they are relevant. Other people must also consider the guidelines, namely, accredited site auditors when conducting a site audit; contaminated land consultants when investigating, remediating, validating and reporting on contaminated sites; and those responsible for land contamination with a duty to notify the EPA.

A current list of guidelines made or approved by the EPA under the CLM Act appears below.

Guidelines made by the EPA

- Assessment and management of hazardous ground gases: Contaminated land guidelines (PDF 4MB)
- Guidelines for the vertical mixing of soil on former broad-acre agricultural land (PDF 148KB)
- Contaminated land sampling design guidelines part 1 – application (PDF 3.3MB)
- Contaminated land sampling design guidelines part 2 – interpretation (PDF 1MB)
- Guidelines for assessing banana plantation sites (PDF 586KB)
- Consultants reporting on contaminated land: Contaminated land guidelines (PDF 1MB)
- Guidelines for assessing former orchards and market gardens (PDF 172KB)
- Guidelines for the NSW Site Auditor Scheme, 3rd edition (PDF 999KB)
- Guidelines for the assessment and management of groundwater contamination (PDF 604KB)
- Guidelines on the duty to report contamination under the Contaminated Land Management Act 1997 (PDF 412KB)

Guidelines that refer to the:

- Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, October 2000), are replaced as of 29 August 2018 by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, August 2018), with the exception of the water quality for primary industries component, which still refer to the ANZECC & ARMCANZ (2000) guidelines
- National Environment Protection (Assessment of Site Contamination) Measure 1999 are replaced as of 16 May 2013 by the National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013).

Guidelines approved by the EPA

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZG (August 2018)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3, Primary Industries - Rationale and Background Information (ANZECC & ARMCANZ (October 2000)
- Composite sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide. Email enHealth.Secretariat@health.gov.au for a copy of this publication.
- Environmental health risk assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia (June 2012)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013)* (ASC NEPM)
- Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes, NSW Agriculture and CMPS&F Environmental (February 1996)
- Australian Drinking Water Guidelines, NHMRC and Natural Resource Management Ministerial Council of Australia and New Zealand (2011)

*The ASC NEPM was amended on 16 May 2013..

Appendix C: Interim Audit Advice

Senversa Pty Ltd
Level 24, 1 Market St, Sydney 2000
ABN 89 132 231 380 www.senversa.com.au

1 September 2022

[redacted]
CPBUI JV
Level 5, 60 Miller Street
North Sydney NSW 2060

Dear [redacted]

Re: Interim Audit Advice No. 1: AEC39, Luddenham Road Luddenham

Review of Sampling and Analysis Quality Plan

1. Introduction and Background

[redacted] (the Site Auditor) of Senversa Pty Ltd (Senversa) has been engaged by CPB Contractors Pty Ltd and United Infrastructure Pty Ltd (CPBUI JV) on behalf of Sydney Metro as a NSW Environment Protection Authority (EPA) Accredited Contaminated Sites Auditor for the proposed development of the Sydney Metro to Western Sydney Airport line. The site is part of the proposed Sydney Metro line and is located at Luddenham Road, Luddenham (hereafter referred to as 'the site').

The site is currently occupied by rural land used as paddocks. The site is potentially impacted from ACM pipelines and isolated ACM in soil from former buildings and an isolated zinc exceedence in soil. The former buildings and isolated zinc exceedence are located adjacent to the site within AEC 39. It is understood that the development of the site will likely include stripping of topsoil and construction of a viaduct for the rail lines. Areas alongside the proposed rail lines will be used by contractors for staging and maintenance for the Metro. Douglas Partners Pty Ltd (Douglas Partners), engaged as the environmental consultant to assess the contamination status of the site, produced the following report, which was forwarded to the Site Auditor for review:

- 'Sampling and Analysis Quality Plan (SAQP), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 17 August 2022 by Douglas Partners (DRAFT).

This interim audit advice details the review of the SAQP for a detailed site investigation in relation to the contamination status of the site.

2. Review Comments

The Site Auditor has undertaken a review of the SAQP against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage, 2011). Review comments are detailed herein.

- Section 1. Please consider the NSW EPA Sampling Design Guidelines (2022), implement appropriate and compliant densities where feasible or provide justification for reduced sampling densities i.e., consistently low results and consistent with the known site history.
- Section 3. Please indicate the potential depth of excavation for the viaduct footings.
- Section 4. Please confirm review of Appendix B in the NEMP regarding the potential for PFAS contamination for the historical and current land use.
- Section 5.
    - Please specify whether previous data for the validation of the asbestos pipe removal within the site area is available. Include in an appendix, the correspondence from Penrith City Council for validation of the pipeline.
    - Please include a summary of analytical results from the previous investigation at the site.
- Section 7. Site Assessment Criteria in Appendix B cover a wide range of analytes and depths. The actual criteria to be applied at the site should be outlined in Section 7 if auditor review is required.
- Section 9. Note. If the site extends across the other dams within AEC39 in the future, sediment and surface water samples should be collected.
- Appendix A.
    - Please indicate the location of previous building footprints and isolated zinc exceedence (identified in the EIS) in Drawing 2.
    - Please show the extent and orientation of the asbestos pipeline through the site (Drawing 2). Ensure adequate targeting of the pipeline location to confirm removal.

It is understood that material reuse criteria in the SAQP was derived from the Human Health and Ecological Risk Assessment (HHERA) prepared to facilitate the re-use of spoil along the Sydney Metro alignment. At this stage we cannot comment on the material reuse criteria stated in the SAQP until approval to the HHERA has been received (if required).

3. Close

We look forward to receiving a response to the comments above and trust this meets your current requirements. Should you have any queries or require further information, please do not hesitate to contact the undersigned.

Yours sincerely,
On behalf of **Senversa Pty Ltd**

NSW EPA Accredited Site Auditor (0803)

MC/MP

Technical Limitations and Uncertainty – *This Interim Advice is not a Site Audit Report or a Site Audit Statement, as defined in the Contaminated Land Management Act 1997, but forms part of the Site Audit process*. It is intended that a Site Audit Statement and report will be issued at the completion of the site audit.
Consistent with NSW EPA requirements for staged "sign-off" of sites that are the subject of progressive assessment, remediation and validation, the Auditor is required to advise that:

- *This site audit advice does not constitute a site audit report or statement.*
- *This letter is considered by the Auditor to be consistent with NSW EPA guidelines and policies.*
- *This letter will be documented in the final Site Audit Statement and associated documentation.*
- *At the completion of the site audit, a Site Audit Statement will be prepared, for the consent agency to include the Site's property information, held by the local council.*

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Senversa Pty Ltd
Level 24, 1 Market St, Sydney 2000
ABN 89 132 231 380 www.senversa.com.au

17 November 2022

[redacted]
CPBUI JV
Level 5, 60 Miller Street
North Sydney NSW 2060

Dear [redacted]

Re: Interim Audit Advice No. 2: AEC39, Luddenham Road Luddenham

Review of Detailed Site Investigation

1. Introduction and Background

[redacted] (the Site Auditor) of Senversa Pty Ltd (Senversa) has been engaged by CPB Contractors Pty Ltd and United Infrastructure Pty Ltd (CPBUI JV) on behalf of Sydney Metro as a NSW Environment Protection Authority (EPA) Accredited Contaminated Sites Auditor for the proposed development of the Sydney Metro to Western Sydney Airport line. The site is part of the proposed Sydney Metro line and is located at Luddenham Road, Luddenham (hereafter referred to as 'the site').

The site is currently occupied by rural land used as paddocks. The site is potentially impacted from ACM pipelines and isolated ACM in soil from former buildings and an isolated zinc exceedence in soil. The former buildings and isolated zinc exceedence are understood to be located adjacent to the site within AEC 39. It is further understood that the development of the site will likely include stripping of topsoil and construction of a viaduct for the rail lines. Areas alongside the proposed rail lines will be used by contractors for staging and maintenance for the Metro. Douglas Partners Pty Ltd (Douglas Partners), engaged as the environmental consultant to assess the contamination status of the site, produced the following reports, which were forwarded to the Site Auditor for review:

- 'Sampling and Analysis Quality Plan (SAQP), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 17 August 2022 by Douglas Partners (DRAFT).
- 'Report on Detailed Site Investigation (Contamination), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 28 October 2022 by Douglas Partners (DRAFT).

The SAQP was previously reviewed and comments provided by the auditor in interim audit advice (IAA) No.1 dated 1 September 2022.

This interim audit advice details the review of the detailed site investigation in relation to the contamination status of the site.

2. Review Comments

The Site Auditor has undertaken a review of the detailed site investigation against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage, 2020). Review comments are detailed herein.

- Section 3. Please indicate the potential depth of excavation for the viaduct footings.
- Section 4. Note where surface water is likely to flow and confirm legal entity of site owner.
- Section 5. Please confirm whether the JBS&G RAP includes a drawing or location description of the site sheds and power poles. Please provide available information on their location to confirm removal. And if it's possible, obtain additional information from the Council regarding the addendum validation report required.
- Section 6. The former buildings and zinc exceedence are noted outside of the site boundary but within AEC 39. However, the boundaries for the site under assessment and AEC39 appear to be the same in the Drawings provided. Please update EIS AEC boundary if different.
- Section 7.3. Confirm drilling method of groundwater monitoring wells, e.g. solid flight auger.
- Section 9. Site Assessment Criteria in Appendix F cover a wide range of analytes and depths. The actual criteria to be applied at the site should be outlined in Section 9 if auditor review is required.
- Section 10.2. Confirm depth of sediment sample collection.
- Discuss DSI compliance with the SAQP.
- Appendix A. Please indicate the location of previous building footprints and isolated zinc exceedence (identified in the EIS) in Drawing 1.
- Appendix C. Previous results don't appear to have been summarised. Please provide analytical result tables of historical data.
- Appendix F. Depending on the proposed earthworks at the site and whether the creek/sediments will remain or be removed and sediments reused/disposed, please give consideration to comparing the sediment analytical data, where applicable, to the ANZG (2018) Australian and New Zealand - Toxicant Default Guideline Values For Sediment Quality - Toxicant default guideline values for sediment quality (Water Quality 2018) default guideline values (DGV) and upper guideline values (GV-high).

It is understood that material reuse criteria in the SAQP and DSI was derived from the Human Health and Ecological Risk Assessment (HHERA) prepared to facilitate the re-use of spoil along the Sydney Metro alignment. At this stage we cannot comment on the material reuse criteria stated in the SAQP until approval to the HHERA has been received (if required).

3. Close

We look forward to receiving a response to the comments above and trust this meets your current requirements. Should you have any queries or require further information, please do not hesitate to contact the undersigned.

NSW EPA Accredited Site Auditor (0803)

ES/MP

Technical Limitations and Uncertainty – *This Interim Advice is not a Site Audit Report or a Site Audit Statement, as defined in the Contaminated Land Management Act 1997, but forms part of the Site Audit process*. It is intended that a Site Audit Statement and report will be issued at the completion of the site audit.
Consistent with NSW EPA requirements for staged "sign-off" of sites that are the subject of progressive assessment, remediation and validation, the Auditor is required to advise that:

- *This site audit advice does not constitute a site audit report or statement.*
- *This letter is considered by the Auditor to be consistent with NSW EPA guidelines and policies.*
- *This letter will be documented in the final Site Audit Statement and associated documentation.*
- *At the completion of the site audit, a Site Audit Statement will be prepared, for the consent agency to include the Site's property information, held by the local council.*

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Senversa Pty Ltd
Level 24, 1 Market St, Sydney 2000
ABN 89 132 231 380 www.senversa.com.au

20 December 2022

[redacted]
CPBUI JV
Level 5, 60 Miller Street
North Sydney NSW 2060

Dear [redacted]

Re: Interim Audit Advice No. 3: AEC39, Luddenham Road Luddenham

Review of Updated Detailed Site Investigation

1. Introduction and Background

Melissa Porter (the Site Auditor) of Senversa Pty Ltd (Senversa) has been engaged by CPB Contractors Pty Ltd and United Infrastructure Pty Ltd (CPBUI JV) on behalf of Sydney Metro as a NSW Environment Protection Authority (EPA) Accredited Contaminated Sites Auditor for the proposed development of the Sydney Metro to Western Sydney Airport line. The site is part of the proposed Sydney Metro line and is located at Luddenham Road, Luddenham (hereafter referred to as 'the site').

The site is currently occupied by rural land used as paddocks. The site is potentially impacted from ACM pipelines and isolated ACM in soil from former buildings and an isolated zinc exceedence in soil. The former buildings and isolated zinc exceedence are understood to be located adjacent to the site. It is further understood that the development of the site will likely include stripping of topsoil and construction of a viaduct for the rail lines. Areas alongside the proposed rail lines will be used by contractors for staging and maintenance for the Metro. Douglas Partners Pty Ltd (Douglas Partners), engaged as the environmental consultant to assess the contamination status of the site, produced the following reports, which were forwarded to the Site Auditor for review:

- 'Sampling and Analysis Quality Plan (SAQP), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 17 August 2022 by Douglas Partners (DRAFT).
- 'Report on Detailed Site Investigation (Contamination), Surface & Civil Alignment Works (SCAW) Package for Sydney Metro – Western Sydney Airport (SMWSA), Area of Environmental Concern (AEC) 39, Luddenham Road, Luddenham' dated 12 December 2022 by Douglas Partners (DRAFT).

The SAQP was previously reviewed and comments provided by the auditor in interim audit advice (IAA) No.1 dated 1 September 2022. The DSI was previously reviewed and comments provided by the auditor in IAA No. 2 dated 17 November 2022.

This interim audit advice details the review of the updated detailed site investigation in relation to the contamination status of the site.

2. Review Comments

The Site Auditor has undertaken a review of the updated detailed site investigation against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2020).

The auditor considers that the DSI addresses the comments provided in IAA No.2 and the DSI can be finalised.

It is understood that material reuse criteria in the SAQP and DSI was derived from the Human Health and Ecological Risk Assessment (HHERA) prepared to facilitate the re-use of spoil along the Sydney Metro alignment. At this stage we cannot comment on the material reuse criteria stated in the SAQP until approval to the HHERA has been received (if required).

3. Close

We look forward to receiving a response to the comments above and trust this meets your current requirements. Should you have any queries or require further information, please do not hesitate to contact the undersigned.

Yours sincerely,
On behalf of **Senversa Pty Ltd**

NSW EPA Accredited Site Auditor (0803)

ES/MP

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Consistent with NSW EPA requirements for staged "sign-off" of sites that are the subject of progressive assessment, remediation and validation, the Auditor is required to advise that:

- *This site audit advice does not constitute a site audit report or statement.*
- *This letter is considered by the Auditor to be consistent with NSW EPA guidelines and policies.*
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Senversa Pty Ltd

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